THE FACTORS ASSOCIATED WITH SURVIVAL RATES OF INTENSIVE CARE UNIT PATIENT AFTER HAVING SUDDEN CARDIAC ARREST

By

MOHAMMED S ABOHASHRH

DEPARTMENT OF HEALTH INFORMATICS

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MOHAMMED S ABOHASHRH

Dissertation Committee:

Dr.Syed Haque, Dissertation committee Chair &Advisor

Dr.Shankar Srinivasan, Dissertation committee Member

Dr. Frederick Coffman, Dissertation committee Member

Approved by the Dissertation Committee:

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

Abstract

Background: Cardiac arrest has become one of the most common cause of death faced by individuals in today's scenario. Cardiopulmonary arrests or cardiac arrests can occur unexpectedly and increase the mortality rates.

Cardiopulmonary Resuscitation (CPR) is a technique developed in an effort to save the life of patients experiencing a cardiac arrest. However, the modern CPR, in spite of being introduced 40 years ago, has not been able to improve the mortality rate.

Dataset and Methods: The Study involved the analysis of publicly available information was conducted at ASIR Central Hospital in Saudi Arabia in order to collect the data of cases regarding in-hospital heart arrests in the ICU to answer the hypothesis question. In this study, the effective use of ADE has also been explored, which can be an important technique in saving the lives of patients suffering from a cardiac arrest. Some solutions can be suggested afterwards, based on the study to improve the survival rate. The study will help in exploring the important factors, which will help in improving the survival rate of patients and improving the quality of the life of patients.

Conclusion: The survival outcome indicated that patients were significantly more likely to die (55.3%) than survive (44.7%) and The vast majority of patients were treated with adrenaline (96.1%) at the time of cardiac arrest, Out of those individuals who received three doses of adrenaline, a majority survived (42.5% died). Out of those who received four doses of adrenaline and were under 61 years of age

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To Whom I care most My beloved sweet mother I love you

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CHAPTER 1

1. INTRODUCTION

Healthcare professionals are considered to be the expert in saving the lives of patients. Most of the individuals, suffering from various diseases, visit hospitals in order to recover from them with the help of the latest techniques in the medical field and experts in healthcare area. Cardiac arrest is one of those cases that need special care and attention by healthcare professionals. Patients admitted to hospitals, after facing a cardiac arrest, are very delicate to handle (Pederson).

Most of the patients suffer from a sudden death due to being unaware of the reasons of the sudden cardiac arrest. Most of the health professionals are unable to handle the cardiac arrest patients due to their lack of knowledge in the effective use of technologies like CPR, which helps in increasing the survival in patients till the medical treatment is arranged. In spite of the availability of modern technologies, like Automated External Defibrillators, in hospitals, the mortality rate in patient, suffering from a cardiac arrest, is increasing day by day (Pederson).

There are other reasons that have been identified, like the lack of medical experts and staff members to handle the patients experiencing cardiac arrests and need an immediate medical treatment. Cardiac arrests often occur unexpectedly, and healthcare professionals must be trained enough to handle the patient with technologies, like CPR. One of the

factors that influence the survival rate is the time in which the healthcare professionals perform CPR on patients. The response of the rapid team and how rapidly they handle the patients in an effective way influence the survival rate (Pederson). There are other factors like the rhythm of the patient's heart, the presence of healthcare professionals in hospitals and their effectiveness in using the technologies like CPR, which are responsible for influencing the survival rate in patients in Saudi Arabia. The survival rate in patients is also impacted by the lack of awareness regarding the importance of adrenaline in the treatment, with CPR. The study of various factors and their influence in improving the survival rate in patients experiencing a cardiac arrest is an important aspect, which needs to be discussed.

1.1 BACKGROUND

The most important responsibility of healthcare professionals is to provide the best possible care and support to patients. Healthcare professionals are required to deal with various kinds of patients suffering from various kinds of diseases. As one patient's needs are different from the other one, the healthcare professionals need to apply different skills to treat them. Cardiac arrest is among those diseases that require effective skills to handle the patients. One of the major concerns in the healthcare field, today, is the increasing mortality in spite of the technological innovations in the field of Medical care.

Treating patients with the latest techniques requires expertise and practical training of the technology, which the healthcare professionals can use while treating patients. In cardiac arrest, sometimes, the patient is not aware of the reason for its occurrence, and it leads to his death. A need was felt to identify the reasons, which are responsible for increasing the mortality rate, especially the patients experiencing a cardiac arrest (American Heart Association).

Delaying the treatment, in the case of a cardiac arrest, leads to the sudden death of the patient. Healthcare professionals are, sometimes, unable to save the lives of patients. There has been the introduction of many techniques, like ADE, which can help in anticipating the cardiac arrest and also helps in the prevention of a sudden cardiac arrest, but still the

mortality rate has not improved. Sometimes, ADE combined with adrenaline is used to treat the patient experiencing a cardiac arrest.

There are various factors, which can help in improving the mortality rates in Saudi Arabia; the identification of these factors has become necessary. The identification of factors will help in adopting precautionary measures, which will ultimately improve the survival rate in patients experiencing a cardiac arrest. In different hospitals of Saudi Arabia, different rapid response teams work differently. Some teams are able to provide a rapid response to patients resulting that saves their lives, and in some hospitals, due to a slow response of rapid teams, the patient dies.

CPR is a technology that has been used by hospitals from the last 40 years. It has been estimated that in spite of the presence of CPR in hospitals of Saudi Arabia, the survival rate has still not improved. CPR can even be performed outside the hospitals, before taking the patient to the hospital, but the chances of the survival of the patient still remains low (American Heart Association).

It is likely that the patient, surviving the cardiac arrest, suffers from neurological outcomes. Those patients, who survive in hospitals with the treatment from the technologies like CPR, face various brain disorders later in their life, after the cardiac arrest. In the southern region of Saudi, the two factors that are responsible for the increasing mortality rate are the longer resuscitation time and providing A systole to patients in the hospital. In Saudi Arabia, technologies like CPR and AED have been used by the professionals, with or without adrenaline, in the hospital. In this Study we also show that the important factors, responsible for the poor survival rate in Saudi Arabia's southern region, it could be being the lack of awareness among the people about the effective use of these technologies (Paradis). Some people are not aware of the negative outcomes that might occur due to the improper use of CPR.

The people might understand that performing CPR is always beneficial in saving the lives of the patients experiencing a cardiac arrest, but they might not be aware of the outcomes, which the patients might face and the outcome they might face while saving the life of the patient.

The important aspect is that the people should be made aware of the proper training programs on the effective use of CPR and the measures that are needed to be adopted before the patient reaches the hospital. Training and education are also required by the healthcare professionals and nurses in hospitals so that they do not fear while handling the patient suffering from a cardiac arrest. Adopting the following measures can help in improving the survival rate in patients in Saudi Arabia's southern region (Paradis).

1.2 IMPORTANCE OF THE STUDY

Due to advancements in the technology, medical services and facilities have become more reliable. The safety of patients has become one of the most important focuses of the medical professionals as the due to the advancement in the technology, information regarding medical errors, which harms the patients, have come into the light. The hospital staff and professionals put their best efforts to ensure that medical errors are minimized and patients get a proper treatment and medical facilities in hospitals.

Medical professionals try to ensure that the mortality rate in patients decreases and the survival rate increases. In spite of the availability of latest technologies, like Cardiopulmonary Resuscitation (CPR), the medical professionals are not able to save the lives of patients, who die because of a cardiac arrest. The present study will help in identifying the causes behind the increasing mortality rate in the southern region of Saudi Arabia in spite of the availability of latest technologies (Matthews). The previous studies, held in other regions of Saudi Arabia, have revealed various facts.

One of the facts that have been revealed from the previous study is that CPR has not been much effective in improving the survival rate of patients. The study will help in identifying the differences between the use of CPR with adrenaline and without it, and the outcomes of using adrenaline with CPR. The study at Asir Central Hospital in Saudi Arabia will help in understanding and analyzing the reasons for the important factors that are continuously increasing the mortality rate in the southern region of Saudi Arabia.

Identifying the reasons will further help in adopting the measures, which will improve the mortality rate in the southern region of Saudi Arabia.

Cardiac arrest is considered to be one of the most common diseases, which has increased the mortality rate. A sudden cardiac arrest leads to the death of patients, without even understanding the reason and symptoms behind the cardiac arrest. The research study is important as it will help in understanding the various reasons of using ADE and CPR technologies, with or without adrenaline, which will help in understanding that whether their use influences the survival rate in patients. Studying the cases of cardiac arrests at Asir Central Hospital in Saudi Arabia will help in gaining an understanding of the reasons, which increase the mortality rate in patients even after being under the coverage of specialized medical facilities, medical professionals and rapid response teams.

One of the reasons for conducting a survey at Asir Central Hospital in Saudi Arabia is that most of the studies regarding cardiac arrests and the survival rate in patients have been conducted in other regions of Saudi Arabia. Conducting the study in the southern region of Saudi Arabia will help in understanding and identifying various factors, which differentiate the survival rate of patients in the southern region as compared to other regions of Saudi Arabia.

The study will help in identifying various problems, which lead to increasing the mortality rate in the southern region of Saudi Arabia (Matthews). The focus of this study is the southern region as most of the studies are conducted in other regions of Saudi Arabia, neglecting the southern region. Conducting the study in the southern region was important as it will reveal the absence of various factors, which prevent the medical professionals in saving the lives of patients suffering from cardiac arrest.

One important part of this study will include identifying the signs and symptoms that leads to a sudden cardiac arrest, and the medical facilities and technologies available to save the lives of patients suffering from it (Matthews). This study will also reveal the importance of devices like automated external defibrillators, and the use of adrenaline with ADE and CPR, which can help in preventing a cardiac arrest and handling it when the patient is admitted to the hospital after a sudden cardiac arrest.

1.3 PURPOSE OF THE STUDY

The increasing mortality rate of patients, in spite of the advanced technologies, has aroused concern in the medical world. Most of the patients suffer from the cardiac arrest in spite of being in the hospital and with expert healthcare professionals. The main purpose of the study is to find out the factors that affect the survival rate of patients in hospitals. The identification of factors will help in understanding the reasons for the increasing mortality rate and the issues related to heath care professionals (Topol and Califf).

It has been analyzed that one of the important issues that increase the mortality rate is the lack of required skills by the healthcare professionals. The technological innovations and advancement will be of no use if the experts are not able to utilize them effectively. The health professionals, who handle the patient suffering from the cardiac arrest, are not able to properly handle the technologies, like CPR. Sometimes, the technologies used with adrenaline lead to have negative outcomes due as healthcare professionals lack knowledge regarding the use of adrenaline.

The main aim of this study is to analyze the requirement of those factors, which will help in preventing a cardiac arrest and will improve the survival rate of patients. The study will help in identifying that whether educating the healthcare professionals regarding the use of advanced technologies can help in improving the survival rate or there are other factors that are responsible for improving the survival rate of patients (Topol and Califf).

It has been observed that most of the healthcare professionals are not aware of the technical knowledge, which is required for effective handling of the technologies, like CPR. The healthcare professionals only have some basic or theoretical knowledge regarding the use of CPR so, whenever a critical situation occurs, they are not able to

practically perform the technique effectively. CPR is one of the most effective ways to improve the survival rate in patients and it, along with adrenaline, can be effective if healthcare professionals possess the technical knowledge, which is required in handling the CPR.

Although other techniques, like moth to moth ventilation and chest compression have been used by healthcare professional to save the life of the patient, but, in spite of their efforts, the survival rate has not improved (Topol and Califf). The main purpose of this study is to help the health professionals in understanding the importance of gaining practical training regarding the use of CPR. After the research paper is completed, it will help in identifying the strengths and weaknesses of healthcare professionals, which prevent the improvement of the survival rate. With the help of this research paper, various factors that influence the survival rate in patients suffering from the cardiac arrest in Saudi Arabia can be identified. One such factor is the time healthcare professionals take in performing CPR on patients, and the time that rapid response teams of Saudi Arabia take to handle the patients suffering from a cardiac arrest.

The study will help in gaining an understanding regarding the importance of practical training that is required by healthcare professionals. The paper will also help in understanding the reasons for the increasing mortality rate and various measures through which the mortality rate can be decreased (Wiley). One of the important points, which the paper discusses, is the willingness and interest in using the technology to save the life of patients. In spite of the practical training, if the healthcare professionals do not feel motivated and influenced enough to perform the technology while treating patients, the technology will not be helpful in saving their lives.

The healthcare professionals must feel motivated enough to learn the use of the latest technology, which will help them in saving the lives of their patients. The patients experiencing a cardiac arrest are in a crucial situation and difficult to handle. Healthcare professionals must know the proper use of the technology and the correct time at which the technology must be used, which will help in saving the lives of patients (Wiley). The paper will help in understanding all the factors that influence the survival rate of patients experiencing a cardiac arrest. This paper will help in understanding various factors and

ideas, which can decrease the mortality rate in patients by understanding the effective use of the advanced technologies while treating them.

1.4. RESEARCH QUESTIONS AND HYPOTHESIS

Research question has a very important role to play in the research work. It provides a direction in which the research will be conducted. With the help of research questions, a reliable and authentic conclusion can be determined. Hypothesis is based on reasoning, and it has a very important role to play in guiding the research work in every step. Hypothesis helps in the development of research techniques, separating relevant from irrelevant observation and selecting the required facts in the research.

Hypothesis also helps in establishing a link between the theory and investigation, and the assumption and observation. It also helps in proper data collection with accuracy. In the same context, the hypothesis and research questions for this research work are as follows:

Question-1:

Is there a relationship between the adrenaline dosage and the survival rate?

Question-2:

Is there a relationship between the survival rate and the used method of ACLS?

Question 3:

Is there a relationship between the survival rate and the total time of doing CPR?

Question 4:

Is there a relationship between the RRT mixture and the survival rate?

CHAPTER 2

2. LITERATURE REVIEW

2.1 DEFINITION OF A CARDIAC ARREST AND CARDIOPULMONARY RESUSCITATION (CPR)

According to Lundbye (2012), cardiac arrest is the situation when the heart malfunctions and suddenly, unexpectedly, stops beating. Cardiac arrest is an electrical problem that occurs suddenly, without any warning. It occurs due to some electrical malfunction in the heart that causes irregularity in the heartbeat. The person with the cardiac arrest dies within seconds of its occurrence as the pumping of the heart gets disrupted as a result of which, the heart is unable to pump up the blood to brain, lungs and other organs.

It usually happens when the heart stops pumping the blood through the whole body. Its symptoms include the sudden collapse of a person with abnormal breathing, and unresponsiveness of the actions present that the person is experiencing a cardiac arrest (Lundbye). With the knowledge gained by researching about the concept of cardiac attack, people can take several advantages, such as they may take steps to avoid such situations of cardiac attack, and as the symptoms are seen, necessary steps can be taken to diagnose it. The study of the cardiac arrest is a significant initiative that researchers can carry out.

The following literature review is mainly objective to explore the concept of cardiac arrest in the respect of its symptoms, treatments, measures to avoid it, and certain other relevant concepts in the context of Saudi Arabia. This literature is quite effective to examine the impact and concept of cardiac arrest over a person and its consequences.

According to Parrillo and Dellinger (2013), it is the situation when the heart stops functioning. It may occur when a person may or may not have diagnosed a heart disease. The time of death is uncertain and unexpected in a cardiac arrest. It usually occurs instantly or just after the symptoms start to appear. Cardiac arrest is caused when the heart's electrical system malfunctions. In a cardiac arrest, death results when the heart suddenly stops working properly (Parrillo and Dellinger). This may be caused by abnormal or irregular heart rhythms often called as arrhythmias.

