Spring 4-5-2004

Effects of a First Responders Automatic External Defibrillator (AED) program on patient Outcomes in a Rural Emergency Medical Service System

Michael D. Olson
Augsburg College

Effects of a First Responders Automatic External Defibrillator (AED) Program on Patient Outcomes in a Rural Emergency Medical Service System

By

Michael D. Olson

Thesis Submitted in Partial Fulfillment

Of the Requirements for the Degree

Of Master of Science

Physician Assistant Studies

Augsburg College

April 5th, 2004

MASTER OF SCIENCE IN PHYSICIAN ASSISTANT STUDIES
AUGSBURG COLLEGE
MINNEAPOLIS, MN

CERTIFICATE OF APPROVAL

This is to certify that the Master's Thesis of

Michael D. Olson

has been approved by the Thesis Review Committee for the Master of Science in Physician Assistant Studies degree

Date of Oral Defense: April 5th, 2004

Terry Lewis, Professor, PA dept.

Dawn B. Ludwig, PA dept. chair

FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT REQUIREMENTS

In accordance with the Family Educational Rights And Privacy Act, Augsburg College is required to advise students in advance that their projects will be made publicly available as part of the curriculum requirements.

Please sign below to indicate that you have been informed of this requirement and agree that your project will be made available as a research source for the academic community through the college's library.

Michael D. Olson

Name

Signature

4-5-04

Date

Abstract

Background

For patients in cardiac arrest the most important variable in survival is rapid activation of emergency medical services to provide early defibrillation. Previous studies have indicated that for the greatest chance of survival the patient must be defibrillated within six minutes of collapse. In September of 2002 the Fairmont police department placed AED's in the medical kits of their officers in an effort to improve the chances of survival for the cardiac arrest patients in the city. This study is an attempt to gauge the success of this AED program by looking at multiple variables in the care of cardiac arrest patients.

Methods

A retrospective chart review study was undertaken and data was captured from patient care documents. An equal number of cardiac arrests (18) were taken from before and after the AED program was initiated for a total of 36 patients in the study.

Results

Statistical significant was found in the time from 911 dispatch to defibrillator placement and analysis, 3.4 min in the pre-AED group vs. 5.2 min in the post AED group (P=0.03). No significance was found in patient outcomes in comparison to the pre-AED period.

Discussion

Although there was no change in the patient outcomes after the AED program was initiated, a closer look at the data shows that a decrease in the amount of time it took to get to the patients side was accomplished, given more time and data points, it is possible that an increase in patient survival might be seen. Focus for the next study would be an attempt to decrease the time from collapse to patient defibrillation.

Table of Contents:

List of Tables:

Chapter 1: Introduction

Introduction and Background to the study

In the United States, cardiovascular disease accounts for approximately one million deaths per year, making it the number one cause of death in adults (Marenco, Wang, Link, Homoud, and Estes, 2001). Nearly half of these deaths are sudden and occur unexpectedly. Patients who experience this sudden event are said to have suffered from a cardiac arrest. Cardiac arrest is the condition when breathing and circulation cease. The majority of cardiac arrests commonly have this event occur outside a medical facility, most often in the home. A number of conditions can cause a cardiac arrest and unfortunately, even with emergency medical services, patients with cardiac arrest typically have about a 5% chance of surviving to hospital discharge in most settings (Marenco et al., 2001).

The most important intervention in treating patients with cardiac arrest is early identification and rapid defibrillation. Typically patients who experience cardiac arrest die secondary to a lethal heart rhythm that is a result of cardiac disease. In the majority of cardiac arrests, coronary artery disease is the cause. The most common arrhythmia, or abnormal heart rhythm, is ventricular fibrillation; less common are asystole (no cardiac electrical activity) and pulseless electrical activity (electrical activity but no heart contraction). Defibrillation is potentially life-saving if the arrhythmia is ventricular fibrillation, but it is of no value in the other two forms of cardiac arrest. Defibrillation is the process by which an electrical shock is delivered across the heart muscle in order to reorganize the electrical process in the heart and hence restore a normal heart contraction. It has been shown that for every minute a patient in ventricular fibrillation goes without defibrillation, their chance of survival decreases by 3-10% per minute (Hossack and Hartwig, 1982). A typical ambulance service, depending on size and

location, has an average response time of five to ten minutes leaving the average cardiac arrest victim with less than a 20-30% chance of survival.

In the early 1990's, in order to improve the odds for these patients, the American Heart Association developed guidelines for the treatment of cardiac arrest victims. These guidelines highlighted the "Chain of Survival", which outlined specific procedures when dealing with a patient who has suffered a cardiac arrest (Emergency Cardiac Care Committee, 1992). The chain of survival includes early access to 911, early CPR, early defibrillation, and early advanced care. Early access is the process by which the cardiac arrest is recognized and notification of the appropriate emergency personnel is completed. Secondly, early CPR ensures that the patient's ventilation (breathing) and circulation (pulse) are maintained until the defibrillator is applied. The next step is defibrillation. Defibrillation is the delivery of an electrical shock in order to "restart" the patient's heart, if the cause of the arrest is ventricular fibrillation. Prior to the early 1990's, it was only ambulance personnel who carried and utilized defibrillators on the cardiac arrest patients. In response to this situation, the American Heart Association with its collaborators laid the groundwork for the development of first responder Automated External Defibrillation (AED) programs throughout the United States.

First responder defibrillation programs provide several potential advantages. First, because typically there are more first responders, such as police officers or firefighters, than ambulances, first responders have a shorter response time to the scene of an incident. An ambulance typically has a response time of five to ten minutes, but first responders can reach victims in a shorter time, typically four to six minutes. This leads to quicker administration of medical care such as CPR, basic first aid and most importantly defibrillation. With a more rapid administration of defibrillation many communities have increased the survival rates of patients

who have suffered cardiac arrest caused by ventricular fibrillation. Communities such as Rochester, MN, Seattle, WA, increased survival to 40% with the addition of AED programs in their first responder groups (White, Asplin, Bugliosi, and Hankins, 1996). This study was similar to many studies performed in the early nineties comparing the effectiveness of first responder defibrillation programs with previous emergency medical response models. In this study, I tested the effectiveness of a newly formed first responder AED program in the rural city of Fairmont, Minnesota.

