A SURVEY ON KNOWLEDGE, ATTITUDE AND CONFIDENCE LEVEL OF ADULT CARDIOPULMONARY RESUSCITATION AMONG MEDICAL OFFICERS IN HEALTH CLINICS IN KELANTAN

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Dissertation submitted in partial fulfillment of the requirements for the Degree Of Master of Medicine (EMERGENCY MEDICINE)

UNIVERSITI SAINS MALAYSIA
2015

ACKNOWLEDGEMENT

I would like to express my deepest appreciation to everyone who provided me with the possibility to complete this dissertation. A special gratitude for my supervisor Dr Nik Arif bin Nik Mohamed, whose contribution in stimulating suggestions and encouragement, helped me to coordinate my dissertation especially in writing this report.

Many thanks to Dr Abu Yazid Md Noh, the Head of Department of Emergency Medicine, Hospital Universiti Sains Malaysia with his kind words of encouragement and support. My gratitude also goes to all lecturers of Emergency Medicine Department, Hospital Universiti Sains Malaysia and Emergency Physicians of Malacca Hospital for providing me excellent atmosphere for my research.

I would also like to thank Pengarah Jabatan Kesihatan Negeri Kelantan for his help in assisting me to carry out my dissertation in health clinics in Kelantan.

My colleagues in Master of Medicine (Emergency Medicine), Class of 2016, you have my warmest gratitude and my deepest appreciation. Your words of wisdom and encouragement when I felt down had kept me back on track. I could not even imagine completing this dissertation without you.

I would also like to thank Dr Abdul Hafiz Shaharuddin, Dr Anas Amri Hashim and Dr Ahmad Nadhir Iskandar, my good friends, who were always encouraging me not to give up. With your constant reminders and best suggestions, I would be able to finally complete my dissertation.

Lastly, special thanks to my family, my mother and father, and my wife, Dr Nurnadrah Ramalan. She was always there cheering me up and stood by me through the good times and bad. Until death do us part, and to you I dedicate this dissertation.

A SURVEY ON KNOWLEDGE, ATTITUDE AND CONFIDENCE LEVEL OF ADULT CARDIOPULMONARY RESUSCITATION (CPR) AMONG MEDICAL OFFICERS IN HEALTH CLINICS IN KELANTAN

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Introduction**:** Medical officers are defined as those who have already completed a two-year internship in hospital settings. They will be posted to any government health facilities including health clinics. Health clinics are considered out-of-hospital health facilities. Based on recent statistics, out-of-hospital cardiac arrests survival rates were very low as compared to in-hospital survival rates. Medical officers working in health clinics have long left the hospital settings. Are their knowledge, attitude and confidence level sufficient to deal with these cases of cardiac arrest? The aim of this study is to determine the level of knowledge, attitude and confidence of medical officers in health clinics in Kelantan and the factors associated with it.

Methodology**:** This was a cross-sectional study using simple random sampling. To validate and test the reliability of the questionnaire, a pre-test was previously done. All medical officers in health clinics in Kelantan were involved in this study. The

questionnaire were posted to their workplace and then collected in a period of a few months. The data was entered and analyzed by SPSS software version no 22.

Results **:** A total of 75 medical officers were involved in the study. The average age was 30.0 years. 73.4% had practiced medicine for more than two years. 58.7% of them had attended more than 5 cardiac arrest cases and 54.7% of them had last performed CPR for more than 12 months. 98.7% had attended BLS courses. 28% out of them had never attended ACLS Courses. 40% of the subjects achieved good knowledge scoring. 100% of these subjects had positive attitude towards adult CPR. In the confidence domain, 53.3% of the subjects had poor confidence in dealing with resuscitation. 60% was not confident to perform endotracheal intubation, 49.3% was not confident to perform defibrillation, 48% was not confident in using resuscitation drugs and 41.3% was not confident to be the team leader in resuscitation. ACLS training was the most important factor that improved their confidence level in adult CPR.

Conclusion: Knowledge of adult CPR among medical officers in health clinics in Kelantan was only average but all of them had positive attitude. The majority had low confidence level. From the study, it was revealed that ACLS training improved both knowledge and confidence level of the doctors. The researcher's recommendation includes integration of life support courses in medical school's syllabus as well as frequent recertification of the courses for everyone. Better knowledge, attitude and confidence level in cardiopulmonary resuscitation would lead to a better healthcare system in Malaysia.