A cardiac arrest occurs due to arrhythmia that is also known as ventricular fibrillation. This happens when the lower chamber of the heart starts beating at an irregular rate chaotically and do not pump blood. Under such a situation, death occurs within minutes after stopping of the heartbeat. Cardiac arrest may be reversed if Cardiopulmonary Resuscitation (CPR) is undertaken and a defibrillator is used to give an electric shock to the heart for bringing back the heart to its normal rhythm within a few minutes (American Heart Association, 2014).

Cardiopulmonary Resuscitation is an emergency procedure that is performed in an attempt to prevent the stopping of the brain functions so that other measures can be taken to restore the immediate blood circulation and breathing in the person experiencing a cardiac arrest. The main purpose of CPR is to restore the partial flow of oxygenated blood to the heart and the brain (Parrillo and Dellinger). The main aim of the CPR is to delay the death of tissues, which occurs due to the stoppage of the blood flow to the brain and heart. CPR also helps in enhancing the chances of successful resuscitation without permanent brain damage.

It is recommended that CPR should be performed by trained persons, in and out of hospitals. CPR includes chest compressions, 5 cm deep and at a rate of 100 per minute, to ensure that an artificial circulation is created by manually pumping blood through the heart in the body. The person performing CPR can also provide external breaths by exhaling into the person’s mouth or nose. CPR is considered as one of the most effective techniques, which is performed by health professionals to enhance the chances of survival in the patients suffering from a cardiac arrest.

2.2 The History of Cardiac Arrest and Cardiopulmonary Resuscitation (CPR)

As per the views of Mann (2014), cardiac arrest is one of those diseases, which lead to an increase in the mortality rate in the world. One of the unique things about a cardiac arrest is that it occurs unexpectedly; one cannot anticipate the time when the person will suffer from the cardiac arrest. The chances of survival for the patient suffering from cardiac arrest depend on the intensity with which the cardiac arrest occurs. In most of the cases, death occurs as the patient is not able to bear the pain, which he faces at the time of the cardiac arrest (Mann).

Cardiac arrest, in general terms, is defined as an abrupt loss of heart functions in an individual, who does not have a family history of heart diseases. The time and the mode of the death are unexpected in a cardiac arrest, it generally occurs shortly after the symptoms occur. Many individuals, from several years, have been suffering from cardiac arrests due to which, the exact date of the occurrence of cardiac arrest cannot be determined (Mann).

There is a difference between the terms, cardiac arrest and heart attack. A heart attack is caused by a blockage that stops the blood from flowing to the heart, and it may cause a cardiac arrest and sudden death. On the other hand, cardiac arrests are caused when the heart's electrical system malfunctions. In cardiac arrests, the death of the patient occurs as the heart suddenly stops working properly. The malfunctioning of the heart's electrical system in a cardiac arrest occurs due to the abnormal or irregular heart rhythms.

According to Acton (2013), cardiopulmonary Resuscitation (CPR) is one of the most important life-saving first aid skills practiced all over the world. It is considered as one of the most effective methods in which the victim of the cardiac arrest is kept alive enough for a definite treatment, which is expected to be delivered to the patient to save his or her life. CPR is used to provide a circulatory support to the patient so that the "shockable rhythm", which causes the cardiac arrest, can be induced (Acton). The technique of

cardiopulmonary resuscitation was introduced in the year 1954, when James Elam along with Dr. Peter Safar experimentally demonstrated the technique and found it superior to previous methods. Dr. Peter Safar wrote a book titled "ABC of resuscitation" in 1957, and the technique was first promoted in the U.S. for the learning of the public in 1970s.

The increasing cases of cardiac arrests influenced doctors to address the problem of this disease by developing new medications, surgical techniques and identifying their risk factors. James Elam and Peter Safar, along with other doctors, started educating the world about the rescue breathing, preventive measures and helping the individual in discovering a new way to treat the cardiac arrest (Acton).

As stated by Gullo and Ristagno (2013), prior to the development of CPR in the 1950s, the accepted method of resuscitation by doctors and the public was chest pressure and arm-lift technique, which was proved ineffective by Safar and Elam. In the year 1954, Elam was the first individual, who demonstrated experimentally that exhaled air ventilation is one of the most effective and sound techniques for the patients suffering from a cardiac arrest (Gullo and Ristagno). Elam and Safar later conducted many experiments and proved the world that rescue breathing is one of the most effective ways to treat the patients of cardiac arrest as it increases the chances of survival of the patient.

With the technique becoming popular, organizations, like American Red Cross, started instructing at local chapters in the proper administration of artificial respiration procedures. Later, in 1960s, the technique was also adopted by National Academy of Science, American Society of Anesthesiologists, Medical Society of the State of New York and the American Red Cross as the preferred method of resuscitation. From 1950s, till now, the technique of CPR is considered as one of the most effective ways to treat the patients suffering from a cardiac arrest and save their lives (Gullo and Ristagno).

2.3 Causes, Risk Factors and Outcome of a Cardiac Arrest

In today's scenario, most of the individuals suffer from a cardiac arrest, which leads to a sudden death. Various techniques have been adopted to reduce the mortality rate of the

patients who die due to a cardiac arrest. A number of reasons for the sudden death of individuals are the lack of knowledge regarding signs and symptoms of the cardiac arrest. Most of the times, individuals are not aware of the measures that they need to adopt before they reach hospitals for the treatment.

According to Acton (2012), in general cases of a cardiac arrest, the patient faces death due to the less limitation in which the patient is unable to recover or not provided with proper treatment. The awareness of symptoms and causes, which lead to a cardiac arrest, can help individuals in adopting various measures that can prevent it. One of the major causes of the cardiac arrest, in most of the individuals, is the Coronary Artery disease. It is caused by plaque building up along the inner walls of arteries of the heart, which generally narrows the lumen of arteries and reduces the blood flow to the heart (Acton).

Other cardiac abnormalities like cardiac rhythm disturbances, hypertensive heart diseases and congestive heart failure can be the causes of the cardiac arrest. There are various causes of the cardiac arrest, which are not related to heart disorders or heart diseases, termed as non-cardiac arrests.

Cardiac arrests that are not related to heart disorders include trauma, bleeding that includes gastrointestinal bleeding, aortic rupture or intracranial hemorrhage. Overdoses of drugs, medicines, drowning (respiratory impairment due to being in water) and pulmonary embolism (blockage of the main artery of lung by the substance that has traveled from other parts in the body through blood) are also responsible for cardiac arrests. One of the causes of the cardiac arrest can be poisoning.

As stated by Ornato and Peberdy (2007), there are various factors that are related to cardiac arrests in individuals. The risk factors include smoking by individuals, lack of physical exercise and excess obesity and diabetes. One of the risk factors associated with cardiac arrests includes the family history, which means the patient can suffer a cardiac arrest if he has a family member, who has already faced a cardiac arrest. Other risk factors include a high blood pressure, high blood cholesterol, family history of heart disease, illegal drugs' consumption and nutritional imbalances, such as low potassium and magnesium levels in the body.

The sudden cardiac arrests generally lead to the death of the patient, but in some cases, the patient faces whole or partial body paralysis. The diagnosis of a cardiac arrest becomes very important after its sudden occurrence (Ornato and Peberdy). There are two types of causes of a cardiac arrest, shakable and non-shakable. Both shakable and non-shakable causes of a cardiac arrest are generally based on the presence and absence of ventricular fibrillation or the pulse-less ventricular tachycardia. Mostly, the shakable rhythms related to a cardiac arrest are treated with CPR and defibrillation. In some cases of a cardiac arrest, patients are diagnosed with medicines and drugs that reduce the pain suffered by them to some extent.

One of the prime causes of a cardiac arrest is a Coronary Artery disease. The ways through which individuals can prevent the sudden occurrence of a cardiac arrest include taking a proper and healthy diet, which is rich in all the essential nutrients required by the body. Other preventive measures include regularly indulging in physical activities and exercise, meditation and quitting cigarette smoking can be helpful (Ornato and Peberdy).

Controlling the high blood pressure and cholesterol levels can also be helpful to the individual in preventing the cardiac arrest. Cardiac arrests are treated through several ways out of which some techniques are effective in saving the life of patients. It is recommended that an individual should maintain his health by following the above mentioned ways, which will help him in fighting against the cardiac arrest and surviving through it.

2.4 Changes in Rhythm and Hemodynamic during a Cardiac Arrest and Resuscitation

According to Weiss and Daoud (2011), ventricular Fibrillation (VF) is the very first arrhythmia recorded in an in-hospital cardiac arrest. Studies show that VF is seen in about 20-35% of patients and should be treated well before time, at its initial stage itself. The frequency of the normal beating of the heart is 50-100 beats per minute. This normal frequency of the heartbeat is referred as the sinus rhythm. Any divergence in this normal heartbeat is called an arrhythmia. Many authors have stated that VF is associated with a

better outcome. Other similar rhythms found in a cardiac arrest are VT, asystole and Pulse-less Electrical Activity (PEA). Ventricular fibrillation has repeatedly been reported to be associated with a better outcome than asystole and PEA (Weiss and Daoud). It is important to treat and diagnose CPR at its initial stage, before the onset of VF, in order to avoid the increasing chances of the cases of asystole.

The stage of diagnosing cardiopulmonary resuscitation usually takes a longer time in the overall process, as a result of which, the overall diagnosing process gets delayed. Since, after the diagnosis of the very first recorded case of a cardiac arrest, it has been seen that the cases of the cardiac arrest have been reduced in the last few decades, after the arrival of the rescue team.

As per the views of Hartpence (2010), many authors provided a number of theories that were totally towards explaining the electrical changes in the heart that starts with the onset of VF. The electrophysiology of Ventricular fibrillation (VF) is not completely explained by any of the researchers, who have conducted research on this subject. The theories given by certain authors helped in explaining the electrical changes occurring in the heart.

The pathological conditions within a person constitute of a few underlying sub-elements of VF that are divided into four classes. These cases are 1) myocardial hypertrophy, 2) myocardial infarction, 3) cardiomyopathy, and 4) structural electrical abnormalities. The majority of structural abnormalities are related to the coronary artery disease. It is required to properly and effectively treat VF (Hartpence). For the purpose of treating VF, timely correction of the arrhythmia is required that is given by delivering an electric shock to the heart. This is called defibrillation. The mechanism of the defibrillation remains obscure. It is uncertain whether the same mechanisms are responsible for atrial versus ventricular arrhythmias. For the purpose of proving it right, three predominant theories are given:

1. According to Shibata et al, a certain amount of current should be present in the entire body to prevent the reentry of arrhythmias. Shibata states that a certain amount of current must spread throughout the entire myocardium.

2. In the words of Zipes et al, the depolarization of the critical mass makes it difficult to allow the remaining muscle mass to maintain a minimum amount or level of reentrant tachycardia.

3. As per Jones et al, the electric shocks given to a person through defibrillation prolongs the myocardial refractoriness at the time of the potential actions to be taken in order to excite the cells during period of depolarized diastole.

Overall, it is observed that arrhythmia is often the result of reentrant circuits; hence, regional depolarization in the area of the circuit is sufficient to terminate them. During a cardiac arrest, the hemodynamic become complex, a simplified picture can be drawn for a cardiac arrest regarding the process that occurs during its occurrence; on the onset of a cardiac arrest, a large pressure is exerted between the central aortas (also known as arterial pressure) and the right side of the heart.

Ellenbogen, et al (2006), despite the cessation of ventricular contraction, the pressure exerted drives ante grade blood flow, and this continues until the pressure gradient is completely eliminated. It is observed that arterial and systemic venous pressure reaches the equilibrium, between 30-50 seconds after the heartbeat stops. The pressure that drives the blood through the heart, i.e. through the coronary arteries, is known as the coronary perfusion pressure. It is calculated by subtracting the pressure exerted from the right atria with the mean aortic pressure (Ellenbogen, et al). Thus, it seems that there is some very minimum and low blood flow through the coronary arteries during the first few minutes after a cardiac arrest.

2.5 The Chain of Survival

According to Norman (2010), for the purpose of the survival of the patient after an in-hospital cardiac arrest, a chain of actions is suggested to be taken for preventing the delay in the operation of the survival of the person. The “chain of survival” was introduced in 1991 by Cummins. It includes the post-resuscitation care. The content of the chain includes an early recognition and call for help, early CPR, early defibrillation and early post-resuscitation care.

Early recognition and call for help: The very first step is to identify the person, who feels unwell and is prone to cardiac arrest. The target is to find the person before the cardiac arrest occurs. If the cardiac arrest occurs, the alarm system activates so that individuals with the correct knowledge and skills regarding the use of CPR can arrive to immediately provide assistance, or rather take the command.

Early CPR: It is important to take actions immediately after the person is identified with the condition of a cardiac arrest with time so that defibrillation can be performed. Performing chest compressions will be highly beneficial for avoiding a cardiac arrest instead of doing nothing at all (Norman).

Early Defibrillation: The purpose of early defibrillation is to restart the heart to a normal rhythm. The AEDs in the hospital wards must be properly placed that is a key to improving the survival rate after an in-hospital cardiac arrest.

Early Post-Resuscitati on Care: This last link in the chain of survival describes different methods of the further care for the survival of the patient. This step is the most important step for the effective implementation of the overall steps for the successfully resuscitated patient. The level of evidence for the post-resuscitation methods varies. The goal of this link is to help in the recovery of the patient, and it can be done by giving them mild hypothermia. It is also believed that only medical attention and care can help the patient to recover after a successful resuscitation in the hospital.

2.6 AUTOMATED EXTERNAL DEFIBRILLATORS (ADE) IN HOSPITALS

As per the views of Field, et al. (2012), ADE is a light-weight device that is used to assess a person's heart rhythm. It is considered as an effective device, which increases the chances of the survival of the patient. With the uses of ADE, any imbalances or irregularities in individuals' heart rhythm can be determined, which will ultimately be helpful in preventing a sudden cardiac arrest. It is proposed as a strategy to improve the survival in the case of a cardiac arrest that occurs in the hospital setting.

It has been observed that of the use of ADE is much helpful in improving the chances of patient's survival and preventing it by adopting precautionary measures. It has been observed that the use of ADEs in hospitals has been quite ineffective as only 1 in 5 patients have initial heart rhythms that respond to defibrillation (Field, et al.). It has been observed that a quick action by healthcare professionals improves the survival rate in their patients experiencing a cardiac arrest. AED is considered to be an important device, which enhances the survival rate in patients experiencing a cardiac arrest. Due to its inbuilt instruction program, AED provides voice prompts to the user, which makes any knowledge of rhythm analysis unnecessary. With the help of AED instructions, the user can perform defibrillation by pushing a button to perform CPR.

According to Eisenberg (2009), AED increases the chances of patients to respond to the medical treatment where defibrillation is needed. AED can be used by even non-medical people due to its portability and easy accessibility. It is safe to be used by everyone provided the person has been trained to operate AED. It has been observed that in 90% cases, AED is able to detect the heart rhythm that needs to be defibrillated. AEDs are available in public areas, such as airports, office complexes, sports arenas and other private and public places, where people frequently gather. It is an effective tool, which is easy to operate and can save the life of the individual facing a sudden cardiac arrest. Usually, ADE is used in cases where life a threatening cardiac arrest occurs. There are basically two types of rhythms that are treated by the device, which are:

-Pulse-less ventricular tachycardia

-Ventricular fibrillation

These two types are shockable cardiac arrests. In this, the heart is said to be electrically active, but the pattern of the heart rhythm is dysfunctional due to which the blood cannot be pumped and circulated to other parts of the body (Eisenberg, 2009). In the case of ventricular fibrillation, the heartbeat is too fast due to which it is not able to effectively pump the blood. Ventricular tachycardia leads to ventricular fibrillation. In the case of ventricular fibrillation, the electric activity of the heart becomes chaotic, which prevents the ventricle from effectively pumping the blood to other parts of the body.