Statement of the problem

In 1996, Mayo Medical Transport (MMT), a division of the Mayo Foundation, purchased the rights and service area from the Fairmont Ambulance for the town and surrounding area of Fairmont, Minnesota. At that time the Fairmont Ambulance was providing basic life support (BLS) in their service area. Gold Cross Ambulance, the ground transport division of MMT, began providing advanced life support (ALS) for this service area. Advanced life support ambulances provide services such as highly trained paramedics who perform several skills unavailable at the basic life support level. These skills include advanced airway management, IV and medication therapy, cardiac monitoring, and many more. Included in these services are equipment and personnel needed to provide advanced-level care to patients with cardiac arrest.

Advanced life support ambulance personnel are highly trained to treat patients in cardiac arrest, but one of the most important aspects of treating these patients is rapid response and early defibrillation. With the addition of advanced life support, significant strides were made in the treatment of patients in cardiac arrest compared to the previous basic life support ambulance, but the time it took to get to the patient, and to deliver defibrillation was basically the same as before the addition of ALS.

The problem that the service faced was finding a way to deliver life saving defibrillation to the patient in a shorter amount of time. In summary, to defibrillate the patient before the arrival of the ambulance in an effort to improve the chances of survival for these patients.

To accomplish this, in the fall of 2002, Gold Cross Ambulance and the Fairmont Police Department collaborated in starting a first responder defibrillation program in the city of Fairmont. Automatic External Defibrillators (AEDs) were placed in police cars of the on duty policemen. Now, as before, when a medical call is received at the local 911 call center both police and ambulance are dispatched simultaneously, but with the addition of the AED program the police department has an additional tool in treating patients with a cardiac arrest.

Purpose of the study

The purpose of this study was to determine whether the addition of an AED program was effective in the treatment of cardiac arrest in Fairmont, MN. More specifically, the study examined the patient data before and after the initiation of the Fairmont Police Department AED program in order to ascertain whether the program had improved three variables. The first variable was the time between the activation of the EMS and first responder system, and the time to first defibrillation. Secondly, the number of patients who obtain a return of spontaneous circulation (ROSC) after treatment before and after the initiation of the AED program was assessed. And third, how many patients maintained a pulse and were admitted to the emergency department was determined.

Hypotheses or questions to be answered

There were multiple questions that I addressed with this study. Each of the questions stemmed from a retrospective look at the previous system without AED's.

First, was there a difference between before and after the initiation of the AED program in the length of time it took to respond to the call and deliver the first defibrillation? Secondly, was there a difference in patient's outcomes before and after initiation of the AED program? Were there more patients that obtained a return of spontaneous circulation (ROSC) after the initiation of the AED program? The study examined whether there was a significant increase in admissions to the emergency department in the AED study period compared with the historical control period.

Definition of terms

Advanced Life Support (ALS): In this context, advanced life support is the level of care provided by the ambulance service personnel. This care includes advanced airway management, IV therapy, medication therapy, and advanced cardiac care. Individuals who perform these skills are usually trained as paramedics.

Automated External Defibrillator (AED): An automated external defibrillator (AED) is a portable device that is used in the recognition and treatment of lethal heart rhythms. It is commonly used by first responders, ambulance, and hospital personnel in the treatment of cardiac arrest. It is turned on by the rescuer and the two defibrillation pads are placed on the chest of the victim. The machine is then turned on to determine whether a shock (defibrillation) is advised. Commonly, the machine will also instruct the rescuer to do CPR in concurrence with the defibrillation.

Cardiac Arrest: Cardiac arrest is when the heart stops beating and spontaneous breathing ceases. There are many causes of cardiac arrest, most commonly cardiovascular disease.

Cardiopulmonary Resuscitation (CPR): Cardiopulmonary resuscitation is the process by which an individual gives breaths and chest compressions to a patient who has suffered cardiac arrest.

This is performed in order to "save" valuable tissue, such as brain tissue, until the patients heart can be started again.

Defibrillation: Defibrillation is the process by which an electrical charge is delivered across the heart in an attempt to reorganize the electrical rhythm to a normal pattern.

Emergency Medical System (EMS): Emergency Medical System refers to the individuals and groups who respond to medical emergencies. These responding individuals are commonly Emergency Medical Technicians working for private ambulance companies, fire departments, or other public safety agencies. These individuals treat medical problems in concurrence with the protocols written by physicians who serve as their medical directors.

First Responders: First responders are individuals or groups who respond first to calls for help. Usually they are police officers or firefighters trained in basic first aid.

Return of Spontaneous Circulation (ROSC): Return of spontaneous circulation refers to restoration of a pulse and heartbeat after a cardiac arrest.

Rural town: As defined by the author of this study, the definition of a rural town is one with a population less than 15,000 within its city limits.

Ventricular fibrillation: A lethal heart rhythm (arrhythmia) present in nearly half of all cases of cardiac arrest characterized by rapid, chaotic nonrepetitive waveforms and clinically by the absence of effective circulating blood. This is the one form of cardiac arrest treatable with defibrillation.

Assumptions and limitations of the study

Assumptions and limitations of the study were as follows. First, an assumption had been made that the first responder group named in this study, the Fairmont Police Department, was always able to get to the patient before the ambulance arrived. This turned out to be the case in

this study. The police were present before the arrival of the ambulance for every cardiac arrest in the post-AED study period.

Secondly, patients who experience cardiac arrest from a cardiac cause initially are most frequently in ventricular fibrillation. Usually this rhythm is present only in the first few minutes of the cardiac arrest event. The more time that passes, the higher the chance the rhythm will convert to asystole, or flat line, in layman's terms. Because the basis of this research was that the first responder group, the police department, arrived at the patient's side before the ambulance service arrived, it was assumed that the patient will frequently be in ventricular fibrillation. It was the case that many patients were in a non-shockable rhythm from the start of the cardiac arrest and did not benefit from delivery of a shock. In summary, not all patients were given a shock either because the original arrest rhythm deteriorated or it initially was not treatable with defibrillation.

These first two limitations showed a collective weakness within the study. If the first responders (police) were not the first on the scene and the patient was not in a rhythm that could be defibrillated this lead to a small number of data points for this study. Because of the relatively short time period of this study and the small call volume of the ambulance service in question this became a significant limitation. To have a successful AED program the AED must be used on patients in ventricular fibrillation and used within six minutes of the patients collapse. Because there were few patients who were in ventricular fibrillation upon arrival of the AED, it was difficult, but not impossible, to assess the success of the AED program

The third limitation of the study comes from the data that was put on the ambulance run report as well as the police post-cardiac arrest form. This limitation was the accuracy of the times entered on the report. Dispatch time is what a dispatcher marks in the computer when an

ambulance goes to the scene, arrives on scene, initiates patient contact, transports the patient, etc. The ambulance crews use these times in writing their reports which includes procedures such as IV's, medications, and defibrillation. Even though the defibrillator does have a clock within the machine, the times that the dispatcher marks and the time on the defibrillator were often not synchronized. This in turn makes the ambulance crew member estimate the time he or she thinks the first defibrillation was given when they write the ambulance report form. This is especially the case in the estimated time of patient collapse. This time is often asked of family members on scene and can subject to inconsistencies. These estimations became a limitation because this time could have been off from a matter of seconds to minutes. Although the crews do make a legitimate attempt at marking the correct times, I do believe that the times were off by a small margin.