Dr Nik Arif Nik Mohamed: Supervisor

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LIST OF ABBREVIATIONS

ABC	Airway, Breathing, Circulation
ACLS	Advanced Cardiac Life Support
AED	Automated External Defibrillator
AHA	American Heart Association
BLS	Basic Life Support
CPR	Cardiopulmonary Resuscitation
ED	Emergency Department
EMS	Emergency Medical Services
ERC	European Resuscitation Council
GP	General Practitioner
HO	House Officer
MO	Medical Officer
HUSM	Hospital Universiti Sains Malaysia
ILCOR	International Liaison Committee on Resuscitation
IHCA	In Hospital Cardiac Arrest
KAC	Knowledge, Attitude, Confidence
MMC	Malaysia Medical Council
NMRR	National Medical Research Registration
OHCA	Out of Hospital Cardiac Arrest
PEA	Pulseless Electrical Activity
ROSC	Return of Spontaneous Circulation
VF	Ventricular Fibrillation
VT	Ventricular Tachycardia

ABSTRAK

KAJIAN MENGENAI PENGETAHUAN, SIKAP DAN KEYAKINAN DIRI PEGAWAI PERUBATAN TERHADAP RESUSITASI KARDIOPULMONARI DEWASA DI KLINIK KESIHATAN DI KELANTAN

Pengenalan

Pegawai perubatan merupakan mereka yang telah menamatkan dua tahun tempoh percubaan di hospital. Mereka akan ditempatkan di prasarana perubatan kerajaan termasuk klinik kesihatan. Klinik kesihatan termasuk di bawah prasarana luar hospital. Berdasarkan statistik terbaru, serangan jantung di luar hospital mempunyai kadar peratusan rendah untuk hidup berbanding dengan di dalam hospital. Pegawai perubatan yang bertugas di klinik kesihatan telah lama meninggalkan hospital. Adakah pengetahuan, sikap dan keyakinan diri mereka cukup untuk menangani kes serangan jantung? Tujuan kajian ini adalah untuk mengkaji tahap pengetahuan, sikap dan keyakinan pegawai perubatan di klinik-klinik kesihatan di Kelantan dan faktor-faktor yang berkaitan dengannya.

Metodologi

Ini adalah satu kajian keratan lintang menggunakan carian rawak mudah. Soalan yang digunakan telah disahkan dengan satu pra-ujian sebelum ini. Semua pegawai perubatan di klinik-klinik kesihatan di Kelantan terlibat dalam kajian ini. Soalan diposkan ke alamat klinik kesihatan dan dikumpulkan kembali dalam masa beberapa bulan. Data kemudiannya dimasukkan dan dianalisa dengan program SPSS versi 22.

Keputusan

Sebanyak 75 pegawai perubatan terlibat dalam kajian ini. Purata taburan umur adalah 30.0 tahun. 73.4% telah bertugas lebih daripada dua tahun. 58.7% daripada mereka telah terlibat lebih daripada lima kes dalam perawatan serangan jantung. 54.7% telah melakukan prosedur resusitasi lebih daripada 12 bulan. 98.7% pernah hadir ke latihan BLS. 28.0% tidak pernah menjalani latihan ACLS. 40.0% daripada populasi kajian menerima markah yang baik untuk tahap pengetahuan. 100% mempunyai sikap yang positif terhadap CPR. 53.3% mempunyai tahap keyakinan yang rendah terhadap resusitasi kardiopulmonari. 60.0% daripada mereka tidak yakin untuk memasukkan tiub pernafasan. 49.3% tidak yakin tentang prosedur renjatan jantung. 48% tidak yakin untuk menggunakan ubat dalam proses resusitasi. Latihan ACLS menyumbang ke arah tahap keyakinan yang tinggi dalam resusitasi kardiopulmonari.

Kesimpulan

Pengetahuan pegawai perubatan di dalam resusitasi kardiopulmonari adalah sederhana tetapi keseluruhan daripada mereka mempunyai sikap yang positif. Kebanyakan daripada mereka mempunyai tahap keyakinan yang rendah. Daripada kajian ini, latihan ACLS meningkatkan pengetahuan dan kadar keyakinan diri pegawai-pegawai perubatan ini. Penyelidik menyarankan agar latihan asas resusitasi dimasukkan dalam silibus pembelajaran di sekolah-sekolah perubatan di samping pembaharuan latihan ini pada kadar yang lebih kerap. Pengetahuan yang tinggi, sikap yang positif dan keyakinan yang tinggi akan memperkukuhkan lagi sistem kesihatan di negara kita.

ABSTRACT

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This was a cross-sectional study using simple random sampling. To validate and test the reliability of the questionnaire, a pre-test was previously done. All medical officers in health clinics in Kelantan were involved in this study. The questionnaire were posted to their workplace and then collected in a period of a few months. The data was entered and analyzed by SPSS software version no 22.