According to Vincent (2008), AEDs are designed in such a way that they can be easily used by a person, who has received training. It requires minimal training to use. One of the best features of ADE is that it automatically detects heart rhythms and determines if a shock is required by the patient or not. The automatic models of ADE will provide shock without the user command (Vincent). In the case of semi-automatic models, the device will provide the user with the information that the shock is needed by the patient, and the user will tell the machine to provide a shock to the patient by pressing a button.

Although ADEs have provided benefit to detect the heart rhythms of the patient and anticipate and handle cardiac arrests, they have been not proved successful in improving the survival rate in patients. Due to the machine and design errors, it has been recommended to redesign and renovate the device so that it could increase the survival rate in the patients suffering from a cardiac arrest (Vincent).

2.7 TECHNIQUES AND TEACHING METHODS FOR CPR

As stated by Brady, et al (2012), CPR is considered as one of the most effective methods, which help in treating the patient suffering from a cardiac arrest. There have been many changes and innovations in the techniques of CPR, which has made it more effective. The new effective CPR is providing no benefit to the patients facing a heart arrest, the

reason being the lack of knowledge and awareness about the proper usage of CPR. Conventional CPR includes chest compression and rescue breathing.

The recent developments and research studies have observed that rescue breathing would be unnecessary and detrimental in some cases of the cardiac arrest. Automated External Defibrillators (ADEs) are lightweight devices that are used to assess a person's heart rhythm. The device can be helpful in anticipating the cardiac arrest. An important principle of learning theories is learning ability (Brady, et al.). The learning process involves emotions and conscious, as well as unconscious processes, and this learning ability keep on improving with more experiences and challenges that come in the way. In the brain, the two cerebral hemispheres complement each other; left cerebral covers the logical thinking and is analytical and rational. The right cerebral hemisphere covers the thinking that is intuitive, random and holistic (Brady, et al.). The most dominant cerebral hemisphere among the left and the right one affects the learning process.

According to Thygerson (2011), various studies have been conducted, in this context, to investigate the time to which the skills remain after a CPR course. One study found that CPR psychomotor skills reduce down within two weeks after training, whereas another study presented results that stated that the skills remain effective for three to six months. Some studies pointed out that healthcare organizations play the main role in preparing healthcare professionals by giving them time for evolving and increasing their knowledge and skills that they require in this area. Other research studies conducted in this field showed that the quality of the attempts made for the resuscitation has been improved after CPR training. It can also be seen that the instructor cannot be sure of the extent to which the health care professionals will remember, or the facts learned during the CPR training. The healthcare professionals must be provided training in the use of CPR with adrenaline, which might be effective in saving the lives of patients.

For an effective medical learning, flexible situation-based learning is required in realistic simulated scenarios, where feedback can be taken and over-learning can be provided. The effectiveness of the learning process is that people innovate, change and expand their knowledge about the realities (Thygerson). People already have a few ideas

and experiences about realities through reading books or by hearing something about it. Experience and interaction between individuals and reality influence the learning process.

The learning process aims to find the meaning in previously acquired knowledge and a new situation so that it becomes possible to view things from a new perspective and then change and expand former knowledge. An understanding of the social environment is very valuable in the learning process, which helps in identifying the strength and weaknesses of the medical area.

It is usually not possible to impart full knowledge to the learner in a course or during a lecture, but it possible to establish a condition in hospitals in which the participants have full knowledge of the technologies and can demonstrate it to other healthcare professionals. Providing practical training to the healthcare professionals and nurses can help them in understanding the various situations, which require various handling techniques by the healthcare professionals (Thygerson).

The practical training also helps the healthcare professionals in identifying the differences between the conditions in hospitals and out of hospitals, and the different methods that they need to adopt to save the patient. Providing education to healthcare professionals can be an important factor in improving the survival rate in patients.

2. 8 Approaches and Fears to Starting CPR

As stated by Henry and Stapleto (2011), cardiac arrest is one of those diseases, which requires proper treatment by healthcare professionals. It requires intense care and due to the lack of awareness and proper training, people find it difficult to handle the situation when a cardiac arrest occurs. Most of the individuals do not perform CPR because

of the fear that they might harm the person experiencing the cardiac arrest. In the case of a family member, people fear that performing CPR may end the life of the patient. Fear of harming the patient by performing CPR reduces the probability of performing CPR on patients. It has been observed that there is a risk associated with performing CPR; people usually think that performing CPR might lead to the transmission of HIV, Severe Acute Respiratory Syndrome (SARS) and Herpes simplex, due to which, they prefer not performing it. Individuals and healthcare professionals are mostly aware of the ways in which CPR should be performed, but they are not confident and motivated enough to perform CPR on patients (Henry and Stapleton).

Unwillingness of performing CPR on patients leads to an increase in the mortality rate of patients suffering from a cardiac arrest. Most of the healthcare professionals, in spite of being aware of the results of performing CPR on patients, do not perform CPR because they are not properly educated about its outcomes. It has been analyzed that by receiving proper education and training, the willingness of individuals and healthcare professionals to perform CPR can be raised (Henry and Stapleton).

Educating the healthcare professionals about the strategies for prevention includes easy access to devices, like pocket masks that prevent any injury to the person performing CPR and prevention of the fear of starting CPR. One of the important fears that prevent healthcare professionals to perform CPR is self-injury. It has been observed that performing CPR on patients might cause damage to the person performing it. Problems like back pain, back discomfort and musculoskeletal injuries have been experienced by the healthcare professionals and nurses performing CPR. Most of the healthcare professionals and nurses think of their interest and avoid performing CPR as they think that performing it might harm them. There have been other problems, which prevent healthcare professionals from performing CPR (Henry and Stapleton). While performing CPR, the ventilation part requires physical efforts, which might cause to hyperventilation to the person performing it.

Education is considered as one of the most important aspects, which cannot only change the attitude and thinking of the people, but can also help them in their and others' development. By providing education and training to the healthcare professionals, the survival rate in the patients dying from a cardiac arrest can be improved.

As per the views of Paradis, et al (2007), CPR is not only performed in hospitals, it is also performed out of the hospitals, like at the home and various other public places; it is generally performed by the person, who has received training on how to effectively perform CPR. Thus, training and education of how to effectively perform CPR are required by both, the healthcare professionals in hospitals and individuals, who are willing to save the lives of the people, which generally include private consultants and medical professionals.

Educating people about the outcomes of performing CPR can positively impact the healthcare professionals and nurses; they can identify the difference between the outcomes of effectively performing CPR, with and without adrenaline (Paradis, et al). Education and training can clear their various doubts regarding the effect of performing CPR on them, and the ways in which performing it can be safe. Healthcare professionals and nurses can get ideas regarding the safe performing of defibrillation, which can improve their willingness to perform CPR on patients that will ultimately improve the survival rate in patients.

2.9 SURVIVAL AFTER IN-HOSPITAL CARDIAC ARREST

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According to Humphreys (2011), it becomes difficult to identify the effectiveness of in-hospital resuscitation. Survival rate in patients differ in different hospitals as there is a difference between the designs of the techniques that are followed in different hospitals. Every hospital differs in terms of the number of admissions of patients suffering from a cardiac arrest, setting of the hospital in an emergency, intervention location and the co-morbid conditions. Survival of the patient in a hospital, after a cardiac arrest, is based on a number of factors (Humphreys). The factors responsible for the survival of patients after a cardiac arrest involves the quality of CPR, use of Adrenaline with ADE, time to

defibrillation and the response time in which the patient was provided treatment by the rapid response teams.

There are various other factors, which might increase the mortality rate in hospitals and result in a sudden death of the patient after a cardiac arrest. The factors responsible for increasing the mortality rate include weaknesses in the chain of survival and the lack of expertise and knowledge of healthcare professionals in effectively performing CPR and the importance of adrenaline in performing it (Humphreys). The main aim of resuscitation is to bring back the person to life and if possible, bring back to the same health he had before experiencing the cardiac arrest. Most of the hospitals lack one or the other factor, which are responsible for improving the survival rate in patients.

As per the views of Rogers (2011), there is a need of updating the areas where the hospitals lack in providing proper care and support to patients so that the survival rate in patients can be improved. People experiencing a cardiac arrest in a hospital have, on an average, have only 22% chances of surviving and going back home. In most of the cases, the patient faces sudden death, or some of the patients face death after a period of time (Rogers). The survival rate also depends on other factors that are not under the control of the healthcare professionals, who are treating the patient. Factors like the age and condition of the patient and in how much time the CPR was performed on the patient help in determining the probabilities of the patient's survival. Other important factors, which influence the survival rate in patients, involve the effects of providing interrupted oxygen to the brain, which might result in neurological problems or a difficulty in talking before the CPR was performed on the patient. The American Heart Association has developed various guidelines, which will help hospitals in improving the quality of the care associated with a cardiac arrest in hospitals (Rogers).

According to Gregory and Mursell (2013), the guidelines offer benchmarks to the healthcare professionals in responding to a cardiac arrest. It has been observed that when people follow quality and the benchmark, the performance is improved. In most of the hospitals, after the identification of the problem areas that prevent the improvement in the survival rate in patients, improvements have been done. An improvement in the survival

rate has been made due to the enhancement of skills of healthcare professionals, and improving the response time of rapid response teams present in hospitals will help them to ensure the better performance of resuscitation (Gregory and Mursell). The other reason for the improvement in the survival rate in hospitals is the healthcare professionals getting better at providing care to the patient after the resuscitation.

If the studies are analyzed, in the past 40 years, the survival rate in the patients, experiencing a cardiac arrest, has not changed much. Although there have been improvements, they have not contributed much in improving the survival rate in patients. Most of the healthcare professionals have clinical experience, which allows them to anticipate the chances of the survival and the quality of life of the patient after the cardiac arrest (Gregory and Mursell).

Various factors, like age and other diseases, which the patient has, before experiencing a cardiac arrest, also play an important role in infusing the survival rate in patients. The survival rate of the patients, experiencing a cardiac arrest, depends on various factors and each factor has a significant role to play in influencing the patient's survival. Analyzing the factors and with the help of providing effective training and education to healthcare professionals are the precautionary measures that can be adopted to prevent the cases of a cardiac arrest. With the help of proper awareness and effective use of techniques like CPR, the use of adrenaline with CPR and ADE can help in saving the lives of patients in the case of a cardiac arrest.

CHAPTER 3

3. RESEARCH METHODOLOGY

3.1 DATA

The main source for the data that has been used for this research was founded in Saudi Arabian ministry of health 2013 annual report. The report consists of three main aspects:

1-The heart arrest with respect of age.

2-The heart arrest with respect of gender.

3-The heart arrest with respect of mortality.

4-The heart arrest with respect of admission.

Additionally, the following are the main system components used in this research,

1- Personal Computer.

2- Software:

2.1 – SPSS 18.0 – for statistical analysis.

2.2 – Microsoft Excel 2015 – Spreadsheet display.

3.1.1 STUDY DESIGN:

This is a cross-sectional base study among the population of Saudi Arabian heart arrests patients. This research designed to identify the factors and the techniques that affects the outcomes of the patients who admitted in the Saudi hospitals for the diagnosis other than heart related disease. The main aim of this study is to analyze the requirement of those factors, which will help in improving the techniques used with a cardiac arrest patient and will improve the survival rate of patients. The study will help in identifying that whether mixing the use of advanced technologies can help in improving the survival rate

or there are other factors that are responsible for improving the survival rate of patients (Topol and Califf).

3.1.2 Study Area and Population:

This study will cover 1008 case that has been diagnosed and admitted in hospital and have heart arrest in hospital. 608 of these subjects are male and 391 are female. The study population ware selected from a single source that share the same demographic characteristic. Their ages are diverse from 1year to 109 years old. All subjects are admitted with deferent admissions causes that end up with an in hospital cardiac arrest.

4. Method:

This chapter is about research methods which would be used for taking the research further. It forms the basis for the entire approach used , tools of data collection, methods. Bryman and Cramer (1990) gave the research model. This model is very useful in understanding the research process about the factors associated with survival rates of in-hospital patient after having sudden cardiac arrest in Asir south region Saudi Arabia and it makes the research easier and simple to follow and understand the outcomes.

4.1 Frequency Tables

Variables were examined for missing data. Additionally, variables were inspected to determine what variables yielded sufficient variability in responding to warrant further analysis.

Percentages were determined for categorical variables (e.g., survival).

4.2 Descriptive Statistics

Means (and standard deviations) were calculated for continuous variables (e.g., dosage and frequency of adrenaline)

4.3 Inferential Statistics

Goodness of fit Chi Square

Are patients more likely to die or survive?

4.3.1 Independent sample t-tests

Does dosage and frequency of adrenaline administration differ for patients who survive versus those who die?

4.3.2 Chi square test if independence

Does survival rate differ across physician teams?

Does survival rate differ across nurse teams?

4.3.3 One-way ANOVA

Does adrenaline dosage and frequency differ across the 4 physician teams?

4.3.4 TWO-WAY ANOVA

Does dosage of adrenaline differ across levels of survival and physician team?

Is there a main effect of survival?

Is there a main effect of physician team?

Is there an interaction between survival and physician team?

Does frequency of adrenaline administration differ across levels of survival and physician team?

Is there a main effect of survival?

Is there a main effect of physician team?

Is there an interaction between survival and physician team?