The fourth limitation was how the equipment was used. Although all of the first responders in this research program have been given training in the use of the AED's, it could have been the case that the equipment was used correctly. Examples of this may be forgetting to bring the AED to the side of the patient, forgetting to turn on the AED, or forgetting to check the operational status of the AED before the start of their shift leading to a failure of the equipment on scene. Although these errors did not happen, the possibility of the mistake must be accounted for.

The fifth limitation is in patient follow-up. To definitively determine whether the AED program was successful, an analysis of the patient's final condition should be investigated. Ideally, I would be able to follow the patients who were resuscitated and admitted to the hospital to see whether the patients were discharged in the same neurological condition in comparison to their neurological status before their cardiac arrest. Unfortunately, due to logistics and patient

confidentiality I was only be able to record whether the patient sustained a pulse to the emergency room. After that point I lost the patient and was not able to find out whether the patient succumbed to their coronary disease or was able to be discharged in the same neurological condition as before their cardiac arrest. This limitation limited me in deciphering whether the AED program was successful.

Summary

With out adequate first responder defibrillation of patients in cardiac arrest few if any have a significant chance of survival. To increase the chances for these patients in ventricular fibrillation cardiac arrest an AED program was initiated in the police department in Fairmont, Minnesota and this study is the investigation on the success of this program. In chapter two a review of the literature was done to investigate and validate the current AED program, in chapter three the methodology of this study is explained, in chapter four the results of the analysis of the data is given, and in the final chapter a discussion of the significance of the data and conclusions to that data is made.

Chapter 2: Literature Review

Organizational structure of the chapter

In this chapter I will introduce and discuss the current literature on the topic of AEDs. I will discuss its history, use, and success in pre-hospital emergency care. This extensive literature research will give insight into my proposed topic on the effects of a first responder AED on patient outcomes in a rural emergency medical service system.

The first part of this chapter encompasses the past research in cardiac arrest in the pre-hospital environment with defibrillation provided by ambulance personnel. I investigated research on what was done in the earlier years and some of the initial observations that lead to the early investigations into defibrillation. The second part of the research involves the investigation into the attempts to improve the survival rates and outcomes of cardiac arrest victims in the pre-hospital environment using defibrillators and public education programs. This includes research on reducing response times and community efforts to make defibrillation a viable treatment in the pre-hospital environment. This section will also review the role of AEDs in first responder groups, such as Police and Fire departments. Thirdly, I investigate the outcomes of patients who have suffered a cardiac arrest event in order to gain insight on the effectiveness of the AED program. Lastly, a summary of the literature in reference to the topic of AED's in a rural EMS system will be examined to tie the previous literature research sections together.

Introduction to the problem

In the late 1960's and early 1970's multiple investigators researched the problem of cardiac arrest, both in and out of the hospital environment. In 1967, Oliver and his colleagues determined that in Albemarle County, Virginia the addition of two hospital coronary care units

did not improve survival from cardiac deaths in the county (Oliver, Julian, and Donald, 1967). In response to this, a mobile coronary care unit was placed in service in an attempt to decrease the coronary related deaths in the county. This unit was an ambulance staffed with volunteer ambulance personnel along with physicians and nurses who provided emergency cardiac care. After the initiation of the program, the researchers observed a 25% reduction in the community mortality from coronary disease (Oliver et al., 1967). This study was the first of many studies, such as Crampton's evaluations of emergency cardiac care in the 1970's, which correlated the advent of mobile coronary care units and advanced cardiac life support with the decrease in morbidity and mortality of patients suffering from coronary events (Crampton, 1980). This initial research was the start of pre-hospital coronary care, which eventually led to the advent of paramedics and advanced life support ambulances in America and elsewhere.

With the advent of emergency medical systems caring for patients suffering from coronary events, more cities began to implement and study these systems. In Washington's King County (Seattle) two studies in the late 1970's showed only two to six lives per 100,000 were saved with EMS cardiopulmonary resuscitation (CPR) and rapid transport to a hospital for defibrillation (Eisenberg, Bergner, and Hallstrom, 1979, 1980). In an additional study, it was found that the addition of defibrillation with early CPR led to a 50% increase in long term survival (Eisenberg, Compass, and Hallstrom, 1980). This study saw high response with CPR within four minutes of collapse and advanced care, more specifically defibrillation, within eight minutes, which led to this increase in long term survival. Clearly, CPR alone does not give the favorable survival rates as does CPR with advanced care including defibrillation. These initial studies into pre-hospital care and advanced cardiac care paved the way for an eruption of research into patients suffering from cardiac arrest.

Improving patient survival and the use of the AED

In the early 1980's it became clear that a number of factors influenced the survival rates of patients who suffered cardiac arrest outside the hospital. Eisenberg et al. (1980) determined that there were four factors that led to improved survival of these patients. These included: paramedic services, rapid time to initiation of cardiopulmonary resuscitation (CPR), rapid time to definitive care, and bystander initiated CPR. This has changed little today. The American Heart Association's "Chain of Survival" has improved these factors and brought emergency cardiac care to the general public. This Chain of Survival includes early access to emergency care, early CPR, early defibrillation, and early advanced care (Emergency Cardiac Care Committee, 1992).

Early access to emergency care is best utilized by the 911 system. As late as 1987-1988 many communities had more than 40 different numbers for accessing fire and ambulance personnel. After the initiation of a nation wide emergency response number many communities were able to decrease the time it took to activate the local emergency systems. In Minneapolis, a study was done that showed before the start of the 911 system only 63% of callers were able to activate the most appropriate emergency response system within one minute. After the initiation of a city wide 911 call system this number rose to 84% of callers who were able to activate the system under the one minute cutoff (Mayron, Long, and Ruiz, 1984). In addition to the initiation of the centralized well known telephone number, a priority dispatching system also decreased the response times of responding agencies to these calls. In Atlanta the addition of the priority dispatch system, which takes callers information and filters it through a variety of questions, helped the city of Atlanta decrease the total response time by 3.8 minutes which is critical in patients who have suffered cardiac arrest (Slovis, Carruth, and Seitz, 1985).

