AN ASSESSMENT OF PREHOSPITAL DEFIBRILLATION
IN WHITMAN COUNTY

By
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A clinical research project submitted in partial fulfillment
of the requirements for the degree of

MASTER OF NURSING

WASHINGTON STATE UNIVERSITY
Intercollegiate Center for Nursing Education

May 1996
To the Faculty of Washington State University:

The members of the Committee appointed to examine the clinical research project of DOROTHEA A. CHENARD find it satisfactory and recommend that it be accepted.

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ACKNOWLEDGEMENTS

Finally, after what seems like an eternity, I have completed another chapter in the pursuit of my formal education. I would like to give recognition to those who have been my inspiration and support.

Special thanks to Dr. Renee Hoeksel, who served as the chairperson of my thesis committee. She was always willing to share her knowledge, insight and time in a way that gave me the inspiration and confidence to keep going. Recognition is also given to Dr. Lorna Schumann and Mike Heston, M.A. for serving on my thesis committee.

I would like to thank all the Fire Chief’s and EMS Community Coordinators who allowed me to access confidential information. Without your cooperation, I would not have completed this undertaking.
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Abstract

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May 1996

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The purpose of this study was to investigate the clinical application of the automatic external defibrillator (AED) as a device that assists the rural emergency medical technician (EMT) when evaluating and treating patients with symptoms of cardiac arrest or chest pain within Whitman County. Data were gathered from each community with a AED greater than one year to determine if there was a relationship between relevant time intervals, frequency of AED use and patient outcomes.

Survey data were obtained from existing medical incident reports using the prehospital defibrillation collection tool. The information was recorded by the investigator in such a manner that the subjects could not be identified, directly or through identifiers linked to the subjects. Patients experiencing cardiac arrest with ventricular fibrillation or ventricular tachycardia as the presenting rhythm had further data analysis conducted utilizing the Utstein template. This method provides a uniform method of calculating an overall survival rate. The relationship between relevant time intervals, gaining access, cardiopulmonary resuscitation, defibrillation and advanced cardiac life support was established through percentages. The descriptive section of the data provided clarification and identified differences within the EMS system of Whitman County.
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DEDICATION

To my father Charles J. Van-Brunt

who died August 11, 1995.
CHAPTER ONE
INTRODUCTION

Cardiovascular disease accounts for more than 900,000 deaths annually. In the United States, approximately 500,000 of these deaths are due to heart attacks. Half of all deaths that result from a heart attack occur before the victim reaches the hospital (Textbook of Advanced Cardiac Life Support, 1994). The American Heart Association has endorsed early defibrillation as the standard of care for patients with symptoms of cardiac arrest. This standard can be problematic to implement in sparsely populated and remote prehospital settings where the frequency of cardiac arrest is low, the rescuer response times are very long and there is limited revenue to purchase an Automatic External Defibrillator. (Cummins, 1985; Michal, 1993; Eisenberg, Cummins, Damon, Larson & Hearne, 1990).

Whitman County is diversely populated and the population is spread out over a large geographical area. There are two local hospitals which provide advanced life support to eighteen rural communities. Eight of these communities have already purchased or obtained grant money from the state in order to purchase an Automatic External Defibrillator (AED). Two more rural areas are considering the purchase of an AED for their emergency medical technicians (EMTs) to use in cardiac arrest situations. Currently, six communities have the ability to transport patients to a nearby hospital; the other communities have to wait for assistance from a transporting unit, which contributes to increased response time.

Survival of an out-of-the hospital cardiac arrest caused by ventricular fibrillation, is determined by the amount of time from collapse to definitive care with
electrical defibrillation (Eisenberg, Cummins, Damon, Larson, & Hearne, 1990). Most neurologically intact survivors have common themes: witnessed cardiac arrests, cardiopulmonary resuscitation (CPR) initiated within minutes, defibrillation availability for ventricular fibrillation, and advanced cardiac life support (ACLS) services within 12-15 minutes from the time of collapse (Weaver, Hill, Fahrenbruch, Copass, Martin, Cobb, & Hallstrom, 1988).

The factors that improve one’s chance for survival all share similarities: central dispatching “911”, prompt cardiopulmonary resuscitation, short ambulance response times, and rapid defibrillation. These are components that the American Heart Association refers to as the “chain of survival” (Textbook of Advanced Cardiac Life Support, 1994, Figure 3).

Many regions within Whitman County are lacking in one or more of these Emergency Medical Services (EMS). One community has all the available resources, while others have limited services, and many have none. A program currently under consideration for the entire region, is the establishment of an “E-911” (Enhanced 911) communication system. Population densities among communities range from less than 200, to greater than 25,000. Many communities rely on volunteer EMT’s to provide professional emergency care whenever the need arises. Currently six communities have “911” services; Colfax, Colton, Pullman, Rosalia, Uniontown and District 14. The City of Pullman, is the only community with all the necessary components to improve one’s chance of survival of an out-of-the hospital cardiac arrest.
Statement of the Problem

Emergency Medical Services (EMS) can be defined as the resources, within a community which are used to deliver emergency care to those individuals with an unpredicted medical event outside a hospital. An individual experiencing chest pain or collapse from a sudden cardiac arrest qualifies as an unpredictable event with an immediate need for evaluation and possible defibrillation. An efficient EMS system is necessary to increase an individual’s chance of survival. Evaluation of the Whitman County Emergency Medical Service system will assist in the future planning needs of all communities that wish to purchase an automatic external defibrillator (AED).

Purpose

The purpose of this study was to investigate the clinical application of the AED as a device that assists the rural emergency medical technician when evaluating patients with symptoms of chest pain or cardiac arrest within Whitman County. Data were gathered from each community with an AED, in use for more than one year to determine the relationship between time intervals, frequency of use and patient outcomes.

The use of AED’s by EMT’s has expanded emergency services in many communities when individuals are in need of emergency cardiac care. Open communication, through the EMS council, motivates and empowers this social service system. The strengths and weaknesses are represented by the human and physical resources brought together to provide professional emergency care. They are measured by outcomes such as survival, disability, or death.
Significance to Nursing

Whitman County is predominantly an agricultural based economy; it is also home to Washington State University which attracts newcomers for educational and employment opportunities. As communities grow, many are considering the purchase of a semi-automatic external defibrillator for use by their local EMT’s in order to help patients survive a prehospital cardiac arrest.

It is imperative that nurses living in small rural communities have an understanding of the events that are taking place within their communities. Some nurses, in rural settings, are also certified EMT’s who respond when summoned to assist their neighbors. Many rural areas have no local health services other than voluntary EMS providers. Most physicians live in larger service areas such as Colfax and Pullman. St. John is the only rural area in Whitman County with a physician locally available.