CHAPTER 4

4. RESULTS AND DISCUSSION

Tableau 1 gender distribution

gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	608	60.3	60.9	60.9
	female	391	38.8	39.1	100.0
	Total	999	99.0	100.0	
Missing	System	10	1.0		
Total		1009	100.0		

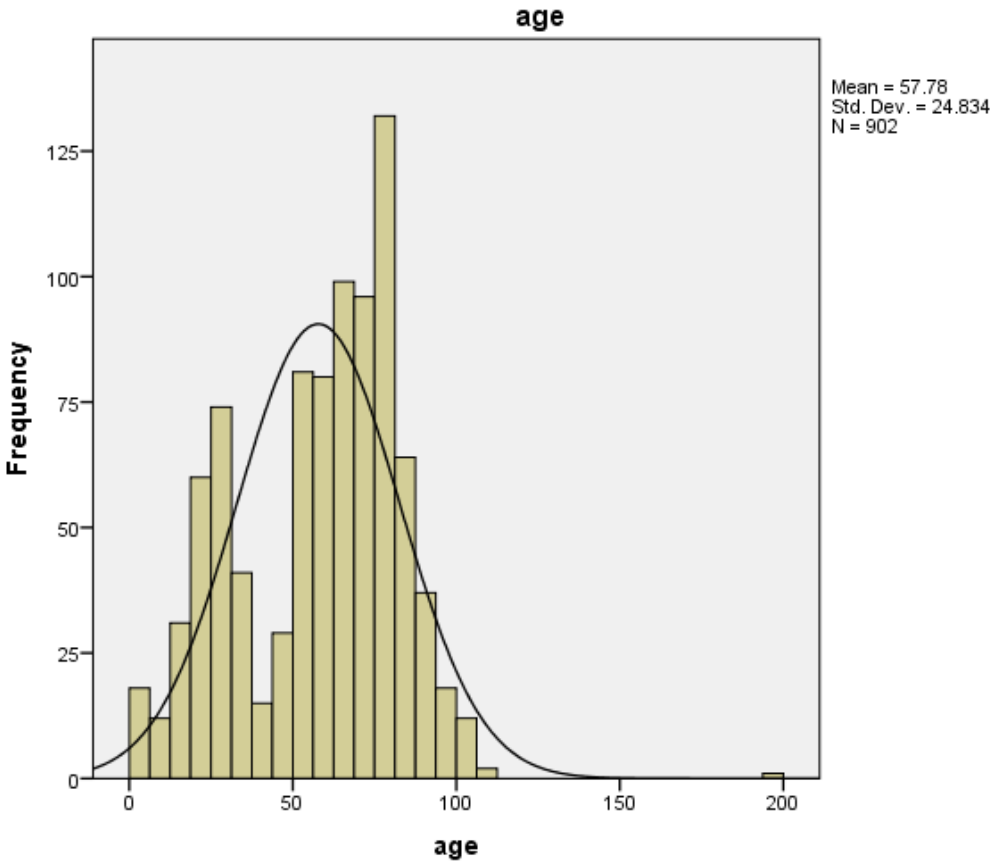


Figure 1 age distribution

Tableau 2 arrest location					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	RR	222	22.0	22.6	22.6
	ICU	147	14.6	15.0	37.6
	IMCU	259	25.7	26.4	64.0
	CCU	81	8.0	8.3	72.3
	MMW	36	3.6	3.7	75.9
	FMW	62	6.1	6.3	82.3
	MGS	13	1.3	1.3	83.6
	FGS	27	2.7	2.8	86.3
	PMW	6	.6	.6	87.0
	PSW	2	.2	.2	87.2
	PICU	41	4.1	4.2	91.3
	NICU	29	2.9	3.0	94.3
	MCW	43	4.3	4.4	98.7
	UORO	10	1.0	1.0	99.7
	ORTHO	2	.2	.2	99.9
	NEUROSURGERY	1	.1	.1	100.0
	Total	981	97.2	100.0	

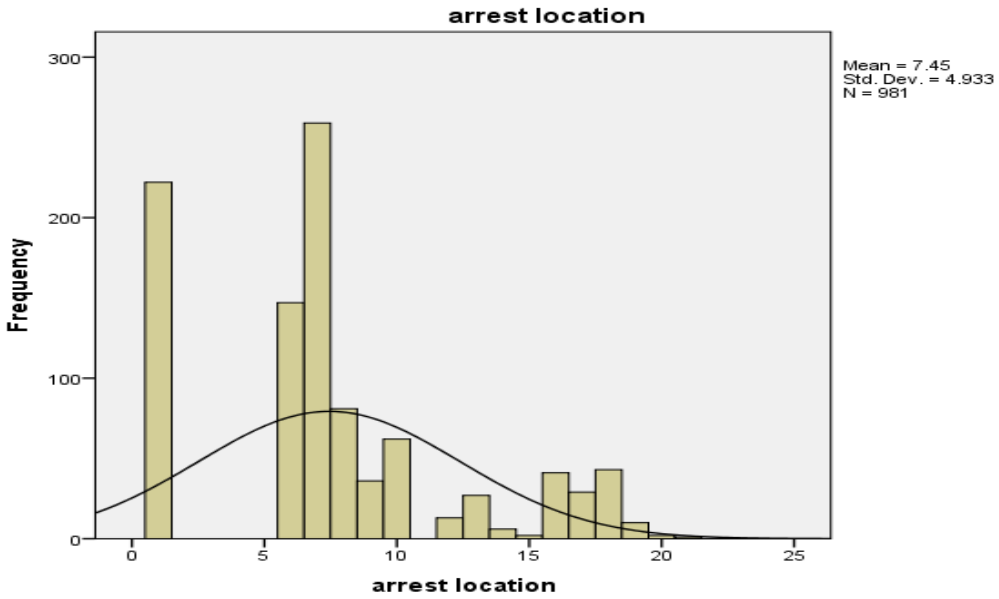


Figure 2 arrest location distribution

Tableau 3 arrest type

arrest type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	RESP	19	1.9	2.1	2.1
	CARDIAC	83	8.2	9.2	11.3
	CARDIOPULMO-NARY	801	79.4	88.7	100.0
	Total	903	89.5	100.0	

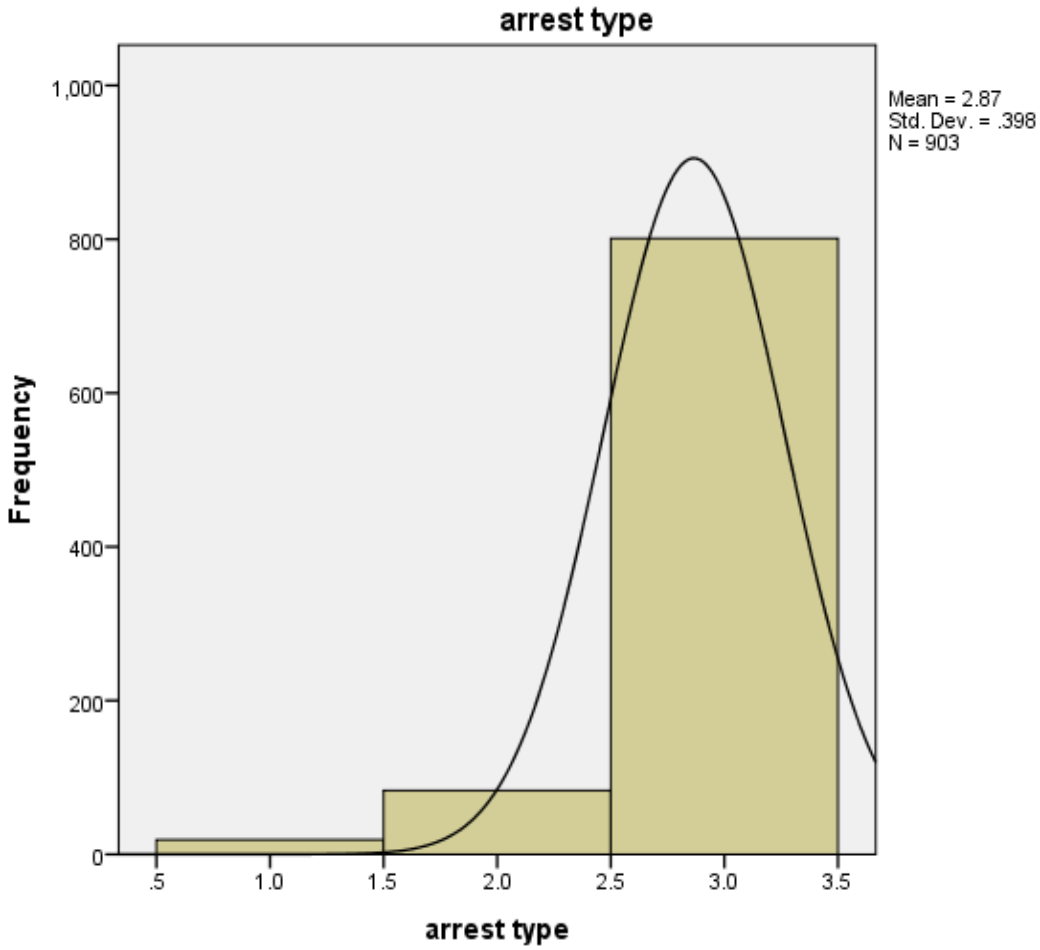


Figure 3 arrest type distribution

Tableau 4 the code team distribution

code team no.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	6	.6	.6	.6
	3	58	5.7	5.8	6.4
	4	122	12.1	12.1	18.5
	5	178	17.6	17.7	36.2
	6	267	26.5	26.5	62.7
	7	299	29.6	29.7	92.4
	8	59	5.8	5.9	98.3
	9	14	1.4	1.4	99.7
	10	2	.2	.2	99.9
	12	1	.1	.1	100.0
	Total	1006	99.7	100.0	
Total		1009	100.0		

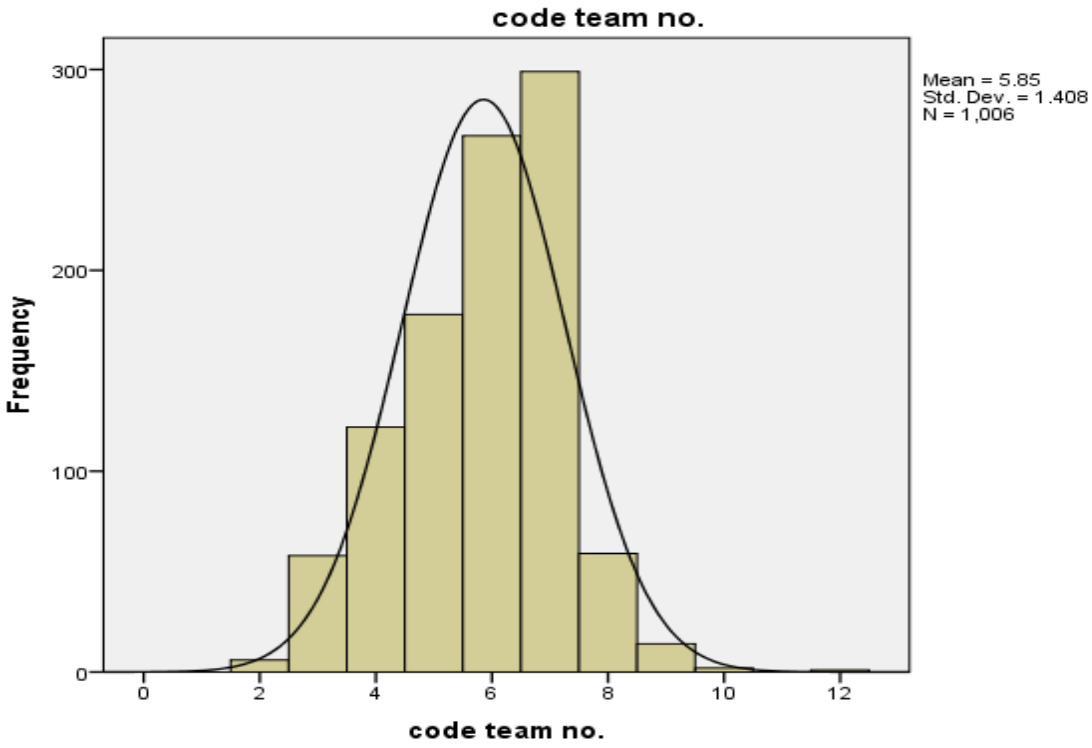


Figure 4 the code team distribution

Tableau 5 the nurse team distribution

nurse no.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	10	1.0	1.0	1.0
	1	53	5.3	5.3	6.3
	2	307	30.4	30.5	36.8
	3	350	34.7	34.8	71.6
	4	234	23.2	23.3	94.8
	5	46	4.6	4.6	99.4
	6	5	.5	.5	99.9
	7	1	.1	.1	100.0
	all	1006	99.7	100.0	
Total		1009	100.0		

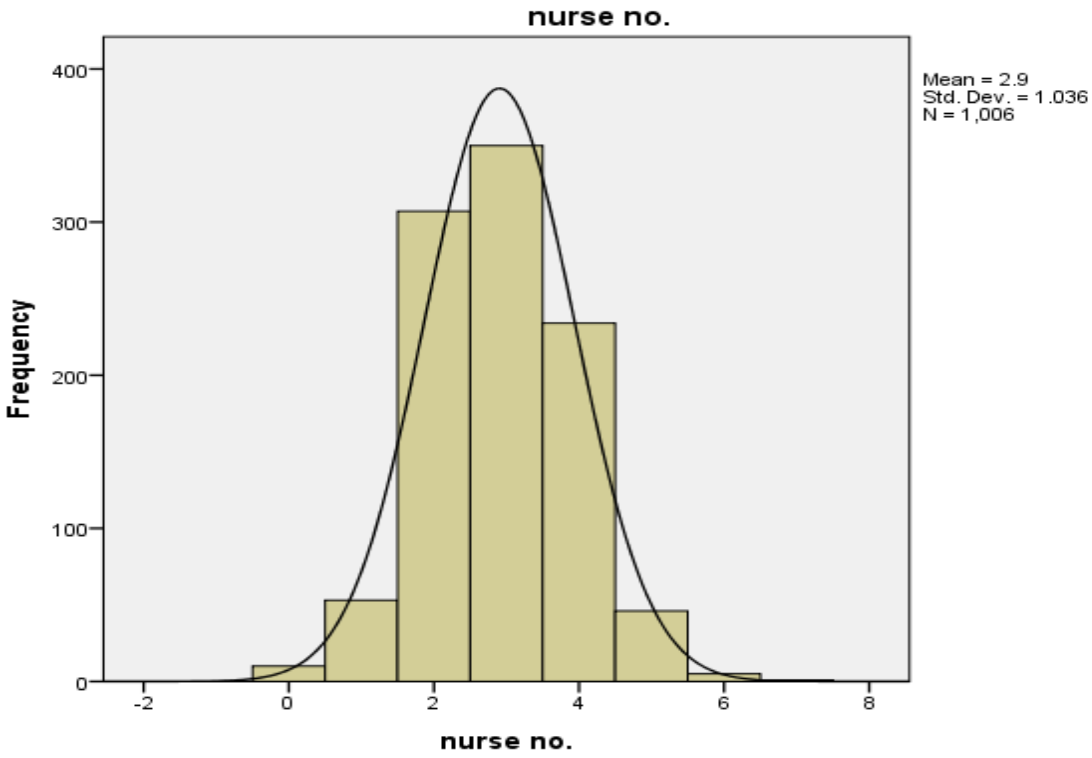


Figure 5 the nurse team distribution

Tableau 6 adrenaline use

Adrenaline use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	966	95.7	96.0	96.0
	NO	40	4.0	4.0	100.0
	Total	1006	99.7	100.0	
Total		1009	100.0		

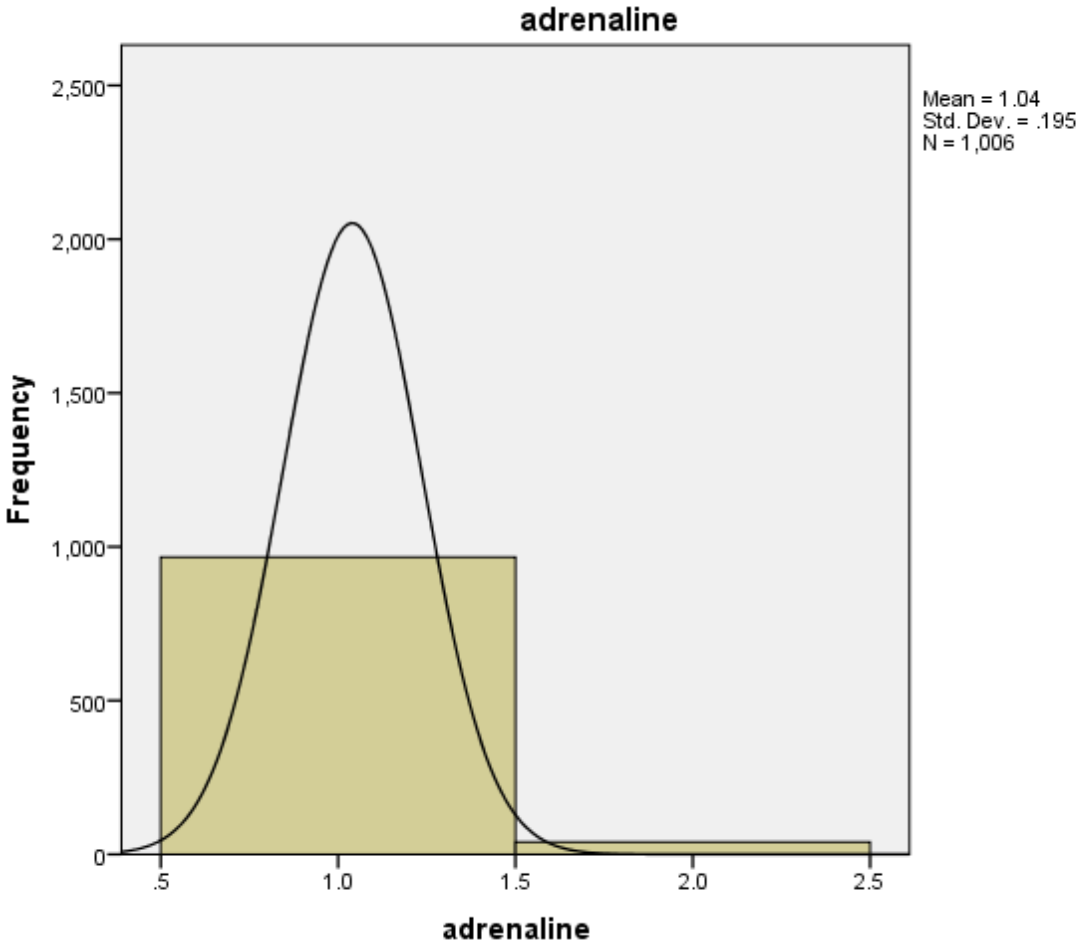


Figure 6 adrenaline used distribution

Tableau 7 how many times adrenaline used

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	104	10.3	10.8	10.8
	2	123	12.2	12.7	23.5
	3	202	20.0	20.9	44.5
	4	149	14.8	15.4	59.9
	5	147	14.6	15.2	75.1
	6	158	15.7	16.4	91.5
	7	62	6.1	6.4	97.9
	8	11	1.1	1.1	99.1
	9	2	.2	.2	99.3
	10	5	.5	.5	99.8
	11	2	.2	.2	100.0
	Total	965	95.6	100.0	
Total		1009	100.0		