Results

A total of 75 medical officers were involved in the study. The average age was 30.0 years. 73.4% had practiced medicine for more than two years. 58.7% of them had attended more than 5 cardiac arrest cases and 54.7% of them had last performed CPR for more than 12 months. 98.7% had attended BLS courses. 28% out of them had never attended ACLS Courses. 40% of the subjects achieved good knowledge scoring. 100% of these subjects had positive attitude towards adult CPR. In the confidence domain, 53.3% of the subjects had poor confidence in dealing with resuscitation. 60% was not confident to perform endotracheal intubation, 49.3% was not confident to perform defibrillation, 48% was not confident in using resuscitation drugs and 41.3% was not confident to be the team leader in resuscitation. ACLS training was the most important factor that improved their confidence level in adult cardiopulmonary resuscitation.

Conclusion

Knowledge of adult CPR among medical officers in health clinics in Kelantan was only average but all of them had positive attitude. The majority had low confidence level. From the study, it was revealed that ACLS training improved both knowledge and confidence level of the doctors. The researcher’s recommendation includes integration of life support courses in medical school’s syllabus as well as frequent recertification of the courses for everyone. Better knowledge, attitude and confidence level in cardiopulmonary resuscitation would lead to a better healthcare system in Malaysia.

1. INTRODUCTION

1.1 CARDIOPULMONARY RESUSCITATION

Cardiopulmonary arrest can be defined as cessation of normal blood flow due to ineffective heart contraction (Wiener *et al.,* 2012). When blood ceases to flow, this will lead to the inevitable damage to multiple organs in a human's body, and if it continues, irreversible and permanent damage will ensue, and soon or later, death will follow.

Human's body is made of a complex system. Cells are the basic unit of life (Sherwood, 2015) and every single cell uses oxygen in order to function. Oxygen is carried in the human body by blood and oxygenated blood flows in the body by a gradient difference generated by the heart pump. Without a functioning heart, there will be no blood flow; oxygen can't be delivered to the cells and eventually death will ensue. This is the condition seen in cardiopulmonary arrest, in which the heart is no longer beating and oxygen fails to reach every cell in our body. Here comes the essential role of cardiopulmonary resuscitation (CPR). It is a procedure done with the aim of manually restoring the blood circulation and respiration until further and advance support arrives to prevent ischemia and early cell death. CPR includes chest compression at the centre of the chest to pump blood to the vital organs, as well as breathing support to the patient in order to provide artificial respiration until the restoration of normal cardiac and respiratory activities occur (Tintinalli *et al.,* 1992).

Human technology advances from early years, so as world's medical care system. Cardiopulmonary resuscitation (CPR) was dated back from early 18th century where The Paris

Academy of Science officially recommended mouth-to mouth resuscitation for drowning victims. Improvements were made over the years when finally in 1954, Dr James Elam, also known as "*father of CPR*" experimentally proved that expired air was sufficient to maintain adequate oxygenation. Together with Dr Peter Safar, they invented mouth-to-mouth resuscitation and this is the basic of modern CPR (Baskett, 2001).

Since then, CPR had been improved and guidelines had been established but it varied from one country to another and one region to another. International Committee on Resuscitation (ILCOR) was founded in 1992 to set a standard to the current guidelines. It provided a forum for liaison between principal resuscitation organisations worldwide. At present, ILCOR comprises representatives of American Heart Association (AHA) , European Resuscitation Council (ERC), Heart and Stroke Foundation of Canada (HSFC), Australian and New Zealand Committee on Resuscitation (ANZCOR), Resuscitation Councils of Southern Africa (RCSA), Inter American Heart Foundation (IAHF) and Resuscitation Council of Asia (RCA). ILCOR, in collaboration with American Heart Association produced the first International CPR Guidelines in the year of 2000.

The new guideline of CPR is based on numerous evidences and analysis and the most fundamental aspect is chest compression with minimal interruption to allow optimum cardiac output to be distributed to vital organs. This is to ensure better chance for return of spontaneous circulation (ROSC) and a higher rate or survival for patients (Field *et al.*, 2010).

In Malaysia, since the establishment of National Committee on Resuscitation Training (NCORT), various life support courses for resuscitation are being offered to mainly the medical staff including doctors, paramedics, and medical students.

1.2 RESEARCH DESCRIPTION

Adult cardiopulmonary resuscitation is of utmost importance especially for health personnel. There were many studies that had been carried out abroad to determine the level of awareness of adult cardiopulmonary resuscitation among various groups including physicians, medical officers, junior doctors, medical students, paramedics, nurses and public citizens. Some of the studies touched on their knowledge of adult cardiopulmonary resuscitation and some focused on attitude and confidence level of adult cardiopulmonary resuscitation for the various groups. The major aim of these studies was to determine their level of awareness of adult cardiopulmonary resuscitation and the factors associated with it. By knowing the factors that contributed to their level of knowledge, attitude, and confidence level on cardiopulmonary resuscitation, they had proposed several suggestions to improve their knowledge, attitude and confidence level and this actually helped to improve the outcome of cardiac arrest cases. However in Malaysia, there were only a few studies that touched on these subjects.