The increased use of AED’s by EMT personnel often require a trained individual within the community to supervise and coordinate the required skill maintenance. Nurses living in these remote areas can assume some responsibility by ensuring their local emergency medical personnel are qualified to assist in resuscitation and defibrillation procedures. Every six months the protocols are reviewed or updated as dictated by the medical program director. Education and training are rehearsed through scenarios to assist with events that may be encountered in the field. The effectiveness of an emergency medical service system is dependent on every component within the system. Nursing is one segment that can contribute to the growth and development of its local EMS chapter. Teaching and caring are valuable assets within the nursing profession; they contribute to the health and wellness of an entire community.
Review of Relevant Literature

Automatic External Defibrillator

Unusual accounts of attempted resuscitation efforts have been recorded since antiquity (Paraskos, 1992). In 1960 successful resuscitation was limited to an occasional victim of respiratory arrest. Emergency thoracotomy with “open chest massage” was described in the 1950s and was often successful if definitive therapy was readily available. “Although restoration of cardiac rhythm is not possible until defibrillation is accomplished, adequate blood flow to the myocardium and cerebrum can be maintained only by cardiac massage. The defibrillator utilizes an ordinary 110 volt, 60 cycle, alternating current. The instrument has sufficient resistance in the circuit, so that the amperage is reduced to 1 or 1 1/2 amperes. The current is passed through two brass circular electrodes about 3 inches in diameter which are applied to each surface of the heart. The organ is shocked for 0.10 second with 2-second intervals between shocks. Usually three to seven shocks will suffice for defibrillation. Before the shocks are applied, the heart should be massaged for 30 to 40 seconds in order to expel the blood from its chambers, because it is usually dilated when ventricular fibrillation had occurred” (Ochsner & DeBakey, 1959, p. 60).

The ability to reverse a fatal arrhythmia without opening the chest challenged the medical community to develop a method of sustaining ventilation and circulation long enough to bring the defibrillator to the patient’s aid. In 1958, rescue ventilation using mouth-to-mouth technique was unveiled. Two years later, a technique describing “closed-chest “compression gained recognition. Together they ushered in the modern era of Cardio-Pulmonary Resuscitation (CPR) (Kouwenhoven, Jude, & Knickerbocker, 1960).
In 1966, a National Academy of Sciences-National Research Council (NAS-NRC) conference on CPR recommended the training of medical, allied health, and other professional personnel in the external chest compression technique according to the standards of the American Heart Association (AHA). This in turn led to the wide acceptance of the theory of CPR among health care professionals (Cardiopulmonary Resuscitation: Conference Proceedings, 1967).

Between 1973 and 1983, the AHA focused on the importance of developing standards and guidelines in CPR and Emergency Cardiac Care (ECC) which included both basic and advanced life support care. Risk factor modifications and preventive measures were stressed as being important within the community setting, as well as early response and bystander CPR. In 1985, changes were made to the existing guidelines, and new recommendations were based on research findings and the clinical data collected since 1973. The AHA and ECC committees endorsed the early use of thrombolytic therapy and emphasized the importance of early defibrillation (Standards for Cardiopulmonary Resuscitation and Emergency cardiac Care, 1992).

Death rates from coronary artery disease fell 30 percent between 1979 and 1989. Advances in medical treatment (including emergency treatment) and healthier life styles were contributing factors. In 1990, 3.6 million people were diagnosed with heart disease. Approximately 675,000 individuals were diagnosed with acute myocardial infarction. Forty-five percent of all heart attacks occur in people under the age of sixty-five. An estimated 6.2 million Americans have significant heart disease. Many of these people are at risk for sudden cardiac death or myocardial infarction. Two-thirds of these sudden deaths will take place outside the hospital and usually occur within two hours after onset of symptoms (Standards for Cardiopulmonary Resuscitation and Emergency Cardiac Care, 1992).
Sudden death related to coronary artery disease (CAD) is the most prominent medical emergency in the United States. As the majority of sudden deaths caused by cardiac arrest occur before hospitalization, individuals within communities must be trained in recognition and prompt intervention if the victim is to survive. When CPR and defibrillation are delayed, the EMS system is impaired and patient outcomes suffer. In such circumstances, the cerebral cortex, the tissue most susceptible to hypoxia is damaged resulting in death or severe neurological deficit (Weaver, et al., 1988).

Survival from cardiac arrest outside the hospital is determined by both bystander CPR and rapid defibrillation. The focus on early defibrillation reflects the fact that an initial tachy-arrhythmia causes 80 to 90 percent of nontraumatic cardiac arrests (Hargarten, Steuven & Waite, 1990). Without defibrillation, a patient’s cardiac activity will deteriorate into a nonviable rhythm.

Automatic external defibrillators were developed in the late 1970s. Their refinement over the past two decades represents an important technological advance. The term “automatic external defibrillator” refers to an external defibrillator that incorporates a rhythm analysis system into the device. Some devices are considered fully automated, whereas others are “semi-automated” or shock advisory defibrillators (Ruskin, 1988). All AED’s are attached to the patient by two adhesive pads and connecting cables. The adhesive pads have two functions, to record the rhythm and administer the electric shock (Barbiere & Liberatore, 1992).

A fully automated defibrillator requires only that the operator attach the defibrillator pads and turn on the device. The device then analyzes the rhythm, if either ventricular fibrillation (VF) or ventricular tachycardia (VT) greater than 180 beats per minute is present, the device will charge its capacitors and administer a shock.
Semiautomated or shock advisory devices require an additional operator step. The operator must first press “analyze”. This is a control device to initiate rhythm analysis; if the presenting rhythm is ventricular fibrillation or ventricular tachycardia greater than 180 beats per minute, the machine will advise the operator to shock. The operator must press the shock button in order to deliver a shock (Barbiere & Liberatore, 1992, Michal, 1993). Semi-automated shock advisory defibrillators are considered safer because the decision to administer the shock is left up to the operator and not the machine (Ruskin, 1988).

**Clinical Literature Support**

Cummins (1985) evaluated the efficacy of AEDs in rural communities based on population. For example, a community of ten thousand can expect about ten cardiac arrests outside the hospital per year. Of these ten people, six will experience ventricular fibrillation. Early defibrillation will likely convert three victims to a perfusing rhythm in the field, and one or two will eventually be discharged from the hospital.

EMT-Defibrillation (EMT-D) in rural Wisconsin communities was evaluated in 1989 by Olson, LaRochelle, Fark, Aprahamian, Aufderheide, Mateer, Hargarten & Stueven. A total of 566 adult patients were classified by initial presenting rhythm, clinical course, and eventual outcome. Populations included were as low as two thousand and as great as fifteen thousand. Survival from EMT-D witnessed arrests accounted for one-third of survivors of ventricular fibrillation. The most common reason for EMS activation was chest pain and shortness of breath. Patients benefited because they were monitored prior to their witnessed arrests. This benefit may be important in cases with long transport times, likely in rural areas.

Two new concepts and proposals pertinent to rural areas were recommended for possible implementation based upon the results of this study. First, defibrillators
need to be kept with the primary EMT on-call rather than in the ambulance, thereby decreasing response time. Second, law enforcement personnel need to be cross trained and carry the defibrillator because they usually arrive on the scene before EMT personnel (Olson, et al., 1989).

The Wisconsin experience concluded that patients in rural areas do present with salvageable rhythms. EMT-D's can safely and effectively defibrillate these patients. A shorter response time seems to be the likely key to survival. A patient who had a witnessed arrest was more likely to survive in this study; such patients were significantly more numerous in the survival group (Olson, et al., 1989).

The primary goal of a 1982 Nebraska investigation was to construct a model that could estimate the impact of EMT defibrillation on communities of varying size. More than 52 percent of Nebraska communities randomly distributed throughout the state participated voluntarily in a uniform reporting system. The source of information was data from the 1982 rescue squad computerized run reports. Groups of communities were defined according to the population (1980 census figures): urban consisted of a population greater than 50,000, intermediate was a population between 10,000 to 49,999, and rural populations were less than 10,000. Ambulance rescue service response times for cardiac arrest, number of rescue runs, and number of cardiac arrests per rescue service were analyzed for each community group (Ornato, McNeill, Craren & Nelson, 1984, p. 1096).