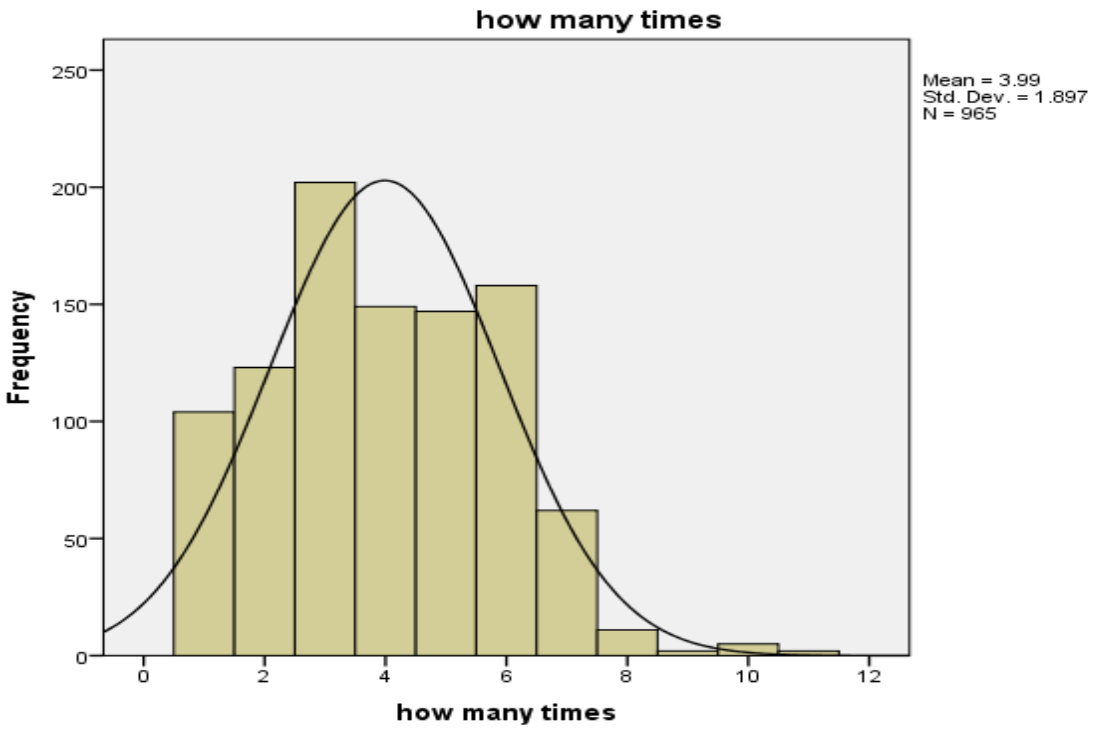


Figure 7 HOW MANY TIMES ADRENALINE USED

Tableau 8 AED usege

AED Defibrillator usage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	87	8.6	8.7	8.7
	NO	916	90.8	91.3	100.0
	Total	1003	99.4	100.0	
Total		1009	100.0		

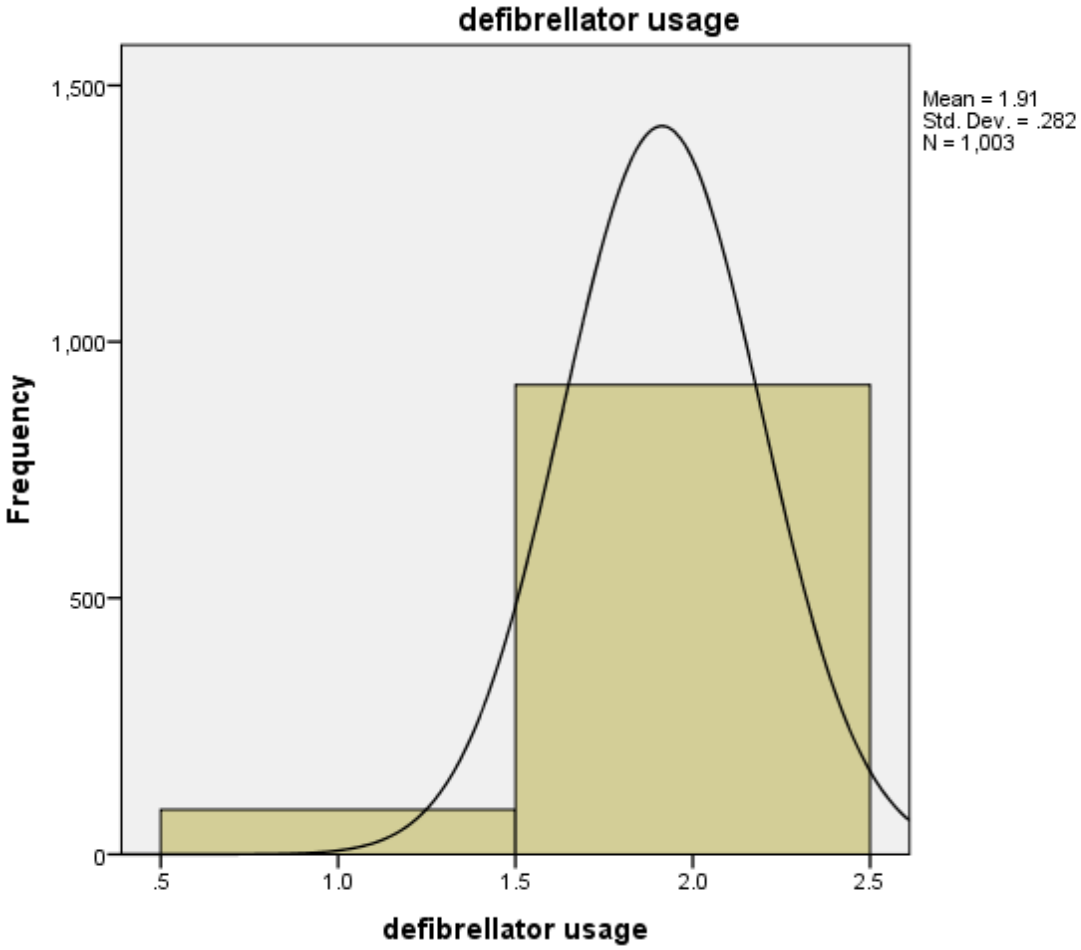


Figure 8 defibrillator usage

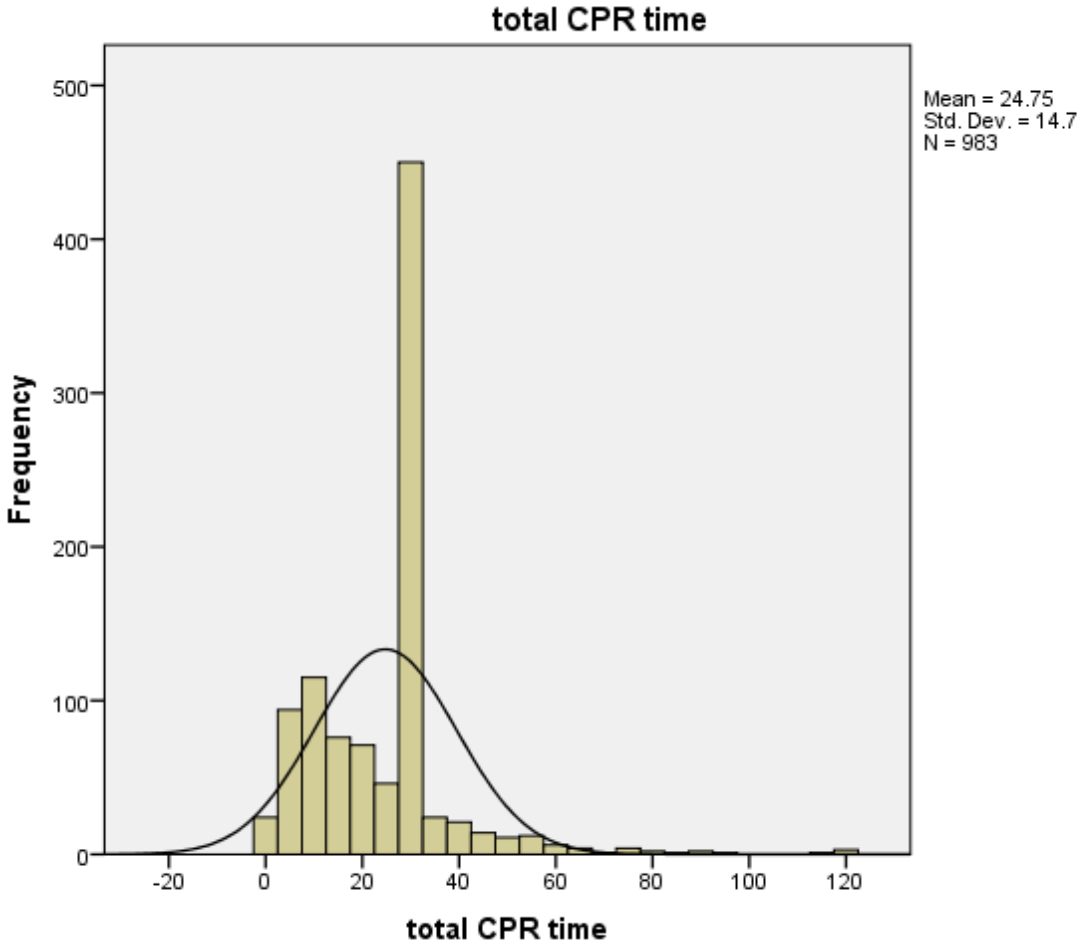


Figure 9 total cpr time

Tableau 9 total outcome (survived/died)

outcome

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SURVIVED	453	44.9	45.1	45.1
	DIED	551	54.6	54.9	100.0
	Total	1004	99.5	100.0	
Missig	System	5	.5		
Total		1009	100.0		

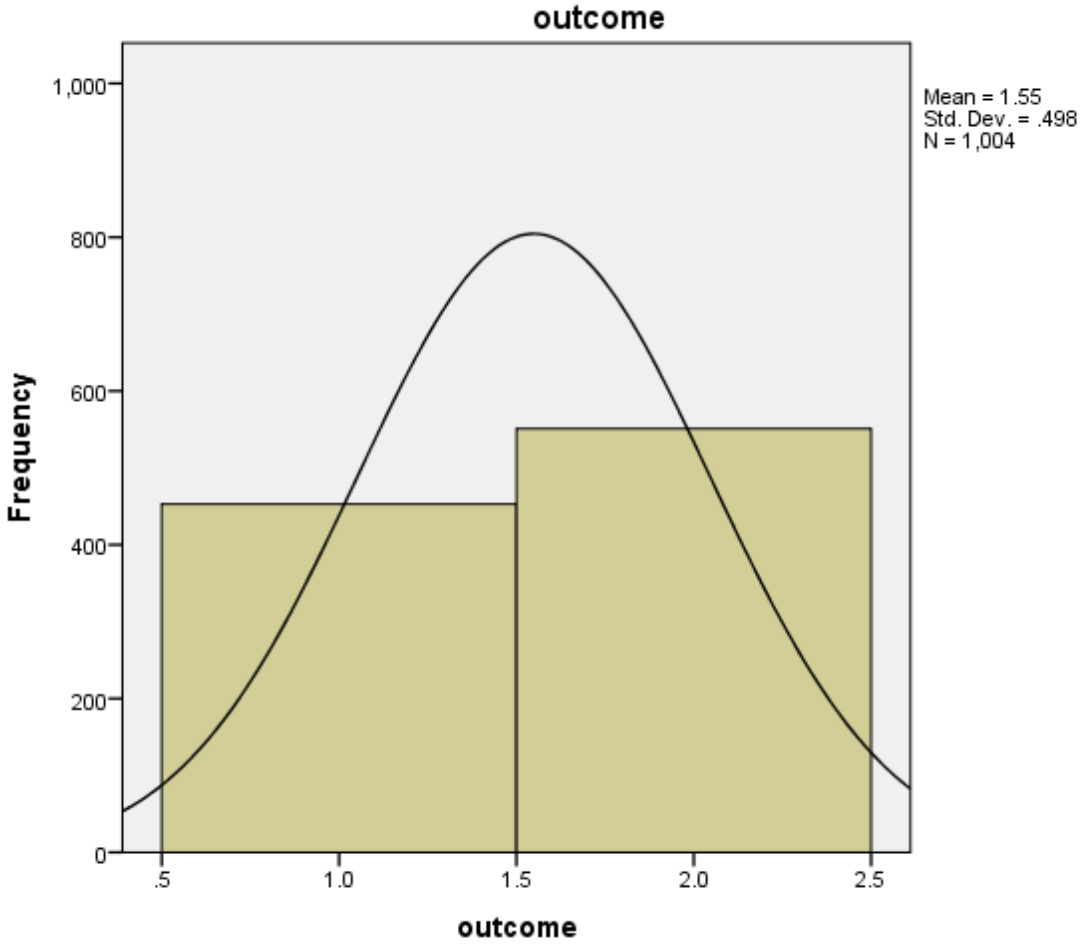


Figure 10 total outcome distribution

4.1. DISCUSSION

The original sample consisted of 1009 individuals (60.3% male and 38.8% female). A primary focus of the research is the impact of the response team on survival rate. Examination of the prevalence of each of the 10 physician teams indicated that six of these teams were present at less than 10% of the hospital reported in the data set. Thus, analyses were conducted on those physician teams (code_team_no) that were reported for more than 10% of the sample (n > 100). The team numbers used range from 4 to 7. Additionally, nurse teams were limited to those ranging from 2 to 4 due to the infrequent combination with the physicians. Elimination of the infrequent physician and nurse teams yielded a sample size of 792. The outcome of four patients was not recoded which led to a final sample size of 788.