The next link in the chain of survival is early CPR. The impact of bystander CPR in the event of a cardiac arrest has been pivotal. In 1985, Cummins and Eisenberg studied nine controlled research studies on the impact of bystander CPR on survival to hospital discharge. Their review of this research showed that in 2,590 cases of cardiac arrest 184 out of 608 (30.3%) patients who received bystander CPR, compared to 182 out of 1,950 (9.3%) patients who did not receive bystander CPR, survived to hospital discharge. Although Cummins and Eisenberg did point out that this review of the literature lacked uniformity, others researching the same topic have demonstrated the trend of better survival rates in patients who have received CPR prior to EMS arrival (Eisenberg, 1980; Goldberg, 1985; Lund 1976; Roth, 1984).

Although all aspects of the chain of survival are important the American Heart Association states that link number two, early defibrillation, is the most important in predicting the outcomes of patients suffering from cardiac arrest (Emergency Cardiac Care Committee, 1992). Others have also concluded that early defibrillation is the key. There has been much research demonstrating that the chain of survival and more specifically early defibrillation improves outcomes and saves lives (Bur, 2001; Hearne, 1988; Weaver, 1984; White, 1997). For example, Weaver et al found that with early defibrillation there was improved neurologic recovery, 39% of patients were awake after collapse and early defibrillation compared to 24% of those who were not given defibrillation under five minutes of collapse or arrest (Weaver et al., 1984). Another study confirming the effectiveness of defibrillation was conducted in Seattle in the late 1980's. This study demonstrated that the addition of defibrillators decreased the time to first defibrillation and increased the number of admissions to the hospital. Although in the end discharges from the hospital remained the same in both groups, it was concluded that

defibrillators had contributed to increased patient survival in the pre-hospital environment (Weaver, Hill, Fahrenbruck, Copass, Martin, Cobb, et al., 1988).

There was a multitude of research that indicated early defibrillation was the key in the chain of survival. One of the ways that researchers have shown this was by placing defibrillators in the hands of first responders. In order to demonstrate the effectiveness of first responder defibrillation, studies have been done to show the effects of AED programs by placing them with first responders while researching the outcomes of patients who have suffered cardiac arrest. White et al discovered that after reviewing data from police and paramedic defibrillation for seven years, fast response and early defibrillation were the keys to increasing survival (White, Hankins, and Bugliosi, 1998). This demonstrates that since first responders typically arrive before the ambulance, AEDs are an essential piece in determining patient survival. Other research has shown that first responders, such as police and fire personnel who are dispatched at the same time as the ambulances, but due to location and greater numbers, are typically on scene before the ambulance arrives, can and have successfully used AED programs within their departments decreasing the time to first defibrillation and hence increasing the chance of survival. Shuster and Keller showed that the addition of a fire department based AED program in Hamilton-Wentworth, Canada that decreased the time to first defibrillation from 11.96 to 8.50 minutes. This was a significant decrease in the time to first defibrillation. For these patients, receiving early CPR, advanced care, and first responder defibrillation meant higher survival rates (Shuster and Keller, 1993). In Pittsburgh, Pennsylvania a police AED program was evaluated and found successful. The Pittsburgh police department correctly identified and started resuscitative efforts in 120 out of 124 cases of cardiac arrest over the research period. The researchers identified a tendency of the first responder to leave the AED inside the vehicle

instead of bringing it to the emergency, which was commonly caused by inaccurate dispatching. They also identified and poor airway management skills which side track the officer which in turn delayed the placement of the AED (Davis and Mosesso, 1998). Although this particular research did not indicate an increased survival rate like the research done by Dr. White and his colleagues, it showed that first responder groups, such as police departments, can operate AED's successfully.

Patient outcomes

The outcome of a patient who has suffered cardiac arrest is the end result or condition of the patient after the arrival of medical care and the administration of that care to the patient. Before the advent of advanced cardiac care and pre-hospital emergency medical care cardiac arrest patients had a minimal chance of survival, often less than 3% (Oliver et al., 1967). With the advent of advanced life support ambulances, the Chain of Survival, and especially early defibrillation many communities have increased this number to near 40%. In a recent study of long term outcomes done by the Mayo Clinic in Rochester, MN it was shown in a population of 200 patients presenting in cardiac arrest with ventricular fibrillation as their presenting rhythm, 79 or 40% of these patients left the hospital neurologically intact (Bunch, White, Gersh, Meverden, Hodge, Ballman, Hammill, et al., 2003). This subgroup of patients received early defibrillation with in 6 minutes of the call to the 911 center. The nonsurvivor subgroup in this research received defibrillation on average 6.6 plus or minus 1.5 minutes and was significantly different (P=0.008) from the survivor group. In contrast to this study, communities studied before the implementation of early defibrillation programs have mortality rates from 90 to 95 percent (Eisenberg, Horwood, Cummins, Reynolds-Haertle, Hearne, 1990). These studies show the importance of early defibrillation in the outcomes of cardiac arrest victims.

Summary

The above research has demonstrated a number of important themes. First, rapid identification of a person in cardiac arrest is essential. With every minute lost without defibrillation the likelihood of survival declines by 3-10%. Early recognition and summoning of advanced life support are essential. Secondly, within this care the most important factor is rapid defibrillation. The patient who has suffered cardiac arrest and is in ventricular fibrillation has a higher chance of survival if they are defibrillated within six minutes of their collapse. Third, in order to get the defibrillator to the patients side in the shortest time possible, police, fire, and other first responder groups have been recruited. Because of this small time frame, less than 6 minutes, first responders have become a pivotal link in the survival of these patients. With these key features in mind, my research was modeled after a previous research study from Dr's. Roger White, Brent Asplin, Thomas Bugliosi, and Daniel Hankins called "High Discharge Survival Rate After Out-of-Hospital Ventricular Fibrillation With Rapid Defibrillation by Police and Paramedics" to study the effects of the Fairmont police departments AED program (White et al., 1996). There have been many research studies investigating AED programs, but this research study was chosen because of geographic proximity, and also because of the similarity of the Emergency Medical System, Gold Cross ambulance service, that was utilized in previous research studies. In addition to the above items, the Mayo clinic and more specifically Dr. Roger White and colleagues have been leaders in the study of early defibrillation and AED programs in Minnesota, designing and implementing research studies in cardiac arrest treatment from the late 1980's to the present day.