The likelihood that a prehospital cardiac arrest victim would be in ventricular fibrillation on arrival of the rescue squad was obtained from the rescue unit response time using regression analysis of published data. Because authors differed in how they reported this information, the regression was performed on a mixture of data reported as mean response time, median response time, or from the times presented.
There was a marked difference in the number of cardiac arrests per ambulance rescue service per year, reflecting different population densities among the regions. The percentage of arrest victims expected to be in VF varied. The model predicted a marked difference in utilization of defibrillation by EMT's based on the population served. “EMT's in urban Nebraska (mean population 242,000) will use the defibrillator once every six weeks. EMTs in intermediate cities (mean population 22,300) will defibrillate once a year. In rural Nebraska (mean population 1,500) the defibrillator will be used once every 5.6 years” (Ornato et. al., 1984, p. 1098).

Questions concerning the cost-effectiveness of EMT-D programs in rural communities with populations less than 5,000 were addressed by Cummins (1985). Guidelines are available for communities considering an EMT-D program. Ideally, this issue should be decided locally by each community. EMT-D programs are expensive; every life saved is considered by many communities to be worth not only the expense, but the extraordinary effort on the part of EMTs to be prepared to save a life (Stults, Brown, Schug, & Bean, 1984, p. 223).

In summary, the literature review indicates that early defibrillation is the most effective treatment for ventricular fibrillation whether the patient is in or out-of-the hospital. A majority of studies indicate there is a greater chance of surviving a cardiac arrest if all components of a well-developed Emergency Medical Service System are in place (Bachman, McDonald, & Obrien, 1986, Cummins, et al., 1988, Eisenberg, Horwood, Cummins, Reynolds-Hearne & Hearne,1990, Olson, et. al., 1989). Semi-automatic external defibrillators are recommended over the conventional manual defibrillator because they require far less time and expense for both initial training and skill maintenance.
Whitman County adopted the utilization of AED’s in 1989 with the assistance of Dr. Lloyd Perino, former Medical Program Director. Currently eight communities have an AED available in their ambulance. Protocols were developed as guidelines to assist the EMT in patient care situations. Every community with an AED is required to document individual EMT skill performance through documentation. This study gathered data from each community with an AED in order to determine the relationship between relevant time intervals, frequency of use, and patient outcomes. An evaluation of the existing EMS system will assist in the future planning needs of all communities considering the purchase of an AED.

Research Questions

The following research questions were investigated.

Question 1. What are the chances of surviving a heart attack or cardiac arrest in Pullman, Washington as compared to other communities within Whitman County during the past five years?

Question 2. What are the differences between time intervals involving early access, witnessed arrest with cardiopulmonary resuscitation, early defibrillation, and early advanced cardiac life support when determining the chances of survival throughout Whitman County during the past five years?
Definition of Terms

The following definitions were used in this study.

**Cardiac arrest**: Cardiac arrest is the cessation of cardiac mechanical activity. It is a clinical diagnosis, confirmed by unresponsiveness, absence of detectable pulse and absence of respiratory effort.

**Cardiopulmonary resuscitation (CPR)**: CPR refers to attempting any of the broad range of maneuvers and techniques used to restore circulation.

**Bystander CPR**: Bystander CPR is an attempt at basic CPR provided by a person not at that moment part of the organized emergency response system.

**Basic life support (BLS)**: BLS is a phase of Emergency Cardiac care (ECC) that includes recognition of cardiac arrest, access to the EMS system, and basic CPR.

**Advanced cardiac life support (ACLS)**: This term refers to attempts at restoration of spontaneous circulation using basic CPR plus advanced airway management, endo-tracheal intubation, defibrillation, and intravenous medications.

**Emergency medical services (EMS)**: Persons who respond to medical emergencies in an official capacity are emergency (or EMS) personnel. The EMS system has two major functional divisions.

**EMS responders**: EMS personnel who respond to medical emergencies by going to the scene in an emergency vehicle. They may be first responders, emergency medical technicians (EMTs), or paramedics EMT-Ps, depending on the EMS system. They may be trained in BLS or ALS. All should be capable of performing defibrillation.

**Emergency Cardiac Care (ECC) system**: Refers to all aspects of ECC, including that rendered by emergency personnel.
EMT-D: Refers to an EMT who has received additional training and currently certified to operate an automatic external defibrillator.

Chain of survival: Is a metaphor to communicate interdependence of a community’s emergency response to cardiac arrest. This response is composed of four links: early access, early CPR, early defibrillation, and early ACLS. With a weak or missing link the result will be poor survival, despite excellence in the rest of the system.

Time intervals: The Utstein recommendations have provided a rational nomenclature for important time intervals. Time intervals should be reported as the A-to-B interval, which represents the period that begins at time point A and ends at time point B.

911 call to dispatch interval: The interval from the time the call for help is first received by the 911 center until the time the emergency vehicle responds to the scene.

Vehicle at scene-to-patient-access interval: The interval from when the emergency response vehicle stops moving at the scene at the address until EMS responders are at the side of the patient.

Patient status at the scene: The recommended categories are return of spontaneous circulation, continuing CPR, or death.

Status on arrival at emergency department: This reflects a change of status.

Status after treatment in the emergency room: The possibilities are admission to the hospital or alternative location or pronounced dead with termination of efforts.

Discharged Alive: If the patient died in the hospital, the date and time of death and the length of survival after return of spontaneous circulation should be recorded.

Discharge destination: If the patient is discharged, researches should record the discharge destination: home, rehabilitation facility, extended care facility, or other.
Alive at one year: This should be determined by outcome of brain injury: The Glasgow-Pittsburgh Cerebral Performance Categories:

1. Good cerebral performance. Conscious. Alert, able to work and lead a normal life. CPC 1, plus no or only mild functional disability from noncerebral organ system abnormalities.

2. Moderate overall disability. Conscious. Moderate cerebral disability alone CPC 2, or moderate disability from noncerebral dysfunction alone or both. Performs independent activities of daily life. May be able to work part-time in sheltered environment but dialed for competent work.

3. Severe overall disability. Conscious. Severe cerebral disability alone. CPC 3, or severe disability from noncerebral dysfunction alone or both. Dependent on others for daily support.

The definition of terms listed in this section are referred to as “Utstein style”. (Permission to use granted). (Appendix C).
CHAPTER TWO
RESEARCH DESIGN

This comparative descriptive study investigated the Emergency Medical Service system of Whitman County. To improve the EMS-ECC system required an accurate measurement of patient outcomes based on the EMS system present in each community. This study examined the medical incident reports from each community, from 1991-1995. The Prehospital Defibrillation Tool (Appendix A) was used to gather nominal data representative of each community. Descriptive statistics were used to summarize the studied data; and described the differences in each community.