SURVIVAL RATE

The survival outcome indicated that patients were significantly more likely to die (55.3%) than survive (44.7%) as indicated by a chi-square goodness of fit analysis, $\chi^2(1, n=788) = 8.954$, $\alpha = .003$. Given that the primary purpose of the present study was to explore factors which predict survival of patients experiencing cardiac arrest, particularly the use of adrenaline and fluctuations in the response team, an examination of the use of adrenaline and response team was explored.

ADRENALINE

The vast majority of patients were treated with adrenaline (96.1%) at the time of cardiac arrest. Additional variables associated with adrenaline use that could be explored to determine the characteristics of adrenaline usage that influence efficacy for survival rates includes dosage and frequency of use.

In regards to dosage, the average was 0.96 (SD = .19). Results of an independent-samples t-test indicated that patients who survived received a statistically significantly higher dose (M = .97, SD = .14) than those who died (M = .94, SD = .21), t (746) =2.17, p=.03.

In regards to how many times adrenaline was administered, the average was 3.98 (SD = 1.90). Results of an independent-samples t-test indicated that patients who survived received statistically significantly fewer administrations of adrenaline (M = 3.10, SD = 1.65) than those who died (M = 4.63, SD = 1.82), t (757) =-11.88, p<.001.

RESPONSE TEAM

- PHYSICIAN

A chi-square test of independence was conducted to determine if the survival rate across physician teams was significantly different. Results indicated that there was a significant difference in survival across the groups, , $\chi^2(3, n=788) =33.02$, $\alpha<.001$. The discrepancy across physician teams is shown below.

Tableau 10 CODE_TEAM_NO * OUTCOME CROSSTABULATION

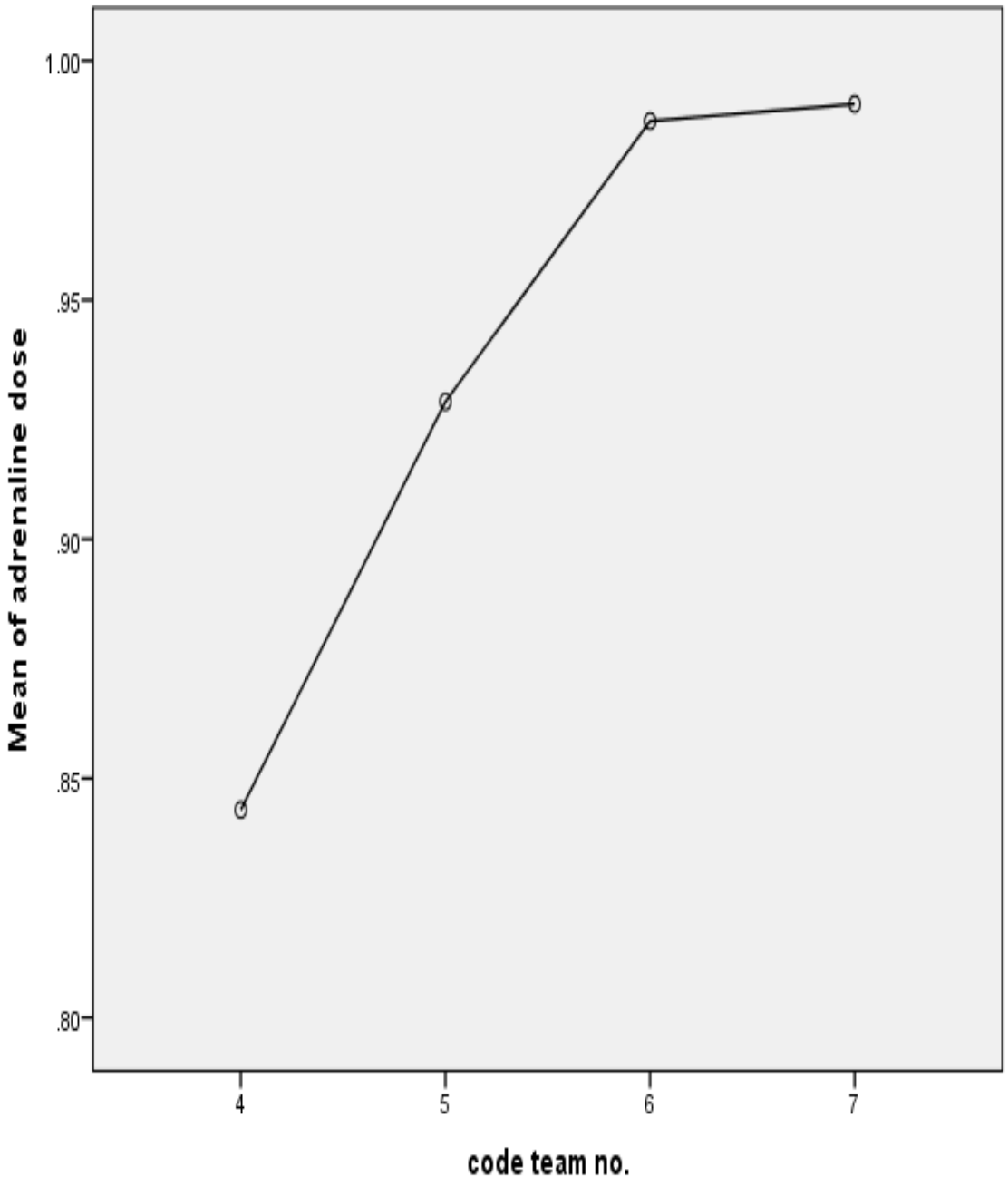
			outcome		Total
			SURVIVED	DIED	
code team no	4	Count	29	74	103
		% within code team no	28.2%	71.8%	100.0%
		% within outcome	8.2%	17.0%	13.1%
	5	Count	56	108	164
		% within codeteamno	34.1%	65.9%	100.0%
		% within outcome	15.9%	24.8%	20.8%
	6	Count	140	108	248
		% within codeteamno	56.5%	43.5%	100.0%
		% within outcome	39.8%	24.8%	31.5%
	7	Count	127	146	273
		% within codeteamno	46.5%	53.5%	100.0%
		% within outcome	36.1%	33.5%	34.6%
Total		Count	352	436	788
		% within codeteamno	44.7%	55.3%	100.0%
		% within outcome	100.0%	100.0%	100.0%

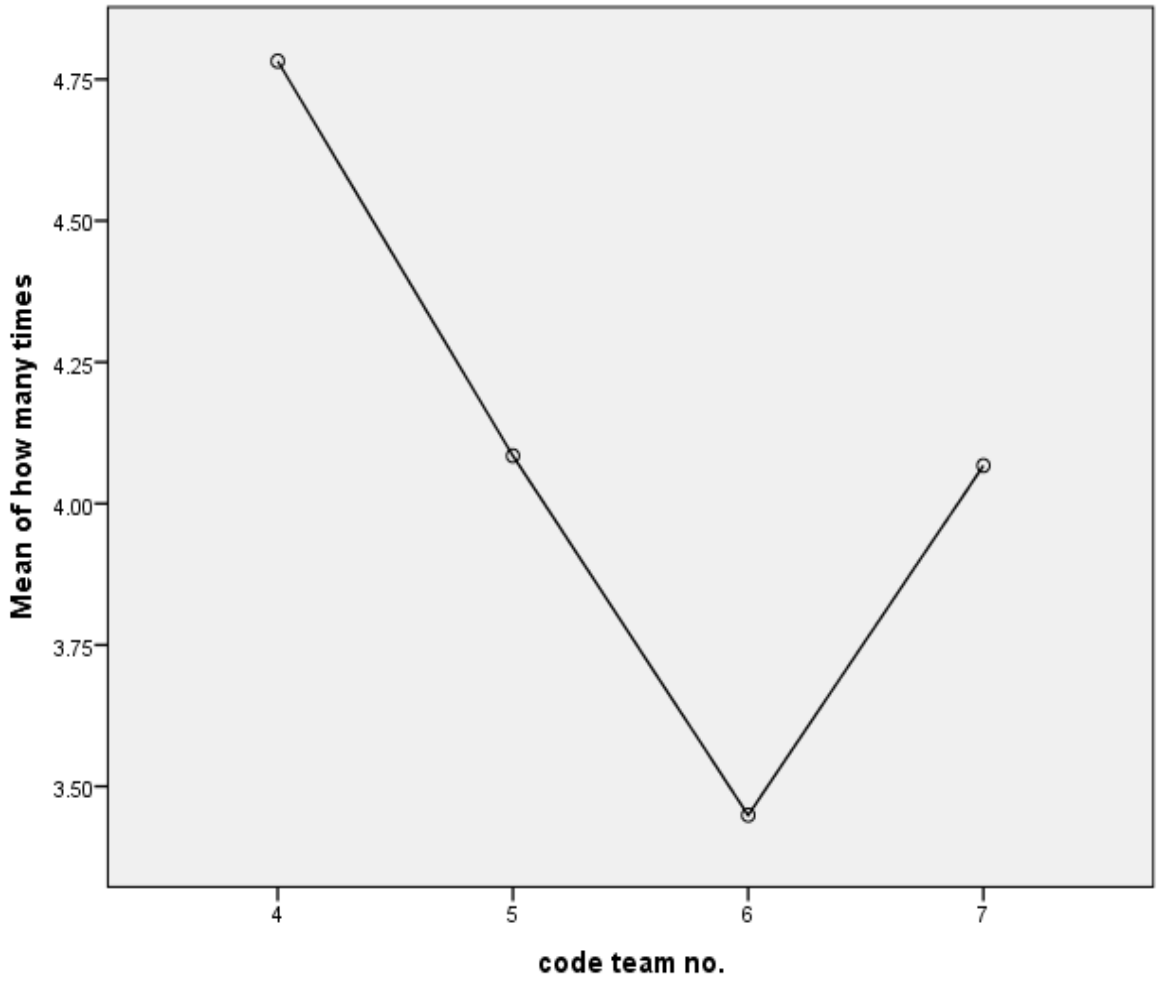
Further analyses were conducted to determine if adrenaline dosage and frequency differed across physician teams. One-way ANOVAs indicated that significant differences

were found across physician groups for both dosage (F (3,744)=19.77, p<.001) and frequency of administration (F(3,755)=13.02, p<.001). Means for each physician group and the graph of the differences across groups are shown below.

Tableau 11 Descriptive

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Adrenaline dose	4	99	.84	.341	.034	.78	.91	0	1
	5	153	.93	.229	.019	.89	.97	0	1
	6	234	.99	.108	.007	.97	1.00	0	1
	7	262	.99	.086	.005	.98	1.00	0	1
	Total	748	.96	.186	.007	.94	.97	0	1
Adrenaline used time	4	101	4.78	2.038	.203	4.38	5.18	1	11
	5	154	4.08	2.083	.168	3.75	4.42	1	10
	6	236	3.45	1.758	.114	3.22	3.67	1	11
	7	268	4.07	1.738	.106	3.86	4.28	1	10
	Total	759	3.97	1.904	.069	3.84	4.11	1	11


1.00
.95
.90
.85
.80
Mean of adrenaline dose
4
5
6
7
code team no.



- NURSE

A chi-square test of independence was conducted to determine if the survival rate across nurse teams was significantly different. Results indicated that there was not a significant difference in survival across the groups. Survival rates across nurse teams are shown below.

Nurse no * outcome Cross tabulation

			outcome		Total
			SURVIVED	DIED	
Nurse no	2	Count	104	150	254
		% within nurse no	40.9%	59.1%	100.0%
		% within outcome	29.5%	34.4%	32.2%
	3	Count	147	184	331
		% within nurse no	44.4%	55.6%	100.0%
		% within outcome	41.8%	42.2%	42.0%
	4	Count	101	102	203
		% within nurse no	49.8%	50.2%	100.0%
		% within outcome	28.7%	23.4%	25.8%
Total		Count	352	436	788
		% within nurse no	44.7%	55.3%	100.0%
		% within outcome	100.0%	100.0%	100.0%

Tableau 12 NURSE NO * OUTCOME CROSS TABULATION

- PHYSICIAN/NURSE TEAMS

The distribution of physician/nurse teams is shown below. Since survival rate did not vary across nurse groups, this variable was not explored further.

Tableau 13 Code_team_no * nurse no Cross tabulation

			nurse no			Total
			2	3	4	
Code team	4	Count	78	21	4	103
		% within codeteamno	75.7%	20.4%	3.9%	100.0%
		% within nurse no	30.7%	6.3%	2.0%	13.1%
	5	Count	80	69	15	164
		% within codeteamno	48.8%	42.1%	9.1%	100.0%
		% within nurse no	31.5%	20.8%	7.4%	20.8%
	6	Count	61	126	61	248

		% within codeteamno	24.6%	50.8%	24.6%	100.0%
		% within nurse no	24.0%	38.1%	30.0%	31.5%
	7	Count	35	115	123	273
		% within codeteamno	12.8%	42.1%	45.1%	100.0%
		% within nurse no	13.8%	34.7%	60.6%	34.6%
Total		Count	254	331	203	788
		% within codeteamno	32.2%	42.0%	25.8%	100.0%
		% within nurse no	100.0%	100.0%	100.0%	100.0%

- Bringing it all together

Thus far, results indicate that survival rates vary across physician teams as well as the dosage of adrenaline administered and the number of times adrenaline is administered. Analyses were conducted to determine if variations in survival rates across physician groups can be linked to either of the adrenaline variables.

- Dose

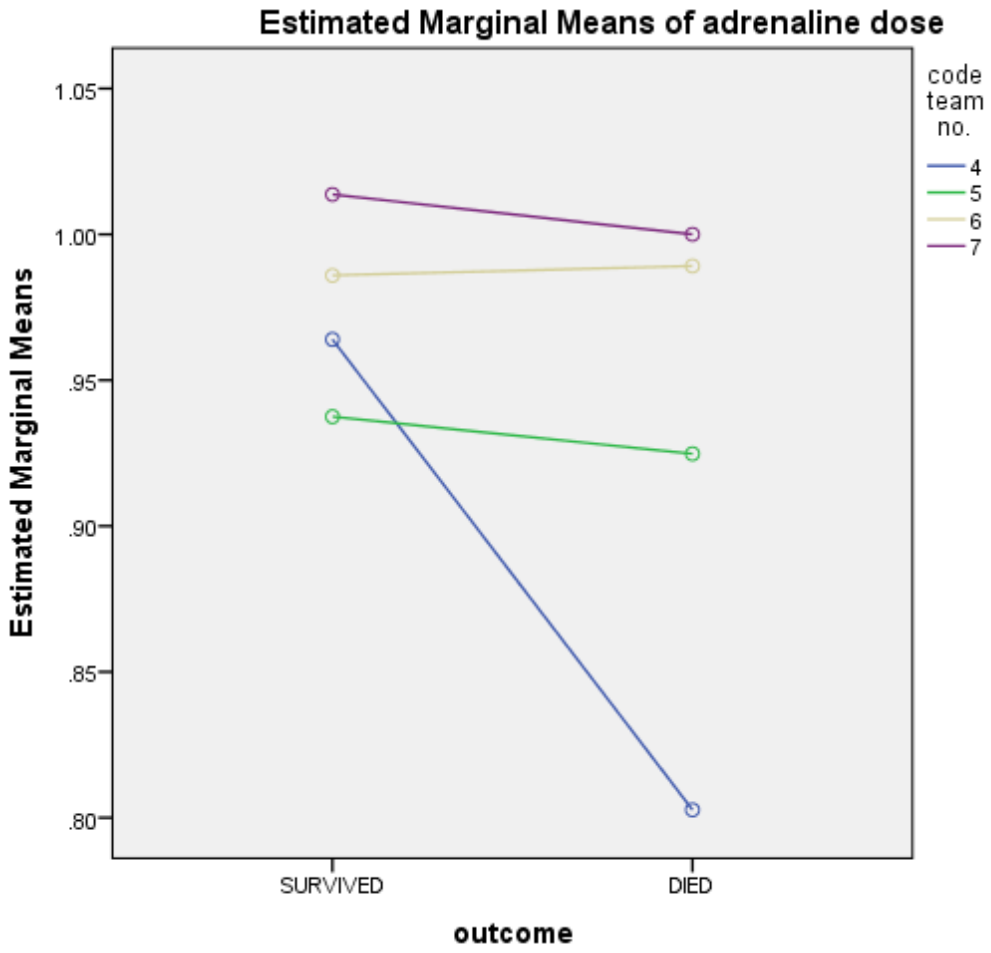
A 2 (survival: yes, no) X 4 (physician team: 4, 5, 6, 7) ANOVA was conducted to determine if these variables (when considered together) are related to the dosage of adrenaline used. Results indicate that, as previously indicated, physician teams differ in their adrenaline dosage ($F(3,741)=7.37$, $p<.001$) as does the dosage given to those who survive versus die ($F(1,741)=5.48$, $p=.02$). The interaction between variables was marginally significant ($F(3,741)=2.54$, $p=.056$). The table of means and graph of the means are shown below.