Chapter 3: Methodology

Introduction

The purpose of this study was to determine the effectiveness of a first responder AED program in a rural EMS system. To determine this, I looked at many different factors in the care of cardiac arrest victims in Fairmont, Minnesota. Identifying a positive response to the addition of the AEDs was postulated to confirm the potential benefit of the use of AED's in a rural EMS system utilizing ALS care. This helped to evaluate the efficacy of AED's in a low volume Advanced Life Support EMS System.

Description of methodology to be used

To gather the data, I used a retrospective chart review methodology approved by Augsburg College Institutional Review Board on October, 14th, 2002 (see Appendix A). This was done in a controlled environment, at the Headquarters of Mayo Medical Transport, Rochester, Minnesota. It was performed in February, 2004 utilizing patient care reports from the EMS system, Gold Cross Ambulance, Fairmont branch, and post-cardiac arrest forms completed by the local first responders, the Fairmont Police Department.

Design of the study

The design of this study is based on the previous experiments and observations done by previous researchers in the area of first responder defibrillation. The study that was chosen for replication was a study done in the mid 1990's by Dr.'s Roger White, Asplin, Bugliosi, and Hankins. The study was titled "High Discharge Survival Rates After Out-of-Hospital Ventricular Fibrillation with Rapid Defibrillation by Police and Paramedics" (White, et al. 1996). This study analyzed three variables. The first variable was time to shock, which is the time from activation of the 911 system until the first defibrillation was given by the first arriving agency

(police or ambulance). This variable was replicated as the time from call to first defibrillation or notification of a no-shock advisory by the first responder agency (police department) in my study of the AED program in Fairmont, MN.

The second variable was the return of spontaneous circulation or ROSC. In the White et al study this variable was defined as the patients who responded to defibrillation and regained a pulse without the help of Advanced Life Support (ALS) care. These patients regained pulses and no vasoactive medication was needed to maintain their pulse (White, et al 1996). In my research study ROSC was classified as a return of pulses after defibrillation(s), with or without ALS care. If a patient regains a pulse after defibrillation and the administration of vasoactive drugs, that patient will fall in the classification of a patient who did obtain ROSC.

The third variable of White et al's study was the survival to discharge variable. This variable was defined as whether the patient exited the hospital with function that let them lead a life that did not need assistance for daily living. These patients were counted as patients who survived to discharge. Patients who were left with a neurologic deficit, or required assistance in their daily living that was a change from their previous living circumstances, were considered non-survivors (White, et al. 1996). In my study, survival was determined by whether the patient maintained a pulse through transport to the local hospital (Fairmont Medical Center). Due to patient confidentiality standards, it would be too difficult to follow the patients through their hospital course and disposition. Therefore, patients who regain a pulse and maintain that pulse, with or without ALS care, were given the classification of survivor. If patients do not regain a pulse and efforts are ceased on scene or shortly after arrival to the emergency department, those patients will be given the non-survivor classification.

These variables were compared to a similar time period before the addition of the first responder AED program but within the time frame of the arrival of Gold Cross ambulance to Fairmont, MN. Data will only be used from the reports of Gold Cross Ambulance and not the previous basic life support ambulance, the Fairmont Municipal Ambulance.

Along with the variable stated above other predicting factors will be recorded. These include number of total shocks delivered, estimated down time before arrival, gender, age, bystander CPR, whether the patient was transported, and whether it was a witnessed arrest. See Appendix A for the data collection spreadsheet.

Sample and population or source of data

The data was collected from the service area of Gold Cross Ambulance, Fairmont Branch. This service area encompasses the city of Fairmont, Minnesota (2000 population of 10,889) and the surrounding farm communities (unknown population). Gold Cross ambulance responds to approximately 2.8 calls for service per 24hrs. This translates to approximately 1022 calls for service annually. An approximate number of cardiac arrests during the year is anywhere from 10 to 22, with an average of 16. The data that was collected was from two different time periods. The first being a time period from February, 2000 to May, 2002 which was before the addition of the first responder AED program. The second time period September, 2002 to February, 2004 was after the initiation of the AED program, both approximately two-and-a third years in length (26 and 29 months respectively).

An equal number of cardiac arrests were chosen before and after the initiation of the AED program. After an analysis of call volume and associated factors, a sample size of 18 cardiac arrests before and after the AED program were collected for a total of 36 cardiac arrests. For the pre-AED group, there were a total of 21 cardiac arrests during the stated time period.

Three of these arrests were dead on arrival and no treatment was initiated. Eighty-five percent of the cardiac arrests for the pre-AED group were chosen. For the post-AED group there were 20 total cardiac arrests with in the states time period with two of these patients being unsalvageable. Ninety percent of the cardiac arrests during the post-AED period were chosen. The total number of cardiac arrests patients sampled for this study is less than the recommended 40 for statistical power, but 36 patients gave reasonable data and statistical information to make adequate conclusions for this AED program.

Instrumentation

There one instrument that was used in the collection of the data for the study. This instrument is found in appendix A at the back of this proposal. The secondary source of data was the ambulance and police reports. For every ambulance run, there is a run report filled out by the crews. These ambulance run report forms include supplementation forms for situations such as cardiac arrests and traumatic injuries. For the purpose of this study, the ambulance report with the cardiac arrest supplementation was used to collect the data. In addition to this, with the AED program coming online, a new form was devised to collect data on the police department side. This was also used in addition to the ambulance run report to collect the data.

This data was extracted from the original paperwork and placed in a computer spreadsheet (see Appendix B) with the following data points that will be used in the study. The following data points will be collected using the computer spreadsheet:

1) Initiation of AED program (Before/After)
2) Form used (Gold Cross / FMT Police / BOTH)
3) Age
4) Gender
5) Time of system activation
6) Time to identification of rhythm and subsequent shock advisory
7) Estimated time of collapse
8) Time to 1st defibrillation

9) Number of shocks delivered (total)
10) Was a spontaneous return of circulation achieved (Yes/No)
11) Estimated down time before arrival
12) Transported? (Yes/No)
13) Outcome at Emergency Room (Died/Admitted or Unknown)
14) Bystander CPR? (Yes/No)
15) Witnessed arrest? (Yes/No)

These data points were taken off the Gold Cross run report and the police post cardiac arrest form then transferred to the computer spreadsheet in order to keep track of the data. The computer spreadsheet included the above points and was used on the cardiac arrests chosen for the study.