Sample

Data were collected in communities throughout Whitman County which had the following criteria: (1) ongoing EMT-D training program in place, (2) an AED available within the community, greater than one year, and (3) the ability to transport to an ALS facility. The communities of Oakesdale and Palouse were excluded because they rely on others for transportation and to refrain from duplication of data. The community of Tekoa was excluded due to their recent purchase of an AED. The records used for conducting this study were obtained from each Emergency Medical Service system throughout Whitman County. Letters were sent to each community EMS coordinator requesting permission to gather data from their medical incident reports (Appendix B). All information collected would be kept confidential. The letter briefly described the purpose and the value of the study and what information would be needed.
Setting

A retrospective study examined the medical incident reports of all patients who entered the EMS system of Whitman County with the specific complaint of chest pain or cardiac arrest from January 1, 1990 through December 31, 1995. The medical incident report is a patient care record initiated by EMT’s at the scene and is part of the patient’s permanent medical record.

Instrumentation

The Utstein style template (Appendix A) was used for reporting data on cardiac arrest resulting from ventricular fibrillation and ventricular tachycardia. Permission to use the Utstein style template was granted on June 9, 1995 by Richard O. Cummins, M.D., (Appendix C) The American Heart Association encourages investigators to seek permission to use the Utstein style template because of its reliability and validity.

Procedure

The published criteria for the factors that improve one’s chance for survival as represented by the “chain of survival” are clearly stated in the 1994 *Textbook of Advanced Cardiac Life Support*. The Emergency Medical Service System is composed of identifiable and interrelated components synonymous to the chain of survival. Data were collected by the researcher, using medical incident reports from each community, and addressed each of the following four components.

Description of dispatch and the EMS system throughout Whitman County was examined to determine if there was a relationship between early access and an increase in survivability. Early access encompasses the events that encourage bystanders to call 911 before or after an event has occurred.
CPR is more effective when initiated immediately after the patient's collapse. Data pertaining to bystander CPR were collected, using the prehospital defibrillation tool, to determine if there was a relationship between early CPR and one's chance for survival as determined by patient outcomes.

*Early defibrillation* is the link in the chain of survival most likely to improve survival (Cummins, Chamberlain & Abramson, et. al., 1991). Data were collected from each community with an AED greater than one year to determine if there is a relationship between time intervals, early defibrillation and patient outcomes.

*Early ACLS* is currently provided by one ambulance service and two local hospitals. Patients that are transported to the emergency room stand a better chance of survival. Data were collected in each community that provided ACLS to determine if there was a relationship between, time intervals, ACLS and patient outcomes as noted on the medical incident reports.

**Analysis**

The Prehospital Defibrillation Collection tool and the Utstein style template (Appendix A) were used in the collection of demographic and statistical data. Patients experiencing cardiac arrest with ventricular fibrillation or ventricular tachycardia had analysis conducted utilizing the Utstein template. The relationships between relevant time intervals, early access, witnessed arrests with CPR, early defibrillation and early advanced life support were established through percentages. The descriptive data provided clarification and identified differences within the EMS system of Whitman County.
Reliability

Reliability refers to the consistency, stability, and repeatability of a data collection instrument (Burns & Grove, 1993). “The recommended Utstein template provides cardiac arrest researchers with a uniform format for data reporting. This is important because of past confusion and inconsistencies in reporting statistical survival rates. The template approach should facilitate comparisons between communities and reduce confusion about numerators and denominators used to calculate survival rates. The template provides a uniform method of calculating an overall survival rate and defines the subgroup stratification that can be used for further analysis” (Cummins, Ornato, Thies & Pepe, 1991 p. 1843).

Validity

The validity of an instrument is a determination of the extent to which the instrument actually reflects the abstract construct being measured (Burns & Grove, 1993). “There is international consensus on the importance of using standard terminology and methods to evaluate survival and the chain of survival. Considerable effort has been directed to create clear, unambiguous terminology, establish a uniform method of reporting data, and improve methods for cardiac arrest research” (Cummins, Chamberlain & Abramson, 1991, p. 970).

The definition of terms listed in this study are referred to as “Utstein style”. This definition of terms was developed by a combined task force of the AHA, the European Resuscitation Council, the Heart and Stroke Foundation of Canada, and the Australian Resuscitation Council. These definitions are intended as a starting point for achieving uniform terminology in the research process (Cummins, Chamberlain & Abramson, 1991, p. 973). A uniform list of definitions adds to the content validity.
Human Subjects

No human subjects were contacted or identified. Records from individual EMS systems were accessed. Only aggregate data were reported. All data were recorded as anonymous and maintained as confidential.

Permission was requested and granted to access medical incident reports from the EMS Coordinators of the following communities (Appendix B).

1. James Krouse, Fire Chief Colfax EMS.
2. Warren Neal, Garfield EMS Coordinator.
3. Pat Wilkins, Fire Chief Pullman EMS.
4. Dale Crutcher, Rosalia EMS Coordinator.
5. Greg Morasch, St. John EMS Coordinator.
6. Mike Bishop, Washington State University EMS Coordinator.
CHAPTER THREE
RESULTS

Introduction

Cardiac arrests occur suddenly and without warning. Survival of an out-of-the-hospital cardiac arrest is dependent on four variables; early access, witnessed arrest with early CPR, early defibrillation and early ACLS (Textbook of Advanced Cardiac Life Support, 1994). This study evaluated the EMS system of Whitman County to determine the effects of prehospital defibrillation on patients presenting with symptoms of cardiac arrest. Documented criteria were measured from the medical incident reports of individual communities over the past five years with the exception of St. John with thirteen months of data.

Research question one asked:

What are the chances of surviving a heart attack or cardiac arrest in Pullman, Washington as compared to other communities within Whitman County during the past five years?

Research question two asked:

What are the differences between time intervals involving early access, witnessed arrests with cardiopulmonary resuscitation, early defibrillation, and early advanced life support when determining the chances of survival throughout Whitman County during the past five years?

Methods

Six communities were selected for this study based on the following criteria: (1) ongoing EMT-D training program in place, (2) an AED available with the community, greater than one year, and (3) the ability to transport a patient to an ALS facility. The communities of Colfax, Garfield, Pullman, Rosalia, St. John and
Figure 1:

PATIENTS ENTERING EMS IN WHITMAN COUNTY, WASHINGTON

Legend
- Chest pain
- Cardiac Arrest

<table>
<thead>
<tr>
<th>Community</th>
<th>Number of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colfax</td>
<td></td>
</tr>
<tr>
<td>Garfield</td>
<td></td>
</tr>
<tr>
<td>Pullman</td>
<td></td>
</tr>
<tr>
<td>Rosalia</td>
<td></td>
</tr>
<tr>
<td>St. John</td>
<td></td>
</tr>
<tr>
<td>WSU</td>
<td></td>
</tr>
</tbody>
</table>

COMMUNITY
Washington State University were examined.

The prehospital defibrillation tool and the Utstein templates were used in the collection of data. The Utstein templates establish a uniform method for reporting cardiac arrest data as recommended by the American Heart Association and ensures comparability with other studies. "The denominator begins with cardiac arrest patients with cardiac etiology and displays how this group will progressively decrease to the proportion alive at one year" (Cummins, et. al., 1991).

Results

Three hundred and fifty one patients entered the Emergency Medical Service system of Whitman County over the past five years. Two hundred and ninety-one individuals presented with symptoms of a heart attack. Sixty patients presented with a cardiac arrest (Figure 1), only nine were successfully defibrillated out-of-the hospital and admitted to an ALS facility. Survival of out-of-the hospital cardiac arrest in Pullman, Washington was 10 percent (6/60) as compared to 3.3 percent in Rosalia, Washington and 1.6 percent in Garfield, Washington. The survival rate for Whitman County, prehospital defibrillation and admission to an ALS facility, was 15 percent (Figure 2).