The researcher's main focus was on the knowledge, attitude and confidence level of adult cardiopulmonary resuscitation among medical officers in health clinics in Kelantan. The study was carried out by distributing questionnaires on knowledge, attitude and confidence level and the questionnaires were collected at the end of the study period. The questionnaires were based on previous study that was done in Kelantan among junior officers to assess their knowledge, attitude and confidence level (Chew *et al.*, 2011). As the topic of this research implied, the questionnaires that were distributed had three major domains including knowledge domain, attitude domain and confidence domain.

Knowledge questions were divided into several topics of interests including general knowledge of adult cardiopulmonary resuscitation, pharmacological treatment, defibrillation machine usage and updates on new guidelines of adult cardiopulmonary resuscitation. Attitude questions had a total of nine questions and it touched on their opinion of training, life support courses, undergraduate syllabus, and their feelings towards resuscitations. Lastly, for confidence domain, there were a total of five questions and they were asked regarding their confidence in performing resuscitation techniques and procedures such as endotracheal intubation, CPR, defibrillation, drug administration and team leader role. All questions were answered in Likert Scale and they were further analysed.

The researcher's target group was medical officers who worked at government health clinics in Kelantan. There were a total of 10 districts and 55 health clinics involved in this study. This was actually a continuation of a study done in Kelantan in 2010 among junior doctors (Chew *et al.,* 2011). These junior doctors would complete their training after two years in hospital settings and they will be sent to numerous government health facilities including health clinics. The researcher wanted to compare whether there were any difference in knowledge, attitude and confidence level of adult cardiopulmonary resuscitation between these two groups and to determine what were the factors associated with it. With that, some actions could be taken into measures to improve their awareness of adult cardiopulmonary resuscitation and to generally improve the healthcare system in Malaysia.

1.3 RESEARCH IMPORTANCE AND JUSTIFICATION

As mentioned previously, without CPR, a patient with cardiac arrest will certainly die. It is the single most important thing to perform to a patient with cardiac arrest cases with hope to temporarily restore the circulation before advance life support arrives (Tintinalli *et al.*, 1992). Knowing the importance of CPR, the researcher conducted this study to determine the level of knowledge, attitude and confidence level among medical officers in health clinics in Kelantan. Knowledge of CPR, attitude and confidence level plays a major role since it is one of the fundamental things for health personnel to equip themselves with. It will make a major difference between a group of people with good knowledge, positive attitude and high level of confidence level of CPR and another group with poor knowledge, negative attitude and low level of confidence level in term of cardiac arrest cases survival rate. The researcher was also interested in knowing what were the factors associated with this level of knowledge, attitude and confidence level. These would be the cornerstone to build better understandings towards what is lacking in our healthcare system in Malaysia regarding adult CPR. Hopefully with the available data, some changes could be made to improve our healthcare system, especially with regards to survival of cardiac arrest cases.

The researcher chose to conduct the study in health clinics in Kelantan and it was not without significance. Health clinics are considered out-of-hospital health facilities and survival rate between out-of-hospital cardiac arrest cases (OHCA) and in-hospital cardiac arrest cases (IHCA) differs. 92% of patients experiencing OHCA event die (Roger *et al.*, 2011). Despite of all the technological and medical advancement, the survival rate of OHCA within these past 30 years had not improved much. Globally, it ranged between 6.7% and 8.4% (Sasson *et al.*, 2010). Numerous researches had been done, new guidelines had been

implemented globally, new technological devices and pharmacological advancement had been introduced but to no avail. However, it is important to note that survival of cardiac arrest lies in early recognition, early basic life support (BLS), early defibrillation, early advanced care and early resuscitative care as per chain of survival in cardiac arrest. This is easily carried out in the hospital thus explains why IHCA has a better survival rate (McNally and Valderrama, 2011).

The researcher also chose this particular group of medical officers who worked in government clinics in Kelantan to see whether their working settings provided them with adequate knowledge on adult cardiopulmonary resuscitation. Since they were working in prehospital settings, did they have the right attitude and good confidence level when attending cardiac arrest cases? They had long left the hospital and they were in a very safe zone, seeing non critical patients on daily basis. They rarely came across cardiac arrest cases. It was unfortunate if their previous knowledge and skills of resuscitation and basic life supports fade away. Improving prehospital health care system is one of the foundations to improve the nation's health care system as a whole.

1.4 PREVIOUS ISSUES AND PROPOSED SOLUTION

There were several studies done previously to determine the level of knowledge, attitude and confidence level on adult cardiopulmonary resuscitation among various groups of people.