Data collection and other procedures

The data collected from ambulance run report form was collected during a trip to the headquarters of Gold Cross Ambulance, in Rochester, MN. This is the central storage facility where ambulance run report forms are kept after the crew finishes the report. The data collection occurred over a number of days during the month of February 2004. This data collection was completed by myself, the primary researcher and was approved in April of 2003, by Mayo Medical Transport, Gold Cross Ambulance (see Appendix C).

The police post cardiac arrest form was collected with the help of Shawn Stoermann, AED program liaison for the Fairmont Police Department, and was collected using the method outlined in the above paragraph. Appropriate data from this form was transferred to the spreadsheet during a specific time period for data collection.

Data analysis

The data collected in this study was considered to be nonparametric data and more specifically nominal data. In this study, descriptive and inferential statistics were used to organize and analyze the data. Descriptively, the mean of each of the categories were tabulated

in order to get an average of the data from both groups. After the categories had been averaged and tabulated using the descriptive statistic, inferential statistics were used to determine whether there was a significant difference between the time before the AED program and the time after the AED program initiation. The significant difference was determined using standard two-tailed t-tests and two-sided chi ^{2} tests with a p value of 0.05 as the cut off for significance difference between the variables.

Chapter 4: Results

A total of 36 cardiac arrests were collected and analyzed for this study. There were 18 cardiac arrest for the pre-AED program group and 18 for the post-AED group. For the pre-AED group this represents 85% of the cardiac arrests for the time period between February 2000 and May 2002. The 18 patients in the post-AED group also represent 90% of the cardiac arrests for the time period of September 2002 to February 2004.

Pre-AED group

The average age in this group was 69.2 years with a range of 43 to 90 years. Men accounted for 14 (78%) out of the 18 patients. In the pre-AED group, eight patients (44%) were found in ventricular fibrillation, five (28%) in asystole, and five (28%) in pulseless electrical activity (PEA). Of the eight patients in ventricular fibrillation (VF) paramedics defibrillated all eight and two (25%) of these patients survived to hospital admission. The two patients who were in VF and were admitted after defibrillation had and times from collapse to defibrillation of three minutes and four minutes respectively. Of the 18 patients, 13 arrests (72%) were witnessed arrests with four patients receiving family or bystander CPR (22%). A return of spontaneous circulation was achieved in seven (39%) of the 18 patients in this group and five (28%) were admitted to the hospital. The two patients that did obtain ROSC and were not admitted to the hospital lost perfusing circulation in the emergency room and were pronounced dead shortly thereafter.

The time from patient collapse to monitor placement and rhythm analysis averaged 8.1 minutes with a range from 3 to 30 minutes. The time from 911 dispatch of the ambulance service to monitor placement and rhythm analysis averaged 5.2 minutes in this group.

Post-AED group

The average age in this group was 63.1 years with a range of 43 to 92 years. Men accounted for 14 (78%) of the 18. In this group, eight patients (44%) were found in ventricular fibrillation, six (34%) in asystole, and four (23%) in pulseless electrical activity (PEA). Of the eight patients in ventricular fibrillation first responders initially defibrillated all eight, all eight of whom had subsequent paramedic defibrillation, and one (13%) survived to hospital admission. The patient who was in VF and was admitted after defibrillation, had an average time from collapse to defibrillation of five minutes. Of the 18 patients in the post-AED group 12 arrests (67%) were witnessed with three (17%) receiving family or bystander CPR. A return of spontaneous circulation was achieved in four (23%) patients in the pre-AED group and three (17%) were admitted to the hospital. The one patient that did obtain ROSC and was not admitted to the hospital lost perfusing circulation in the emergency room and was pronounced dead shortly thereafter.

The time from patient collapse to monitor placement and rhythm analysis averaged 8.9 minutes with a range from 2 to 30 minutes. The time from 911 dispatch of the ambulance service to monitor placement and rhythm analysis averaged 3.4 minutes in this group

There were no significant differences among any of the variables within the arrest data. Neither witnessed arrest, "downtime", return of spontaneous circulation, bystander CPR, outcome, or gender proved to be different between the groups (Table 1).

Table 1:
Arrest data and statistical significance

Variable	Pre-AED (n = 18)	Post-AED (n = 18)	P-value *
Male gender, n (%)	14 (78)	14 (78)	1.00
Witnessed arrest, n (%)	13 (72)	12 (67)	0.59
ROSC, n (%)	7 (39)	4 (23)	0.28
Outcome, n admitted (%)	5 (28)	3 (17)	0.46
Bystander CPR, n (%)	4 (23)	3 (17)	0.56
Downtime[1], min	8.16	8.94	0.77

* = statistical significance (P<0.05)
[1] = downtime is the time of collapse to time of pt contact by EMS

In table 2 the significant difference from 911 dispatch to monitor placement in the pre and post-AED programs is shown. For the data point of 911 ambulance dispatch to monitor placement and rhythm analysis there was a significant difference (P = 0.03) with an average of 3.4 minutes in the post-AED group when compared to 5.2 minutes in the pre-AED group. In the pre-AED group the time from collapse to monitor placement and rhythm analysis was 8.1 minutes compared with 8.9 minutes in the post-AED group. (P=0.38, see Table 1).

Table 2:
911 Dispatch to monitor placement and rhythm analysis

Patient group	Time (min)*	P-value #
Pre-AED	5.2 (2-11)	
Post-AED	3.4 (2-8)	0.03

* = median (range)
# = statistical significance = P<0.05

In this study 36 data points were utilized. In terms of statistical significance a total of 40 or higher is ideal for statistical power. Statistical power is a term which means how much stock a researcher can put in their statistical analysis of their data. A study with 500 data points will have much more statistical power than one with 30. This is an important realization for this research study. This study only had 36 data points, so statistical significance must be questioned,

but in light of data in the literature and sound methodology, statistical power and significance can be extrapolated from these data points.

Chapter 5: Discussion

Observations into whether a first responder AED program is effective in a rural EMS system is analyzed and discussed in this chapter. Significant findings in reference to the study's hypothesis were as follows. In the study group of 36 patients spread over a time period of 27 months it was found that the Fairmont Police Department AED program did not increase the rate of admission to the hospital of cardiac arrest victims nor did the patients have a higher rate of ROSC. In the pre-AED group there were five patients who were admitted to the emergency department at Fairmont Medical Center as compared with three in the post-AED group (P=0.46). In addition there were seven patients who obtained a return of spontaneous circulation (ROSC) in the pre-AED group and four patients in the post-AED group (P=0.28).