Tableau 14 Code team no. * outcome

3. Code team no. * outcome

Dependent Variable: adrenaline dose

code team no.	outcome	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
4	SURVIVED	.964	.046	.873	1.055
	DIED	.803	.027	.750	.855
5	SURVIVED	.938	.033	.872	1.003
	DIED	.925	.023	.880	.969
6	SURVIVED	.986	.020	.946	1.026
	DIED	.989	.022	.945	1.033
7	SURVIVED	1.014	.021	.972	1.055
	DIED	1.000	.019	.962	1.038



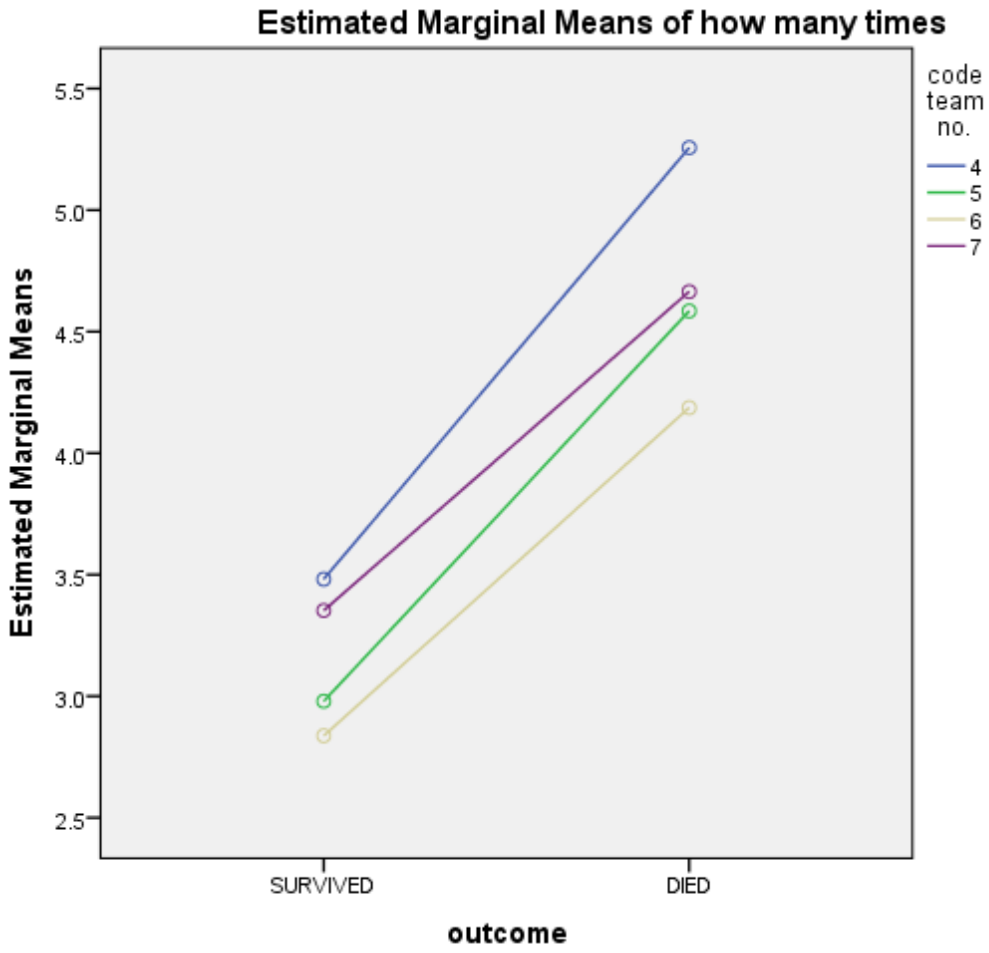
-FREQUENCY

A 2 (survival: yes, no) X 4 (physician team: 4, 5, 6, 7) ANOVA was conducted to determine if these variables (when considered together) are related to the frequency of adrenaline administration. Results indicate that, as previously indicated, physician teams differ in their frequency of adrenaline administration ($F(3,751)=6.17$, $p<.001$) as does the frequency given to those who survive versus die ($F(1,751)=108.19$, $p<.001$). No significant interaction was found. The table of means and graph of the means are shown below.

Tableau 15 Descriptive Statistics

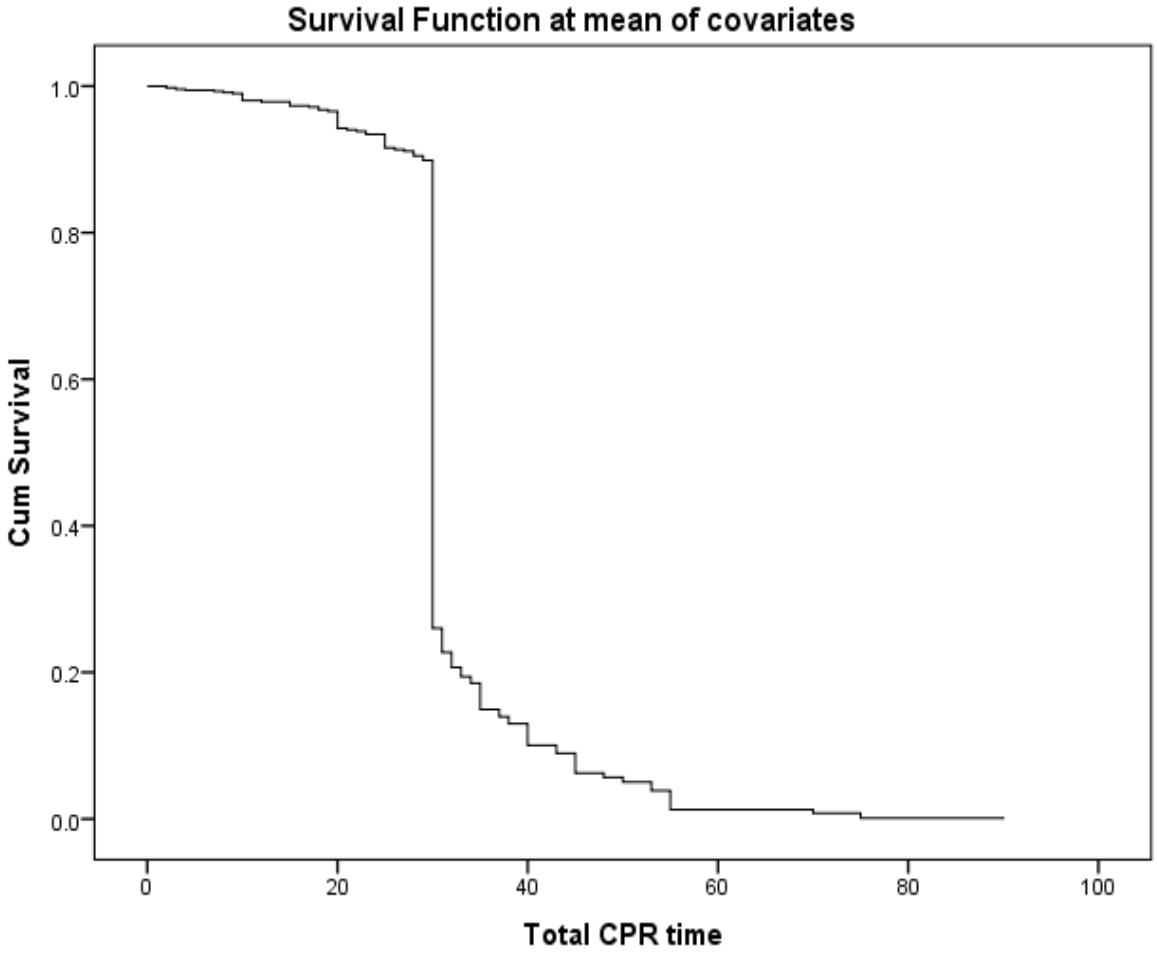
Dependent Variable: how many times adrenaline

Code team no	outcome	Mean	Std. Deviation	N
4	SURVIVED	3.48	1.988	27
	DIED	5.26	1.851	74
	Total	4.78	2.038	101
5	SURVIVED	2.98	1.604	48
	DIED	4.58	2.088	106
	Total	4.08	2.083	154
6	SURVIVED	2.84	1.657	129
	DIED	4.19	1.591	107
	Total	3.45	1.758	236
7	SURVIVED	3.35	1.537	122
	DIED	4.66	1.674	146
	Total	4.07	1.738	268
Total	SURVIVED	3.10	1.648	326
	DIED	4.63	1.821	433
	Total	3.97	1.904	759

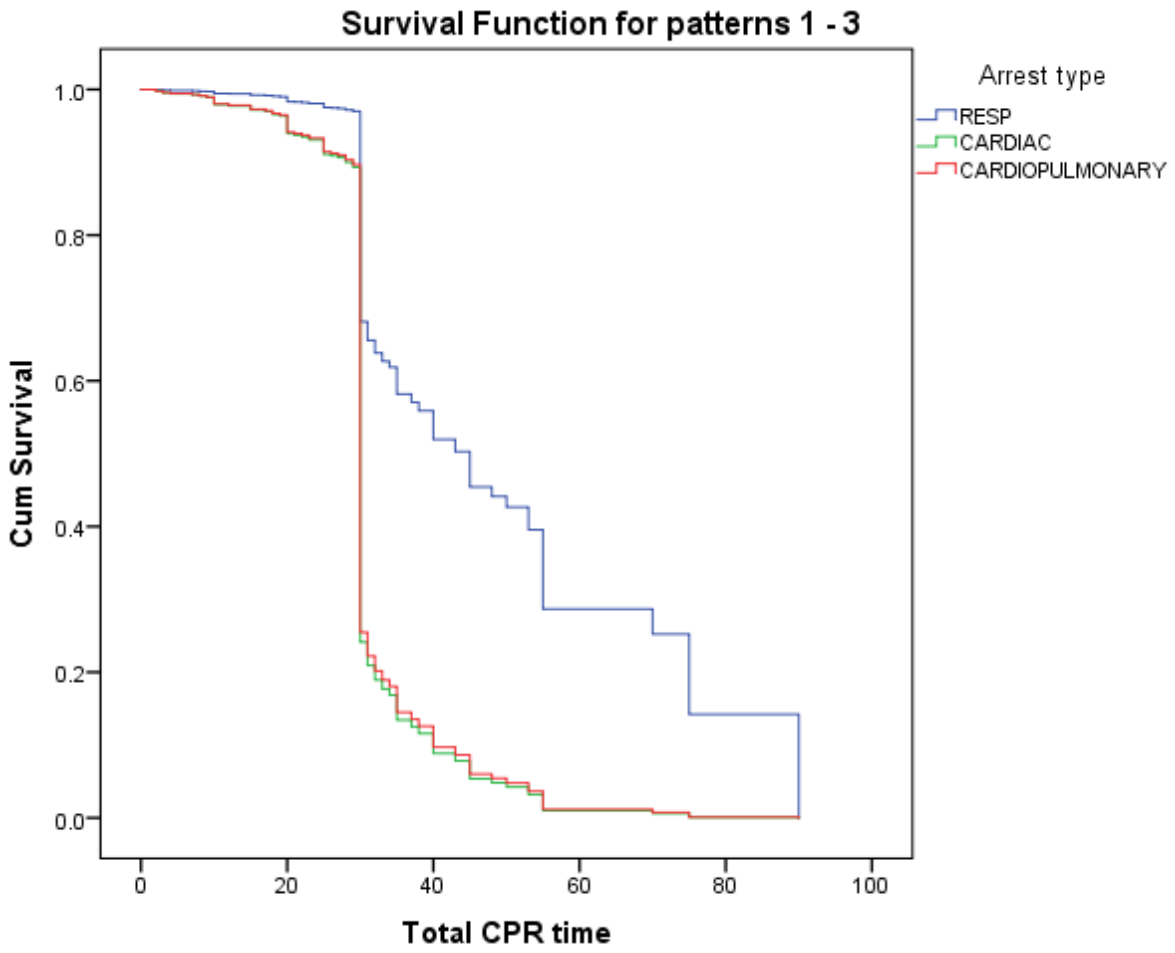

Estimated Marginal Means of how many times
Estimated Marginal Means
5.5
5.0
4.5
4.0
3.5
3.0
2.5
SURVIVED
DIED
outcome
code team no.
4
5
6
7

- SURVIVAL ANALYSES:

The basic survival curve is a visual display of the model for survival time based on the covariates.



We can observe a sharp decline in the survival probability with increase Total CPR time. The survival time can be separately plotted for different arrest type. The survival plot given below suggest that survival probability is different for respiratory type cardiac arrest.


Survival Function for patterns 1 - 3
Arrest type
RESP
CARDIAC
CARDIOPULMONARY
Cum Survival
1.0
0.8
0.6
0.4
0.2
0.0
0
20
40
60
80
100
Total CPR time

Variables in the Equation

	B	SE	Wald	df	Sig.	Exp(B)
Age	.002	.003	.420	1	.517	1.002
Gender	-.111	.164	.453	1	.501	.895
Adrenaline	-5.049	1.236	16.697	1	.000	.006
Adrenaline dose	.697	.672	1.077	1	.299	2.008
Defibrillator usage	-.873	.383	5.195	1	.023	.418
Time of arrest	.000	.000	.708	1	.400	1.000
Arrest type			.701	2	.704	
Arrest type(1)	.062	1.129	.003	1	.956	1.064
Arrest type(2)	.398	1.070	.138	1	.710	1.488
Arrest rhythm			.106	2	.948	
Arrest rhythm(1)	.310	1.010	.094	1	.759	1.364
Arrest rhythm(2)	-.045	.452	.010	1	.922	.956

The significance of the variables in the model is tested using Wald test. The P value associated with the Wald test indicates that Adrenaline and Adrenaline Dose have significant effect on the survival probability.

The value of Exp(B) for marital means that the hazard rate for Adrenaline =Yes is 0.006 times that of an Adrenaline =No . Also the hazard rate Defibrillator usage =Yes is 0.418 times that of an Adrenaline =No. Also the hazard rate

The global significance of the model is tested using Chi-Square test.