The differences between time intervals involving early access, witnessed arrests with cardiopulmonary resuscitation, early defibrillation, and early advanced life support were examined involving the nine patients who were successfully defibrillated out-of-the hospital and admitted to an ALS facility. Figure 3, is representative of these differences.

The mean response time from call (911) to arrival on scene was 4.5 minutes, with a range from 1-10 minutes (Figure 4). Availability of 911 was documented on seven medical incident reports. Nine cardiac arrests were witnessed; CPR was in
PERCENTAGE OF SUCCESSFUL PREHOSPITAL DEFIBRILLATION

Legend

Survivors

PERCENTAGE

Colfax  | Garfield  | Pullman  | Rosalia  | St. John  | WSU
---|---|---|---|---|---
33% | 7% | 40% | 67% | |
DIFFERENCES BETWEEN TIME INTERVALS

Figure 3:
Differences in response time

Mean response time among communities.
progress on eight occasions. Defibrillation was indicated for each patient however; it was withheld on one patient in ventricular tachycardia (VT), greater than 180, with a pulse. The mean response time to an ALS facility was 10.3 minutes per documentation (Figure 4). The overall survival rate in Whitman County was 3.33 percent (2/60). Survival as defined by the template is discharged alive greater than 1 year (Figure 5).

Limitations

Two major limitations were identified: (1) not accessing the medical records of patients who were admitted to ALS facilities and (2) there was a lack of uniform documentation on Medical incident reports throughout the county. These limitations prohibits knowing the final outcomes of all patients who were successfully defibrillation prior to ALS admission.

Conclusion

The commonality shared by these nine patients were early access, witnessed arrests with early CPR, availability of an AED / SAED by the responding EMS system and a quick response time to an ALS facility. Links that contribute to successful outcomes can be problematic to implement in sparsely populated and remote prehospital settings where the frequency of cardiac arrest is low, the rescuer response time are very long and there is limited revenue to purchase an AED / SAED.

Rural communities are often challenged to evaluate and develop resources inorder to provide services that will increase the chances of survival from an out-of-the hospital cardiac arrest. This study shows that early defibrillation did contribute to a small percentage of patient outcomes; and that virtually in any community, a possibility does exist that an AED / SAED in trained hands may save some lives.
FIVE YEAR SURVIVAL RATE
CHAPTER FOUR

Discussion and Limitations

The best way to evaluate the strength of the chain of survival is to assess the survival rates achieved by the system. In this study, the researcher evaluated the Emergency Medical Service systems of Whitman County. Six communities were selected for this study based on the following criteria: (1) ongoing EMT-D training program in place, (2) an AED available within the community, greater than one year, and (3) the ability to transport to an ALS facility. The communities of Colfax, Garfield, Pullman, Rosalia, St. John and Washington State University met the criteria. Two additional criteria were examined: (1) patients entering EMS with symptoms of a heart attack, such as chest pain and shortness of breath, and (2) patients with a cardiac arrest. The medical incident report completed by first responder's or EMT's were assessed, over the past five years, for the documented information that was essential for this evaluation.

Survival of cardiac arrest depends on a series of essential interventions. The American Heart Association (AHA) feels that if one of these essential actions is neglected or delayed, survival is unlikely. The chain of survival is used to illustrate this sequence (Figure 6).

![Diagram of the chain of survival](image)

The "chain of survival" metaphor (reproduced with permission from Cummins, et al).
Early Access

A majority of studies indicate there is a greater chance of surviving a cardiac arrest if all components of a well-developed Emergency Medical Service System are in place (Bachman, et al., 1986, Cummins, et al., 1988, Eisenberg, et al., 1990, Olson, et al., 1989). Response time depends upon citizens having rapid access to an efficient dispatch system.

Early access incorporates the events which encourage a person to activate their local EMS; events could be symptoms of a heart attack, like chest pain and shortness of breath or a cardiac arrest which promotes activation of the EMS system. A description of dispatch and the EMS system throughout Whitman County was examined to determine if there was a relationship between early access and an increase in survivability. Early access was determined by using the actual recorded time the initial call was received. This initial time was used to determine the amount of time that transpired from receiving the call, being dispatched, and arriving on scene.

Pullman and WSU have 911 services through a central dispatch system. Colfax and Rosalia have a designated firefighter available to answer incoming 911 calls; a page then goes out notifying EMS volunteers of a need within the community. The communities of Garfield and St. John have a designated emergency number that residents call. Once activated, the emergency is transmitted over a frequency that notifies the need for EMS activation. The differences in early access, or 911 call to arrival on scene is illustrated in Figure 4.

Early CPR is more effective when initiated immediately after the patient's collapse. The technique of CPR keeps some oxygenated blood flowing to the brain and other vital organs until defibrillation is available. When a person goes into ventricular fibrillation it takes about 8 to 12 minutes before that rhythm deteriorates into
a non-viable rhythm like asystole (Cummins, 1985).

The mean response time, in this study, for nine patients who were admitted to an ALS facility was 4.5 minutes, with a range from 1-10 minutes (Figure 3). The number of witnessed cardiac arrest, over five years, was forty 11% of all emergency calls. The mean time from collapse to call was 2.9 minutes and the mean time from call to initiation of CPR was 4.5 minutes. Patient outcomes were used to measure the relationship between early CPR, early defibrillation, and admission to an ALS facility. Eight out of sixty patients were successfully defibrillated out-of-the hospital, all had ventricular fibrillation as their presenting rhythm. One patient with ventricular tachycardia was successfully cardioverted in the emergency department. This supports the present data available on increasing chances of survival when CPR is administered within four to six minutes from time of collapse (Textbook of Advanced Cardiac Life Support, 1994).

Twenty patients, over five years, had unwitnessed cardiac arrests. All had asystole as their presenting cardiac rhythm. AEDs are not programmed to intervene when asystole is present, CPR is the recommended treatment modality in Whitman County. All unwitnessed cardiac arrests had efforts ceased in the receiving Emergency department. An EMT-D program will have little, if any, effect on improving the survival rate from unwitnessed cardiac arrests (Cummins, et al., 1985).

Despite the complexity of cardiac arrest data, certain minimal data needs to be collected (Cummins, 1991). Many important events occur during a cardiac arrest. Each event has a corresponding time at which it occurs. The events do not always occur in the same order, and every patient will not experience all events. Time intervals determine overall outcomes in cardiac arrest. The time interval from collapse
to initiation of resuscitation is a major determinant of ultimate survival. Research into cardiac arrest and system performance depend on accurate determination of when specific events occurred and the time intervals between these events (Eisenberg, et al., 1990).

Early defibrillation is considered the standard for success when resuscitating patients in ventricular fibrillation. The treatment of defibrillation was obtained from documentation provided by the EMT or first responder completing the medical incident report. Defibrillation was recorded as an individual event with a specific time interval by WSU and Pullman EMS respectively. Twenty-two records were available with documented times for defibrillation. The first shock occurred within six minutes from arrival on scene. A dual channel tape recorder is available on all Whitman County AEDs; it records the date, time and rhythm on one channel and voices of EMS personnel on the other channel. The recorded tapes were utilized for documentation purposes only and recycled.