The result that was statistically different was the time from 911 dispatch to AED/cardiac monitor placement and rhythm analysis. In previous studies, such as the one done in Hamilton-Wentworth, Canada, researchers showed a decrease in time to first defibrillation from 11.96 to 8.50 minutes utilizing a first responder AED program (Shuster and Keller, 1993). This data showed that decreasing the time from dispatch to defibrillation was possible using a first responder AED program. In my research, the pre-AED group, or ambulance only defibrillation, took on average, 5.2 minutes from the initial activation, or request of service, to placement of the monitor and analysis of the rhythm. After the AED program was initiated, the time from 911 dispatch to first responder monitor placement (AED placement) was decreased from 5.2 to 3.4 minutes. This result was statistically significant (P=0.03) and is important in the determination of current and future success for this AED program.

One of the most important factors in the survival of cardiac arrest victims, and more specifically the victims in ventricular fibrillation, is the length of time from patient collapse to

defibrillation. White et al have demonstrated that early defibrillation, six minutes or less from time of collapse, is crucial to patient's survival from ventricular fibrillation (White, Hankins, Bugliosi, 1998). Although the time from 911 dispatch to monitor placement in both pre and post-AED groups was less than six minutes, the time from collapse to monitor placement was 8.16 in the pre-AED group and 8.94 minutes in the post-AED group (P=0.77). This is the most likely reason for low survival rates and the lack of improvement in the post AED study period. It is also important to realize that the estimated time of patient collapse is at best a good estimate. Commonly obtained from family members or bystanders on scene and recorded as an estimate by ambulance personnel, this time maybe off by a matter of seconds to minutes. This estimation is important to analyze, but should be understood for its inconsistencies. In addition to the time from patient collapse to defibrillation, a closer look at the data revealed that the patients who did obtain ROSC and subsequently were admitted to the hospital were defibrillated in less than six minutes. In the pre-AED group two patients were admitted to the hospital after defibrillation out of ventricular fibrillation and these two patients were both defibrillated four minutes after collapse. Similarly, in the post-AED group, the one patient who was admitted after defibrillation was defibrillated five minutes after collapse. This experience, while very limited, does reinforce previous studies that conclude that defibrillation in less than six minutes is the most important factor in patient survival. In addition, the other variables, such as age or gender, whether the cardiac arrest was witnessed, or whether the family or bystanders initiated CPR was not significantly different between the two groups (Table 1, Chapter 4).

There were many possible reasons for the lack of increase in survival in the post AED group. One of the most likely reasons is the small sample size. In comparable research done by experts in the field of AED and defibrillation a common sample size is from 84-200 patients

(Davis, 1997; Weaver, 1988; White, 1996, 1998). The sample size for this research study was only 36 patients. With the addition of the AED program, defibrillators are now getting to the patients side faster than before and this is the key factor in predicting survival. Only a large number of patients would enable confirmation of survival benefits, based on the shorter time to defibrillation.

Another possible reason for the lack of increased survival in the post-AED group is in the analysis of the time from patient collapse to monitor placement and rhythm determination. As stated in the previous paragraphs, the time from collapse to monitor placement was not significantly different between the pre and post-AED groups (8.16 and 8.94 minutes respectively) and this is not within the suggested time period of six minutes or less recommended by past cardiac arrest and AED researchers. Possible explanations for this data include a lack of data points in the study, poor cardiac arrest recognition by family members or bystanders leading to a delay in the activation of the emergency medical system, or slow activation of EMS by the 911 dispatchers after the call for service is received. For future evaluation of the success of the AED program and the survivability of the cardiac arrest patients in Fairmont, it is imperative that an explanation for the longer time period from collapse to defibrillation be investigated and attempts to reducing this time be made.

Overall, the first responder AED program in Fairmont, Minnesota has made significant strides in the treatment of cardiac arrest victims. This is evident in the decreased time from 911 dispatch to monitor/AED placement. This decrease should increase survival in patients in ventricular fibrillation as long as the time from collapse to monitor placement and defibrillation is decreased. If the time from patient collapse to monitor/AED placement decreases to approximately six minutes or less, an increase in ROSC and survival should be seen.

Recommendations in the further study of the Fairmont first responder AED program include; a similar investigation replicating the current study lasting approximately two to five years to assess the impact on survival if the time from collapse to defibrillation decreases. From previous research done on this subject I would extrapolate that a longer study with more patients would probably give positive results in outcomes and time from collapse to defibrillation. In addition, an investigation to why the time from collapse to monitor placement and analysis is high, which may include analysis of dispatch procedure or an examination of community programs in heart disease and cardiac arrest recognition. These additional studies would further help in the analysis of the success of a rural first responder AED program.

In conclusion, many researchers have shown that decreasing the time from patient collapse to defibrillation will increase survival from ventricular fibrillation (Bur, 2001; Hearne, 1988; Weaver, 1984; White, 1997). One way to decrease this time is to place defibrillators in the hands of the individuals who can respond fastest. These individuals are the first responders, such as police and fire personnel, and in some settings possibly the general public. By placing AED's in the hands of the Fairmont Police Department the time is takes to get to the patients side from 911 dispatch has been significantly decreased and although this did not increase the number of patients who survived, over a longer period of time with more patients improved survival should be observed.

References

Bunch, T.J., White, R.D., Gersh, B.J., Meverden, R.A., Hodge, D.O., Ballman, K.V., et al. (2003). Long-term outcomes of out-of-hospital cardiac arrest after successful early defibrillation. The New England Journal of Medicine, 26, 2626-2633.

Bur, A., Kittler, H., Sterz, F., Holzer, M., Eisenberg, P., Oschatz, E., et al. (2001). Effects of bystander first aid, defibrillation, and advanced life support on neurologic outcome and hospital costs in patients after ventricular fibrillation cardiac arrest. Intensive Care Medicine, 27, 1474-1480.

Crampton, R.S. (1980). Prehospital advanced cardiac life support: Evaluation of a decade of experience. Topics in Emergency Medicine, 1, 27-36.

Cummings, R.O., & Eisenberg, M.S. (1985). Prehospital cardiopulmonary resuscitation: Is it effective? The Journal of the American Medical Association, 253, 2408-2412.

Davis, E.A., & Mosesso, V.N. (1998). Performance of police responders in utilizing automated external defibrillation on victims of sudden cardiac arrest. Prehospital Emergency Care, 2, 101-107.

Eisenberg, M.S., Bergner, L., & Hallstrom, A. (1979). Paramedic programs and out-of-hospital cardiac arrest: I. Factors associated with successful resuscitation. The American Journal of Public Health, 69, 30-38.