Omnibus Tests of Model Coefficients

-2 Log Likelihood	Overall (score)			Change From Previous Step			Change From Previous Block		
	Chi-square	df	Sig.	Chi-square	df	Sig.	Chi-square	df	Sig.
1517.899	101.922	10	.000	19.616	10	.033	19.616	10	.033

a. Beginning Block Number 1. Method = Enter

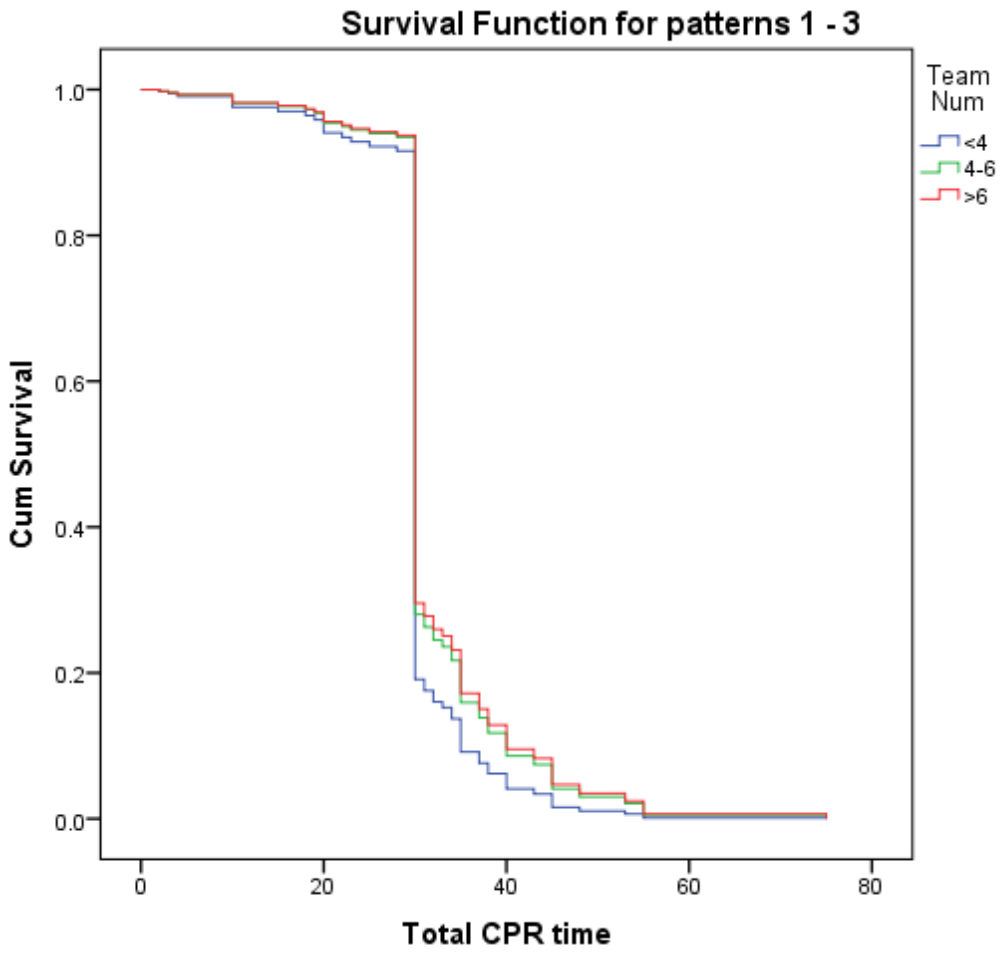
The Chi-Square test statistic is highly significant indicating that the model is able to explain the variability in the total CPR time.

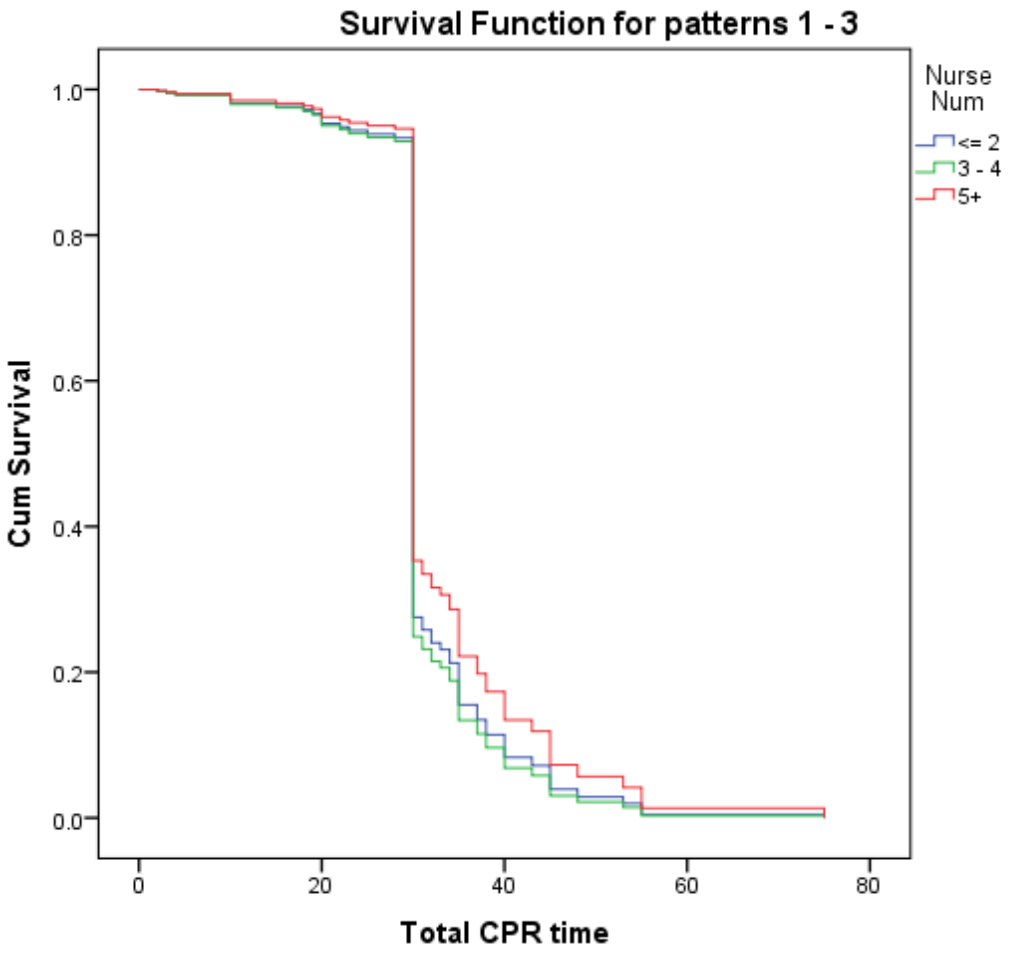
Cox Regression Procedure is adopted by including nurse code category (NC) and team code category (TC) as explanatory variables.

Variables in the Equation

	B	SE	Wald	df	Sig.	Exp(B)
age	.003	.003	.752	1	.386	1.003
gender	-.184	.171	1.158	1	.282	.832
arrest type			1.007	2	.604	
arrest type(1)	-.029	1.133	.001	1	.980	.971
arrest type(2)	.388	1.071	.131	1	.717	1.473
arrest rhythm	-.020	.221	.008	1	.927	.980
adrenaline	-4.916	1.245	15.583	1	.000	.007
adrenaline dose	.883	.691	1.632	1	.201	2.417
Defibrillator usage	-.871	.389	5.003	1	.025	.419
Time of Arrest	.000	.000	.541	1	.462	1.000
NC			.540	2	.763	
NC(1)	.076	.223	.115	1	.734	1.079
NC(2)	-.213	.479	.199	1	.656	.808
TC			1.430	2	.489	
TC(1)	-.263	.222	1.403	1	.236	.768
TC(2)	-.306	.411	.555	1	.456	.736

These two variables are found to have only insignificant effect on the regression model. The plot of survival curve for these categorical variable also supports this argument. In other words, there no specific combination of (rrt_team_code) and (nurse code) that increase or decrease survival rate.

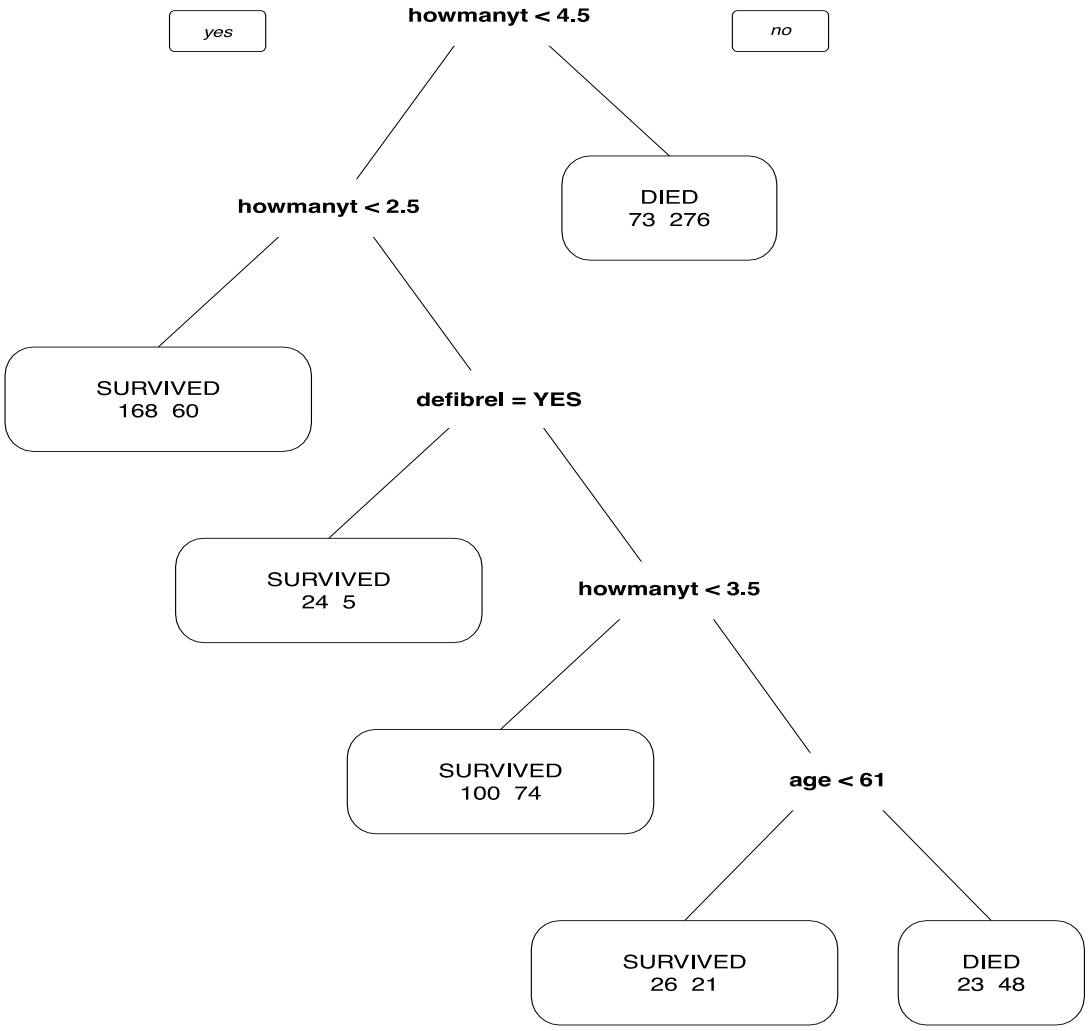



Survival Function for patterns 1 - 3
Nurse Num
<= 2
3 - 4
5+
Cum Survival
1.0
0.8
0.6
0.4
0.2
0.0
0
20
40
60
80
Total CPR time

CLASSIFICATION TREE:

Analysis was performed using Rpart (Recursive Partitioning) package version 4.1-10 for R. A classification tree was produced. The outcome variable was whether an individual survived or died. The independent variables were the individual's age, gender, type of cardiac arrest (respiratory, cardiac, or cardiopulmonary), whether the individual received adrenaline and how many times the individual received adrenaline, whether a defibrillator was used, whether atropine was used, whether amiodarone was used, whether noradrenaline, whether CA gluconate was used, whether Dobutamine was used, the breathing pattern of the individual (spontaneous, apnea, assisted), and whether a carotid pulse was present or absent. According to the classification tree analysis, the variables in order of importance were how many times adrenaline was used, whether noradrenaline was used, the age of the patient, defibrillator usage, amiodarone usage, CA gluconate usage, Dobutamine usage, and adrenaline usage.

A classification tree was produced. Figure 1 displays the classification tree. According to the classification tree, those individuals who received greater than 4.5 doses (five or more doses) of adrenaline were more likely to die (79.1% died) and those individuals who received less than 2.5 doses (two or less doses) were more likely to survive (26.3% died). Out of those individuals who received between three and four doses of adrenaline and a defibrillator was used a majority survived (17.2% died). Out of those individuals who received three doses of adrenaline, a majority survived (42.5% died). Out of those who received four doses of adrenaline and were under 61 years of age, a majority survived (44.7% died) and out of those who received four doses of adrenaline and were 61 or more years of age a majority died (67.6% died).


yes
howmanyt < 4.5
no
howmanyt < 2.5
DIED
73 276
SURVIVED
168 60
defibrel = YES
SURVIVED
24 5
howmanyt < 3.5
SURVIVED
100 74
age < 61
SURVIVED
26 21
DIED
23 48

Chapter 5

5. Summary and Conclusion

5.1 Conclusion

The original sample involved of 1009 individuals (60.3% male and 38.8% female). A primary focus of the research is the impact of the response team on survival rate. Examination of the prevalence of each of the 10 physician teams indicated that six of these teams were present at less than 10% of the hospital reported in the data set. Thus, analyses were conducted on those physician teams (code_team_no) that were reported for more than 10% of the sample (n > 100). The team numbers used range from 4 to 7. Additionally, nurse teams were limited to those ranging from 2 to 4 due to the infrequent combination with the physicians. Elimination of the infrequent physician and nurse teams yielded a sample size of 792. The outcome of four patients was not recoded which led to a final sample size of 788.

Survival Rate

The survival outcome indicated that patients were significantly more likely to die (55.3%) than survive (44.7%) as indicated by a chi-square goodness of fit analysis, $\chi^2(1, n=788)=8.954$, $\alpha=.003$. Given that the primary purpose of the present study was to explore factors which predict survival of patients experiencing cardiac arrest, particularly the use of adrenaline and fluctuations in the response team, an examination of the use of adrenaline and response team was explored.

Adrenaline

The vast majority of patients were treated with adrenaline (96.1%) at the time of cardiac arrest. Additional variables associated with adrenaline use that could be explored to determine the characteristics of adrenaline usage that influence efficacy for survival rates includes dosage and frequency of use.

In regards to dosage, the average was 0.96 (SD = .19). Results of an independent-samples t-test indicated that patients who survived received a statistically significantly higher dose (M = .97, SD = .14) than those who died (M = .94, SD = .21), t(746)=2.17, p=.03.

In regards to how many times adrenaline was administered, the average was 3.98 (SD = 1.90). Results of an independent-samples t-test indicated that patients who survived received statistically significantly fewer administrations of adrenaline (M = 3.10, SD = 1.65) than those who died (M = 4.63, SD = 1.82), t(757)=-11.88, p<.001.

5.2 SUMMARY

In summary, this is the primary complete analysis that attempts to find the variables associated with survival rate of in-hospital cardiac arrest and can be used to define the survival variables reliably and that influence efficacy for survival rates

those patients who received greater than 4.5 doses (five or more doses) of adrenaline were more likely to die (79.1% died) and those individuals who received less than 2.5 doses (two or less doses) were more likely to survive (26.3% died). Out of those individuals who received between three and four doses of adrenaline and a defibrillator was used a majority survived (17.2% died). Out of those individuals who received three doses of adrenaline, a majority survived (42.5% died). Out of those who received four doses of adrenaline and were under 61 years of age, a majority survived (44.7% died) and out of those who received four doses of adrenaline and were 61 or more years of age a majority died (67.6% died).

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