One study on knowledge, attitude and confidence Level of adult cardiopulmonary resuscitation among junior medical officers in Kelantan revealed that more than 85% of them were not confident in the practice of resuscitation. Adding to that statement, only approximately 15% of them were confident to be the team leader of resuscitation. Another interesting point to be noted was that 66% of the junior doctors never handled a defibrillator (Chew *et al.*, 2011) although defibrillation was considered one of the important chains that could improve survival rate and outcome of cardiac arrest cases (Wik *et al.*, 2005). As they were the doctors that would be sent to government health clinic after completing their housemanship practice, this number was rather worrying. They were the front liners who would handle cardiac arrest cases, although rarely, in the health care settings soon or later.

Furthermore, one study carried out in Karnataka, India revealed that most of the junior doctors had inadequate knowledge and skills to perform CPR. Out of 20 series of questions on basic life support and CPR, almost 50% of them had poor and very poor grades based on their scoring system. This was mostly due to the lack of structured basic life support and CPR teaching in the curriculum, as well as lack of resources. Busy residency schedule that rendered them unable to practice contributed to their poor performances in CPR (Avabratha *et al.*, 2012).

With regards to their confidence level, many of the studies had mentioned that frequent life support updates and recertification pointed towards a higher confidence level in performing cardiopulmonary resuscitation (Hopstock, 2008a) & (Buck-Barrett and Squire, 2004). Many of them with outdated life support certification scored lower confidence level. Knowledge is not equivalent with confidence level. Although some had average or even good knowledge, their confidence level was still not up to par (Avabratha *et al.*, 2012).

The researcher was very interested to conduct an almost similar survey towards medical officers in government in Kelantan to see whether the level of knowledge, attitude and confidence level are more or less the same with the average scores from the various groups of people. The researcher also conducted surveillance on the associated factors related to their level of knowledge attitude and confidence level. Some of the factors that would be tested include place of graduation, duration of practice, number of cardiac arrest cases attended, basic and advanced life support training, and duration of last performed defibrillation and CPR.

Based on the previous studies, the researcher proposed that to increase their knowledge in resuscitation, basic cardiopulmonary resuscitation should be incorporated into medical schools' syllabus. Maybe the contents were already in the syllabus but in view of the poor knowledge, it should be modified and strengthened so that it could easily be understood and absorbed, and be brought to practice. Theory is never equivalent to practical skills. The researcher also proposed that more practical sessions should be carried out during medical schools and even during housemanship period. This could actually boost their confidence level so that they could apply the knowledge intro practice. Basic and advanced life support course are being held very frequently and in the course they were taught theoretically and

through practical sessions. People tend to forget; hence the researcher also proposed frequent life support recertification, yearly if possible.

1.5 STUDY SUMMARY

The researcher conducted a survey on the level of knowledge, attitude, and confidence of adult cardiopulmonary resuscitation among medical officers in health clinics in Kelantan. The survey tested the target group's level of knowledge, attitude, and confidence of adult cardiopulmonary resuscitation and the associated factors.

Some of the issues that arose from previous studies include the low level of knowledge, attitude and confidence level of these medical personnel in dealing with cardiopulmonary resuscitations. Among the associated factors related to this include no proper and structured syllabuses regarding cardiopulmonary resuscitation in medical schools, no frequent life support recertification among the doctors, and too busy internship schedules rendering them unable to grasp the knowledge and skill to perform cardiopulmonary resuscitation correctly.

With this study, the researcher would like to analyse their level of knowledge, attitude and confidence level as well as the factors associated with it and to come up with new proposals and solutions on how to increase their level of knowledge, attitude, and confidence level in performing cardiopulmonary resuscitation. The researcher's target group was medical officers who worked in prehospital settings because the researcher really believed that a nation's good healthcare system begins with the root, which is good prehospital healthcare system.

2. OBJECTIVES

2.1 GENERAL OBJECTIVE

To determine the awareness of adult cardiopulmonary resuscitation (CPR) among medical officers in government health clinics in Kelantan.

2.2 SPECIFIC OBJECTIVES

1. To determine the knowledge, attitude and confidence level of adult cardiopulmonary resuscitation (CPR) among doctors in government health clinics in Kelantan.

2. To describe the associated factors that influence the knowledge, attitude and confidence level of adult cardiopulmonary resuscitation (CPR) among doctors in government health clinics in Kelantan.

3. LITERATURE REVIEW

3.1 CPR AND ACLS

Cardiopulmonary resuscitation or more commonly known as CPR is actually an emergency procedure which is done to a patient who is unresponsive, has agonal breathing or not breathing, in order to restore spontaneous breathing and blood circulation to the brain which is halted during cardiac arrest. CPR is carried out until further advanced medical care arrives. Performing CPR is relatively easy once a person is trained to do it. Knowing its importance, many public citizens have taken the initiatives to learn CPR.