Early ACLS is currently provided by one ambulance service and two local hospitals. Early ALS was recorded from the actual times documented on the medical incident reports; time from defibrillation to arrival at an ALS facility. The mean response time, in this study, for nine patients who were admitted to an ALS facility was 4.5 minutes, with a range from 1-10 minutes (Figure 3). Advanced life support was not addressed in this study; however it is recognized as an essential component in the chain of survival when attempting to maintain survivability.

Documentation of events were inconsistent throughout the county. WSU and Pullman EMS inputs information through a computer program. Whether the information was available or not, data were documented as such on the report. The remaining EMS systems document their medical incident reports in a variety of ways;
brief descriptions were noted in some communities and others were detailed. Documentation of data were often unavailable throughout the county. This makes it difficult to determine whether a community’s ECC-EMS system results in optimal patient survival; and makes evaluation of Whitman County’s EMS system problematic.

Published survival rates for out-of-the hospital cardiac arrest vary widely among cities and communities. This has occurred in part because of variability in reporting mechanisms and the lack of consistent terminology. Different systems cannot readily be compared or contrasted because data were rarely compatible (Cummins, et al., 1991).

In comparison with the Wisconsin and Nebraska studies, shorter response times were key factors when determining survival rates in Whitman County. Patients who had a witnessed arrest, received early CPR and had ventricular fibrillation as their presenting rhythms were more likely to survive in this study as well. There was a marked difference in the number of cardiac arrests per ambulance rescue service per year, reflecting different population densities among the region. Populations for each community were based on data provided by the 1990 census bureau. The towns of Garfield, Rosalia and St. John have mean populations of 550; Colfax has a mean population of 2,750; and Pullman, home to WSU, has a mean population of 28,000.

Both the Nebraska and Wisconsin studies utilized different methods for calculating survival rates. This study utilized the Utstein style template for calculating data and survival rates. The recommended Utstein template provides cardiac arrest researchers with a uniform format for data reporting. This is important because of past confusion and inconsistencies in reporting statistical survival rates. The template approach facilitated comparisons between communities and reduced confusion
about numerators and denominators used to calculate survival rates. The Utstein templates were used to evaluate cardiac arrests, individually and throughout the county (Appendix D).

Standardization of terminology provides the means to evaluate important trends in emergency cardiac care that are being tested throughout the country. Outcomes in the past were difficult to compare because the terminology was inconsistent. "A successful save or resuscitation may mean return of a pulse for five minutes in one system, admission to the hospital in another, and discharged alive from the hospital in a third. Because of this inconsistency in reporting data, no true standard exists for the survival rate that can (or should) be achieved by communities" (Cummins, et. al., 1991).

This study utilized the Utstein template to establish a uniform and consistent method for comparing data. Nine patients, or 15 percent, were successfully defibrillated out-of-the hospital and admitted to an ALS facility over the past five years. The overall survival rate in Whitman County for cardiac arrest victims over the past five years was 3.3 percent (2/6).
Conclusion

This study attempted to utilize the recommended guidelines for reporting data from cardiac arrests. A retrospective evaluation of sixty cardiac arrest victims, over five years, revealed a 3.3 percent survival rate. Of the nine patients who were admitted to an ALS facility, eight suffered a witnessed arrest, had CPR administered within 4-6 minutes of collapse, and were successfully defibrillated with ventricular fibrillation as the initial rhythm. One patient with ventricular tachycardia was cardioverted in the emergency department prior to admission.

The percentage of patients in ventricular fibrillation (N=17) and the chances of survival are increased when bystander CPR is initiated prior to arrival of the rescue of EMS service. Every community should recognize this advantage and encourage an emphasis on CPR training. Quick response times are essential if defibrillation out-of-the hospital is to be effective. Communities which rely on others for transport need to develop methods for optimizing a quicker transport time. Defibrillation did contribute to the survival of patients with ventricular fibrillation as the presenting rhythm. The literature review indicates that early defibrillation is the most effective treatment for ventricular fibrillation whether the patient is in or out-of-the hospital; and the majority of sudden deaths, caused by cardiac arrest, occur before hospitalization. Individuals, like first responder’s and EMT’s within communities should be trained in the recognition and prompt intervention if the victim is to survive (Weaver, et al., 1988).

A majority of studies indicate there is a greater chance of surviving a cardiac arrest if all components of a well-developed EMS system are in place (Cummins, et. al., 1988, Eisenberg, et. al., 1990, Olson, et. al., 1989). Response times depend upon citizens having rapid access to an efficient dispatch system. Current methods are
weak; every community within the county has addressed this problem. Enhanced 911 services will be available to all communities throughout the county by September of 1996. E-911 provides dispatchers with the caller's address and telephone number. Dispatchers will offer instruction to the caller on how to perform CPR until the EMS responders arrive.

The use of AED's by first responders and EMT's has expanded emergency medical services in many rural communities. E-911 services will be available to all communities throughout Whitman County by September of 1996. This should enhance each community by assisting with early access. Whitman County has expanded its role and services when contributing to the factors that improve one's chance for survival from a cardiac arrest.

Advanced life support was not addressed in this study; however it is recognized that it is an essential component in the chain of survival when attempting to maintain survivability. Future studies should also examine the medical records of patients that were admitted to each ALS facility. This would supply information needed to complete the template and verify an accurate method for calculating the overall survival rate. Finally, a uniform method for documenting data would improve documentation and strengthen future research. A study could be repeated in two to five years after the implementation of E-911, to see if this component contributes to an increase in the overall survival rate. Continued evaluation of Whitman County's EMS system should be an ongoing process; it would enhance the quality of care given to patients and the providers who care for them.

The future of early defibrillation is spreading, stimulated by the new technology of AEDs. QANTAS, the Australian airline, now have defibrillators and personnel trained in rapid defibrillation on every international flight. Australian travel to Europe
takes at least 24 hours and may require, as long as 48 hours. In just over three years, 16 cardiac arrests have occurred with two hospital survivors from ventricular fibrillation (O'Rourke, Ornato, Dracup, Moss, Kerber and Weisfeldt, 1995). In the future we may find AEDs of every airline.

In 1995, the AHA hosted a conference called "Public Access Defibrillation," and made the following statement: "If emergency response time cannot be improved, then defibrillators need to be more readily available. Since survival from cardiac arrest is determined by both bystander CPR and rapid defibrillation, this new extension of defibrillation technology and training into the community is the next logical step in strengthening the chain of survival" (O'Rourke, et. al., 1995).

The future of early defibrillation in Whitman County is only limited by the human and financial resources available within each community. First responders have often been recognized as an important adjunct of the EMS system, as they were usually the first to arrive on scene. Whitman County has recognized this dimension over the past few years and authorizes first-responders to operate the defibrillator.

Community resources are especially limited in towns with populations less than 500; perhaps by increasing response times through E-911, earlier defibrillation by first-responders and EMTs, each community will be able to capitalize on more of their assets. This assessment of prehospital defibrillation should assist in the future planning needs of all communities that wish to purchase a semi-automatic external defibrillator.
Limitations

Potential threats to validity and reliability did occur in this study from the assumption that each patient’s medical record was accurate and complete. Additionally, even though the criteria may be valid, the data may not be reproducible because the sources of information may change over time or may be incomplete. This study was limited by two factors; one documentation appropriate for the study was not recorded on the medical incident report. Second, lost data from incorporated communities were not included. Many incorporated and unincorporated communities were excluded because they rely on other communities for transport. Data regarding the dispatch service within each community were obtained from secondary sources and must be regarded as such.