Eisenberg, M.S., Bergner, L., & Hallstrom, A. (1979). Paramedic programs and out-of-hospital cardiac arrest: II. Impact of community mortality. The American Journal of Public Health, 69, 39-42.

Eisenberg, M.S., Bergner, L., & Hallstrom, A. (1980). Out-of-hospital cardiac arrest:

Improved survival with paramedic services. Lancet, 1, 812-815.

Eisenberg, M.S., Compass, M.K., & Hallstrom, A.P. (1980). Treatment of out-of-hospital cardiac arrests with rapid defibrillation by emergency medical technicians. The New England Journal of Medicine, 302, 1379-1383.

Eisenberg, M.S., Horwood, B.T., Cummins, R.O., Reynolds-Haertle, R., & Hearne, T.R. (1990) Cardiac arrest and resuscitation; a tale of 29 cities. The Annals of Emergency Medicine, 19, 179-186.

Emergency Cardiac Care Committee and Subcommittees. (1992). American Heart Association: Guidelines for cardiopulmonary resuscitation and emergency care. IX. Ensuring effectiveness of community wide emergency cardiac care. The Journal of the American Medical Association, 268, 2289-2295.

Goldberg, R.J., DeCosimo, D., & St. Louis, P. (1985). Physician's attitudes and practices toward CPR training in family members of patients with coronary heart disease. The American Journal of Public Health, 75, 281-283.

Hearne, T.R., & Cummins, R.O. (1988). Improved survival form cardiac arrest in the community. PACE, 11, 1968-1973.

Hossack, K.F., & Hartwig, R. (1982). Cardiac Arrest associated with supervised cardiac Rehabilitation. The Journal of Cardiac Rehabilitation, 2, 402-408.

Lund, I., & Skulberg, A. (1976). Cardiopulmonary resuscitation by lay people. Lancet, 2, 702-704.

Marenco, J.P., Wang, P.J., Link, M.S., Homoud, M.K., & Estes, M.N.A. (2001). Improving survival from sudden cardiac arrest. The role of the Automatic External Defibrillator. The Journal of the American Medical Association, 285, 1193-1200.

Mayron, R., Long, R.S., & Ruiz, E. (1984). The 911 emergency telephone number: Impact on emergency medical systems access in a metropolitan area. The American Journal of Emergency Medicine, 2, 491-493.

Oliver, M.F., Julian, D.G., & Donald, K.W. (1967). Problems in evaluating coronary care units: Their responsibilities and their relation to the community. The American Journal of Cardiology, 20, 465-474.

Roth, R., Stewart, R.D., & Rogers, K. (1984). Out of hospital cardiac arrest: Factors associated with survival. The Annals of Emergency Medicine, 13, 237-243.

Shuster, M., & Keller, J.L. (1993). Effect of fire department first-responder automated defibrillation. The Annals of Emergency Medicine, 22, 721-727.

Solvis, C.M., Carruth, T.B., & Seitz, T.B. (1985). A priority dispatch system for emergency services. The Annals of Emergency Medicine, 14, 1055-1060.

Weaver, D.W., Copass, M.K., Bufi, D., Ray, R., Hallstrom, A.P., & Cobb, L.A. (1984). Improved neurologic recovery and survival after early defibrillation. Therapy and Prevention, 69, 943-948.

Weaver, D.W., Hill, D., Fahrenbruck, C.E., Copass, M.K., Martin, J.S., Cobb, L.A., et al. (1988). Use of the Automatic External Defibrillator in the management of out-of-hospital cardiac arrest. The New England Journal of Medicine, 319, 661-667.

White, R.D. (1997). Optimal Access to – and response by – public and voluntary services, including the role of bystanders and family members, in cardiopulmonary resuscitation. New Horizons, 5, 153-157.

White, R.D., Asplin, B.R., Bugliosi, T.F., & Hankins D.G. (1996). High discharge

survival rate after out-of-hospital ventricular fibrillation with rapid defibrillation by police and paramedics. The Annals of Emergency Medicine, 28, 480-485.

White, R.D, Hankins, D.G, & Bugliosi, T.F. (1998). Seven years' experience with early defibrillation by police and paramedics in an emergency medical services system. Resuscitation, 39, 145-151.

Appendix A:

Institutional Research Board
Augsburg College
Box 107

October 14, 2002

To: Michael Olson

From: Norma C. Noonan, Chair

I am pleased to inform you that the IRB has approved your research proposal, Effect of a First Responders AED Program....

__XX__ as submitted

_____ as revised on _____

___ with the following conditions: Please submit a copy of the letter (s) of approval from Gold Cross Ambulance and Mayo Medical Transportation for your file since this approval is contingent upon their receipt of their letter of approval.

Your IRB approval number which should be noted in your written project and in any major documents alluding to the research project is as follows:

2002-33-3

I wish you success with your project. If you have any questions, you may contact me: 612-330-1198 or noonan@augsburg.edu.

c. Dr. Dawn Ludwig

Appendix B:

AED DATA COLLECTION SHEET
MASTER THESIS, MIKE OLSON

_____ Initiation of AED program (BEFORE/AFTER)

_____ Form used (Gold Cross / FMT Police / BOTH)

_____ Gender

_____ Age

_____Time of system activation

_____Time OF identification of rhythm and subsequent shock advisory

_____Estimated time of patient collapse

_____Time OF 1st defibrillation

_____Number of shocks delivered (total)

_____ Was a spontaneous return of circulation achieved (Yes/No)

_____ Estimated down time before arrival

_____Transported? (Yes/No)

_____Outcome at Emergency Room if transported (Died/Admitted or Unknown)

_____ Bystander CPR? (Yes/No or Unknown)

_____ Witnessed arrest? (Yes/No or Unknown)

Appendix C:

Gold Cross Ambulance Service
1308 Marsh Street
Mankato, Minnesota 56001-5215
1-800-606-6296
Office 507-345-7540
Dispatch 507-345-3420
Billing 1-800-776-9002
Fax 507-345-7543

April 17, 2003

Michael Olson
3607 E 26th Street
Minneapolis, MN 55406

Dear Mr. Olson,

This letter is in response to your request to conduct research with Gold Cross Ambulance run reports for the study of "Effects of a First Responder Automatic External Defibrillator (AED) Program on Patient Outcomes in a Rural EMS System."

Your request was discussed at the April 17th MMT Administrative Committee Meeting and permission was granted for you to conduct this research as stated in your institutional review board (IRB) form.

Sincerely,

Russel D. Weiss
Regional Coach, Processes
Gold Cross, Mayo Medical Transportation