Performing CPR involves compression of the chest between 5cm to 6cm in depth with a rate of at least 100 times per minute. The best location of chest compression is at the centre of the chest. Breaths are provided by the rescuer into patients' lungs by mouth-to-mouth ventilation or a device that pushes air into patients' lungs. The optimal chest compression to breath ratio is 30 to 2 which refers to 30 chest compressions to 2 breaths before continuing the cycle again. For a trained rescuer, CPR is carried out for 5 cycles or 2 minutes before checking the pulse again and if the patient has a pulse and breathing spontaneously, he will be put in recovery position. However, if there is no pulse palpable, CPR will be resumed until further helps arrive. All guidelines on CPR including International Liaison Committee on Resuscitation (ILCOR) stressed on high quality CPR. Among the criteria is chest compression should be done fast with a rate of at least 100 times per minute and the depth of chest compression should be at least 5 cm deep. The rescuer should also allow complete chest recoil between compression and interruption should be minimized when doing chest compression. CPR is usually continued until there is return of spontaneous circulation, patient is declared dead, or the rescuer is unable to continue due to exhaustion (Field *et al.*, 2010).

However, chest compression alone is not sufficient to restart the heart. Its main function is actually to restore circulation to the brain and heart temporarily to prevent and delay tissue death. In order to successfully restore heart rhythm, defibrillation is required. Defibrillation is a procedure done when there is ventricular fibrillation and pulseless ventricular tachycardia noted on cardiac monitor. It delivers electrical shock to the heart in order to stun it with an expectation that the heart electrical conductivity will restart from its original sinus node (Borden and Gaggin, 2014).

A patient with cardiac arrest will not stand a chance of surviving with only CPR and defibrillation. A cardiac arrest case needs further and advanced medical care. Here comes the role of advanced cardiac life support (ACLS), which refers to a set of clinical interventions for the urgent treatment of cardiac arrest as well as the knowledge and skills to deploy those interventions. While BLS consists of early CPR and defibrillation which can be vital to a patient with cardiac arrest, ACLS involves responding to an unconscious person, analyzing the cause of the emergency, determining the treatments needed and taking more advanced clinical steps to restore their breathing and heartbeat (Ayala *et al.*, 2012).

ACLS as the name implies, consists of more advanced interventions to increase patient's survival in cardiac arrest cases. All major components of ACLS are discussed globally and ACLS books are published internationally for reference. Some of the major components include airway management, ventilation support, and treatment of bradyarrhythmias and tachyarrhythmias. For the treatment of cardiac arrest, ACLS interventions are based on basic life support (BLS) foundation of fast recognition and activation of the emergency response system, early CPR, and rapid defibrillation to further increase the chance of return of spontaneous circulation with drug therapy, advanced airway

management, and physiologic monitoring. Following return of spontaneous circulation, survival and neurologic outcome can be improved with integrated post–cardiac arrest care (Meaney *et al.*, 2013).

While drugs are not part of basic life support and CPR, ACLS incorporated drugs into its many algorithms during resuscitation. Epinephrine or adrenaline is the primary drug used in the pulseless arrest algorithm. It is used for its potent vasoconstrictive effects and also for its ability to increase cardiac output. Epinephrine is also considered a vasopressor. It exerts its effect by binding directly to alpha-1 adrenergic receptors of the blood vessels and this causes direct vasoconstriction. Vasoconstriction improves perfusion pressure to the brain and heart. At the same time, it also binds to beta-1 adrenergic receptor of the heart. This action improves cardiac output indirectly by increasing heart muscle contractility, heart rate, and conductivity through the atrioventricular node. It is given every three to five minutes during cardiac arrests and can be given either through the veins, endotracheal tube or through the intraosseous. Intravenous dose is 1mg with 1:1000 concentrations. There is no clinical evidence that the use of adrenaline during cardiac arrest increases rates of survival to discharge from the hospital. However, studies had shown that adrenaline improved rates of return of spontaneous circulation. Atropine, another drug that was used in the past, is no longer indicated in cardiac arrest cases (Jeung *et al.*, 2011).

3.2 BASIS OF CARDIOPULMONARY RESUSCITATION

The basis of cardiopulmonary resuscitation lies within two main theories which include cardiac pump theory and thoracic pump theory. In cardiac pump theory, during chest compression, pressure gradient will be generated in the ventricles causing closure of the atrioventricular valves and opening of semilunar valves and this will lead to expulsion of the blood into the great arteries. During decompression, pressure inside the ventricles will suddenly drop causing closure of the semilunar valves and opening of atrioventricular valves and this will allow blood to flow from atrium into the ventricles (Weisfeldt and Chandra, 1981).