Another concern that arises is that only one person collected the data. This introduces the possibility of bias, “. . . evaluative research is more likely to be purposive rather than random; therefore the researcher is faced with accounting for possible bias...” (Brink & Wood, 1994. p. 119).

Finally, there is a loss of outcome data. This occurred because medical records were not assessed on all patient’s admitted to an ALS facility. This area needs to be addressed in future research.
REFERENCES
References


APPENDICES
APPENDIX A

I. Prehospital Defibrillation Collection Tool

II. Utstein Style Template
AN ASSESSMENT OF PREHOSPITAL DEFIBRILLATION  
IN WHITMAN COUNTY

Pre-Hospital Defibrillation Collection Tool:

Community: _________________ Year ___ Subject # ________
Age: ___ Gender: ___ male ___ female Time of call: ______ AM: ______ PM:
911 Available__yes__no, if no name of agency receiving call ________________
CPR in progress__yes__no Witnessed arrest? __yes__no
AED available in community? __yes__no. Time of EMT arrival_______________
V-fib presenting rhythm? __yes__no. V-fib __ course __ fine __ other
V-tachycardia > 180 presenting rhythm? __yes__no Pt. conscious __yes__no
Shockable rhythm? __yes__no. Converting rhythm__________.
Number of times shocked__ Re-perfusion arrhythmia __yes__no.
AED for monitoring only? __yes__no No shock indicated? yes__ no__
Oxygen __yes__no. IV or Na. Lock__yes__no. PTL__yes__no
Time to ALS. ______ Hospital admission? __yes__no Facility_______________
Total time transpired from time of call to pt receiving ALS_________________
Patient Survival__yes__no. Neurological intact? __yes__no
More than one EMS service involved? __yes__no.
Transport location __________________. Estimated mileage______.
MD available __yes__no Medications used: __yes__no
Police on scene__yes__no. Time from collapse to CPR______.
Known medical History__yes__no. Diagnosis if known: ________________
D.O.A. __yes__no Cause of death______________________________
Discharge from hospital? __yes__no Pre-arrest status __yes__no
1. Population served by EMS system N=____

2. Confirmed cardiac arrests considered for resuscitation N=____

3. Resuscitations not attempted N=____

4. Resuscitations attempted N=____

5. Cardiac etiology N=____

6. Non-cardiac etiology N=____

7. Arrest witnessed (bystanders) N=____

8. Arrest not witnessed N=____

9. Arrest witnessed (EMS personnel) N=____

10. Initial rhythm VF* N=____

11. Initial rhythm VT* N=____

12. Initial rhythm asystole N=____

13. Other initial rhythms N=____

14. Determine presence of bystander CPR: yes or no for each subset

15. Any Return of Spontaneous Circulation (ROSC) N=____

16. Never achieved ROSC N=____

17. Efforts ceased a. expired in field N=____ or (if transported) b. expired in ED N=____

18. Admitted to ICU/ward N=____

19. Expired in hospital a. total N=____ b. within 24 hrs N=____

20. Discharged alive N=____

21. Expired within one year of discharge. N=____

22. Alive at one year N=____

*VF and VT should be recorded separately through template

Recommended Utstein Style Template for reporting data on cardiac arrest
APPENDIX B

I. Letter to Mike Bishop, W.S.U. / E.M.S.

II. Letter to Pat Wilkins, Pullman / EMS

III. Letter to James Krouse, Colfax / EMS

IV. Letter to Warren Neal, Garfield / EMS

V. Letter to Greg Morasch, St. John / EMS

VI. Letter to Dale Crutcher, Rosalia / EMS

VII. Letter to Robert Cummins, MD

VIII. Letter to Richard Kerber, MD
Mike Bishop  
Washington State University  
Safety Bldg, Wilson Road  
Pullman, Washington 99164

Dear Mr. Bishop:

I am a graduate student in the Master of Nursing program at Washington State University. I am evaluating the Emergency Medical Service system as it presently exists in Whitman County. I am interested in gathering data that supports the utilization of automatic external defibrillators by emergency medical technicians in rural communities.

As you know, survival of an out-of-the hospital cardiac arrest caused by ventricular fibrillation is determined by the amount of time from collapse to definitive care with electrical defibrillation. The American Heart Association has determined that defibrillation is the most effective means for improving the survival rate from ventricular fibrillation.

I would like permission to review the data your department collects whenever a semiautomatic defibrillator is applied to a patient. All information collected will be kept confidential. The information gathered will be used to provide statistical data that will support the concept that survival is dependent on the availability of 911, early CPR, early defibrillation, and early advanced life support.

I plan to call you next week for further discussion and to answer any questions you might have. Thank you for your consideration regarding this matter.

Sincerely,

Dorcy Chenard, R.N., BSN, EMT
January 8, 1996

Pat Wilkins
Pullman Fire Chief & EMS
South 620 Grand Avenue
Pullman, Washington 99163

Dear Mr. Wilkins:

I am a graduate student in the Master of Nursing program at Washington State University. I am evaluating the Emergency Medical Service system as it presently exists in Whitman County. I am interested in gathering data that supports the utilization of automatic external defibrillators by emergency medical technicians in rural communities.

As you know, survival of an out-of-the hospital cardiac arrest caused by ventricular fibrillation is determined by the amount of time from collapse to definitive care with electrical defibrillation. The American Heart Association has determined that defibrillation is the most effective means for improving the survival rate from ventricular fibrillation.

I would like permission to review the data your department collects whenever a semiautomatic defibrillator is applied to a patient. All information collected will be kept confidential. The information gathered will be used to provide statistical data that will support the concept that survival is dependent on the availability of 911, early CPR, early defibrillation, and early advanced life support.

I plan to call you next week for further discussion and to answer any questions you might have. Thank you for your consideration regarding this matter.

Sincerely,

Dorcy Chenard, R.N., BSN, EMT
James Krouse  
Colfax Fire Chief & EMS  
North 400 Mill Street  
Colfax, Washington 99111

Dear Mr. Krouse:  

I am a graduate student in the Master of Nursing program at Washington State University. I am evaluating the Emergency Medical Service system as it presently exists in Whitman County. I am interested in gathering data that supports the utilization of automatic external defibrillators by emergency medical technicians in rural communities.

As you know, survival of an out-of-the hospital cardiac arrest caused by ventricular fibrillation is determined by the amount of time from collapse to definitive care with electrical defibrillation. The American Heart Association has determined that defibrillation is the most effective means for improving the survival rate from ventricular fibrillation.

I would like permission to review the data your department collects whenever a semiautomatic defibrillator is applied to a patient. All information collected will be kept confidential. The information gathered will be used to provide statistical data that will support the concept that survival is dependent on the availability of 911, early CPR, early defibrillation, and early advanced life support.

I plan to call you next week for further discussion and to answer any questions you might have. Thank you for your consideration regarding this matter.