The initial cardiac pump theory was then challenged by thoracic pump theory. In thoracic pump theory, chest compression will raise intrathoracic aortic pressure with regards to extrathoracic aortic pressure and this drives blood out of the chest and blood will flow in a one-way direction. Moreover, intrathoracic venous pressure is also raised relative to extrathoracic venous pressure, and with the addition of the valve, this will prevent back flow in the great veins (Weisfeldt and Chandra, 1981).

Early data supporting the thoracic pump theory in humans arose from the description of ‘cough CPR’ in which a patient’s consciousness during ventricular fibrillation can be maintained as long as cough was continued. It is important to note that during cough there is minimal cardiac compression; however there is a large intrathoracic to extrathoracic pressure gradient (Criley *et al.*, 1976). However, a study using transesophageal echocardiography to measure the chamber size, the valve opening and closure and blood volume and flow during

cardiopulmonary resuscitation postulated that cardiac compression is the predominant mechanism for blood flow during cardiopulmonary resuscitation (Redberg *et al.*, 1993).

However both of the theories were accepted globally because it is likely that both theories are functioning simultaneously during cardiopulmonary resuscitation despite of many arguments.

3.3 CARDIAC ARREST

Cardiac arrest is also known as cardiopulmonary arrest or circulatory arrest, in which there is a sudden halt in effective blood circulation. This is primarily due to failure of the heart to contract effectively or not contracting at all (Wiener *et al.,* 2012). As mentioned previously, the heart pumps oxygenated blood in addition to glucose as fuel to the cells in human's body. When this cycle is disrupted, it leads to catastrophic effects. A person with cardiac arrest will lose his consciousness due to inadequate cerebral perfusion pressure, followed by a cessation in breathing. He will likely develop brain injury if the cardiac arrest is left untreated for a few minutes, and death will ensue if no help arrives (Safar, 1986). Cardiac arrest can rise from cardiac cause, primarily from coronary artery disease and it can also be due to non-cardiac causes (Broderick *et al.*, 2015).

Basically, cardiac arrest can be divided into out-of-hospital cardiac arrest (OHCA) and in-hospital cardiac arrest (IHCA). It is important to remember that both carries different mortality rates. IHCA carries better survival rate as compared to OHCA. A retrospective study by Broderick *et al* showed a 30% survival of IHCA as compared to OHCA which was only 6.8 % (Control and Prevention, 2002). It is important to note that survival of cardiac arrest lies in early recognition, early basic life support (BLS), early defibrillation, early advanced care and early resuscitative care as per chain of survival in cardiac arrest. This is easily carried out in the hospital thus explains why IHCA has a better survival rate.

OHCA, in contrast, depends primarily on bystanders or the person who witnesses the arrest. It is known that early CPR is paramount in determining patient's survival. Good and high quality chest compression is of utmost importance in the initial phase. This is why all

medical personnel should at least be equipped with good basic knowledge and skills of life support. Knowing the importance of early CPR, currently efforts are being made to educate the public regarding the correct and effective technique of CPR, since they are the ones who witness cardiac arrest cases first before the paramedics or medical teams arrive. Hence it is vital for every responsible citizen to learn and know the correct technique of CPR. In Malaysia, nationwide, the citizens have been exposed to the first aid and CPR. This is partly due to the effort of Health Ministry in collaboration with many governmental and non-governmental organizations including Educational Ministry and the Red Crescent Society to organize first aid and basic life support courses. School children are now having some awareness and basic knowledge on how to perform CPR and this, hopefully, will improve the survival of OHCA.

3.4 CHAIN OF SURVIVAL

Chain of survival as per American Heart Association recommendation is fundamental in determining the survival rate for cardiac arrest cases. There are five major important steps and each of them is linked together. Without any of these steps, a patient with cardiac arrest likely will not survive. The chain include rapid activation of Emergency Medical Service (EMS), rapid initiation of cardiopulmonary resuscitation (CPR), prompt application and use of an automated external defibrillator (AED), rapid delivery of advanced life support by EMS providers, and early post resuscitative care (McNally and Valderrama, 2011).

In a cardiac arrest case, all of this links should be applied collectively as a whole in order to increase the chance of survival. Strengthening the weak links in chain of survival, particularly in out-of-hospital cardiac arrest (OHCA) will definitely improve the outcome. It is important to know that in OHCA, the first two steps which include rapid activation of EMS and rapid CPR depend on the witnessing bystanders. This chain may appear to be the weakest because most of the bystanders are not equipped with decent knowledge of resuscitation. These are the steps that need further strengthening in order to improve the outcome including increasing the public awareness towards cardiac arrest cases in addition to the reduction of ambulance response time. Awareness towards rapid activation of EMS and early CPR has already been raised to the public worldwide. According to one study, strengthening this chains indeed improve the survival rate (Lund-Kordahl *et al.*, 2010).

Again, comparing in-hospital cardiac arrest (IHCA) and out-of-hospital cardiac arrest (OHCA) gives a very clear explanation on why the links should be strengthened. As mentioned previously, survival rate in IHCA surpasses OHCA (Control and Prevention,

2002). This showed that the most crucial step is early recognition and early CPR. Human's body particularly the vital organs such as the brain and the heart will not last long if cessation of the oxygen from cardiac arrest is not reversed.

3.5 OUT-OF-HOSPITAL CARDIAC ARREST (OHCA)

Generally, cardiac arrest can technically be divided into in-hospital cardiac arrest (IHCA) and out-of-hospital cardiac arrest. There are many studies comparing the outcome and survival rates between the two events and most of the studies favour IHCA over OHCA. It is found that the survival rate of OHCA events only range between 6.7% and 8.4% whereas it can be as high as 30% in IHCA events (Sasson *et al.*, 2010). This finding is not surprising due to the fact that IHCA events were treated in a more aggressive and controlled manner, and this group of people received early CPR and defibrillation as all patients were still in the hospital. This finding also sparked interests among researcher globally, on how to improve OHCA. Since OHCA is a major public health problem, many studies had taken place to look for the predictors that favour a better survival rate and outcome globally.

What really matters is to determine what are the factors associated with better survival rate of OHCA patient. A large population-based study, The Utstein Osaka Project, which started at 1998 and covered more than 8 million people, was conducted. During this period of more than 8 years, changes in the Emergency Medical System (EMS) were made to improve the chain of survival. This includes training the public with regards to performing CPR, and to educate the EMS personnel to deliver shock without physician's direction. The main objective in this study is to see whether improvement in the survival chain could increase the survival rate of OHCA and the result revealed that there were increased survival rates of patients with OHCA events by strengthening the chain links (Iwami *et al.*, 2009).

However it is also imperative to remember that the characteristic and outcome of OHCA differ from one country to another. The Pan Asian Resuscitation Outcomes Study

(PAROS) study was conducted for three years from 2009 until 2012 to report the characteristic of OHCA in seven countries including Japan, Singapore, South Korea, Malaysia, Taiwan, Thailand, and UAE-Dubai. A total of 66,786 cases from January 2009 to December 2012 were collected and analysed. Proportion of unwitnessed arrests ranged from 26.4% (Thailand) to 67.9% (Taiwan) while ventricular fibrillation as the initial presenting rhythm (VF) ranged from 4.1% (Malaysia) to 19.8% (UAE). Bystander CPR rates varied from 10.5% (UAE) to 42.4% (Korea). For arrests that were witnessed and had ventricular fibrillation, the survival rate to hospital discharge ranged from no reported survivors at all to 31.2%. However, the overall survival to hospital discharge varied from 1.3% to 8.9% (Ma *et al.*, 2014).

This huge collection of statistical analysis showed variation between countries probably due to the differences in medical facilities and medical advancement in a particular country as well as the level of public awareness on cardiac cases (Ma *et al.*, 2014). Nevertheless, strengthening the links of chain of survival, despite of much country's variation, remains the best predictors of better outcome of OHCA events (Iwami *et al.*, 2009).

3.6 MEDICAL OFFICERS IN MALAYSIA

House officer basically means a medical practitioner who undergoes internship training under the Medical Act 1971. 'Housemanship' or 'Internship' is the period of resident medical practice before full registration as stipulated under the Medical Act 1971. Currently in Malaysia, a house officer needs to complete a six-posting internship training before he can be registered in the Malaysian Medical Council as a fully registered medical practitioner (Dr. Hj. Wan Mazlan bin Hj. Mohamed Woojdy, 2008) In this 6-posting training period, he will be under strict supervision and the training must be done in a training hospital for six major postings including medical, surgical, paediatrics, obstetrics and gynaecology, orthopaedics, and emergency department and/or anaesthesiology department.

Only after completing the 6 postings he would be entitled to become a fully registered medical practitioner or a medical officer. During this training period, a house officer needs to consolidate the knowledge built during undergraduate studies and apply it in the clinical practice, brush up clinical, technical, and professional skills, as well as take increasing responsibility for patient's care (Dr. Hj. Wan Mazlan bin Hj. Mohamed Woojdy, 2008). House officers are also expected to excel in resuscitation knowledge and skills since they deal with cardiac arrest cases on daily basis.

As defined under Article 132 of the Federal Constitution, they have to serve a continuous total period of not less than 3 years upon being given full registration (Medical Act 1971 section 40). Medical officers can either choose to work in hospitals or they can work at other government health facility including district hospitals and health clinic. In health clinics, they are running the clinics during office hours with some exception of extended