Sincerely,

Dorcy Chenard, R.N., BSN, EMT
January 8, 1996

Warren Neal
Garfield EMS
P.O. Box 374
Garfield, Washington 99130

Dear Mr. Neal:

I am a graduate student in the Master of Nursing program at Washington State University. I am evaluating the Emergency Medical Service system as it presently exists in Whitman County. I am interested in gathering data that supports the utilization of automatic external defibrillators by emergency medical technicians in rural communities.

As you know, survival of an out-of-the hospital cardiac arrest caused by ventricular fibrillation is determined by the amount of time from collapse to definitive care with electrical defibrillation. The American Heart Association has determined that defibrillation is the most effective means for improving the survival rate from ventricular fibrillation.

I would like permission to review the data your department collects whenever a semiautomatic defibrillator is applied to a patient. All information collected will be kept confidential. The information gathered will be used to provide statistical data that will support the concept that survival is dependent on the availability of 911, early CPR, early defibrillation, and early advanced life support.

I plan to call you next week for further discussion and to answer any questions you might have. Thank you for your consideration regarding this matter.

Sincerely,

Dorcy Chenard, R.N., BSN, EMT
Greg Morasch
St. John Volunteer Fire Dept.
Box 221
St. John, Washington 99171

Dear Mr. Morasch:

I am a graduate student in the Master of Nursing program at Washington State University. I am evaluating the Emergency Medical Service system as it presently exists in Whitman County. I am interested in gathering data that supports the utilization of automatic external defibrillators by emergency medical technicians in rural communities.

As you know, survival of an out-of-the hospital cardiac arrest caused by ventricular fibrillation is determined by the amount of time from collapse to definitive care with electrical defibrillation. The American Heart Association has determined that defibrillation is the most effective means for improving the survival rate from ventricular fibrillation.

I would like permission to review the data your department collects whenever a semiautomatic defibrillator is applied to a patient. All information collected will be kept confidential. The information gathered will be used to provide statistical data that will support the concept that survival is dependent on the availability of 911, early CPR, early defibrillation, and early advanced life support.

I plan to call you next week for further discussion and to answer any questions you might have. Thank you for your consideration regarding this matter.

Sincerely,

Dorcy Chenard, R.N., BSN, EMT
January 8, 1996

Dale Crutcher
C/O Rosalia EMS
General Delivery
Rosalia, Washington 99170

Dear Mr. Crutcher:

I am a graduate student in the Master of Nursing program at Washington State University. I am evaluating the Emergency Medical Service system as it presently exists in Whitman County. I am interested in gathering data that supports the utilization of automatic external defibrillators by emergency medical technicians in rural communities.

As you know, survival of an out-of-the hospital cardiac arrest caused by ventricular fibrillation is determined by the amount of time from collapse to definitive care with electrical defibrillation. The American Heart Association has determined that defibrillation is the most effective means for improving the survival rate from ventricular fibrillation.

I would like permission to review the data your department collects whenever a semiautomatic defibrillator is applied to a patient. All information collected will be kept confidential. The information gathered will be used to provide statistical data that will support the concept that survival is dependent on the availability of 911, early CPR, early defibrillation, and early advanced life support.

I plan to call you next week for further discussion and to answer any questions you might have. Thank you for your consideration regarding this matter.

Sincerely,

Dorcy Chenard, R.N., BSN, EMT
May 20, 1995

Richard O. Cummins, MD, MPH
Vice Chair, AHA ECC Committee
University of Washington Medical Center
Seattle, Washington 98195

Dear Dr. Cummins:

I am a graduate student in the Master of Nursing program at Washington State University. I am evaluating the Emergency Medical Service system as it presently exists in Whitman County. I am interested in gathering data that supports the use of automatic external defibrillators by emergency medical technicians in rural communities.

I would like permission to reproduce and use the Utstein-style template recommended for recording data on cardiac arrest. Also, I would like permission to reproduce and use the Definitions and Terminology in Emergency Cardiac Care. These guidelines would add content validity to a retrospective evaluation of prehospital defibrillation throughout Whitman County.

Thank you for your consideration regarding this matter.

Sincerely,

Dorcy Chenard, R.N., BSN, EMT
Dear Dr. Kerber:

I am a graduate student in the Master of Nursing program at Washington State University. I am evaluating the Emergency Medical Service system as it presently exists in Whitman County. I am interested in gathering data that supports the utilization of automatic external defibrillators by emergency medical technicians in rural communities.

I would like to permission to reproduce and use the emergency cardiac care systems concept that is schematically illustrated by the "chain of survival" metaphor. This concept represents the very components that are essential in the Emergency Medical Service System of every community. I would be honored if I could display a copy of this symbol within the context of my thesis.

Thank you for your consideration.

Sincerely,

Dorcy Chenard, R.N., BSN, EMT
APPENDIX C

I. Letter from Dr. Cummins granting permission

II. Letter from Dr. Richard Kerber granting permission
Dear Dr. Cummins:

I am a graduate student in the Master of Nursing program at Washington State University. I am evaluating the Emergency Medical Service system as it presently exists in Whitman County. I am interested in gathering data that supports the use of automatic external defibrillators by emergency medical technicians in rural communities.

I would like permission to reproduce and use the Utstein-style template recommended for recording data on cardiac arrest. Also, I would like permission to reproduce and use the Definitions and Terminology in Emergency Cardiac Care. These guidelines would add content validity to a retrospective evaluation of prehospital defibrillation throughout Whitman County.

Thank you for your consideration regarding this matter.

Sincerely,

Dorcy Chenard, R.N., BSN, EMT

May 20, 1995

Richard O. Cummins, MD, MPH
Vice Chair, AHA ECC Committee
University of Washington Medical Center
Seattle, Washington 98195

June 9, 1995

My permission is granted to use the figures noted above. I would be interested in seeing what you come up with.

Dorcy Chenard, R.N., BSN, EMT
June 9, 1995

Dorcy Chenard, R.N., BSN, EMT
Route 1, Box 218
Palouse, WA 99161

Dear Ms. Chenard:

Your letter requesting permission to reproduce our “chain of survival” illustration has been received.

You do not indicate in your request which “chain of survival” illustration you are referring to. However, the most current “Chain of Survival” illustration is on the cover of the Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiac Care, a copy of which is enclosed.

You may use the links or statements which correspond with each chain but we ask that you develop your own symbols or pictures to go inside each chain and then list us as a source or reference, i.e., Reference: American Heart Association.

We are sorry we could not be of immediate help to you and wish you luck with your thesis.

Sincerely,

[Signature]

Marilyn Allan
Copyright Specialist

Encl.
APPENDIX D

I. Utstein Template for Colfax, Washington
II. Utstein Template for Garfield, Washington
III. Utstein Template for Pullman, Washington
IV. Utstein Template for Rosalia, Washington
V. Utstein Template for St. John, Washington
VI. Utstein Template for Washington State University
VII. Utstein Template for Whitman County
Table 1:

1. Population served by EMS system \( N = 90 \)

2. Confirmed cardiac arrests considered for resuscitation \( N = 14 \)

3. Resuscitations not attempted \( N = \_

4. Resuscitations attempted \( N = 14 \)

5. Cardiac etiology \( N = 14 \)

6. Non-cardiac etiology \( N = \_

7. Arrest witnessed (bystanders) \( N = 8 \)

8. Arrest not witnessed \( N = 6 \)

9. Arrest witnessed (EMS personnel) \( N = \_

10. Initial rhythm \( VF^* N = 2 \)

11. Initial rhythm \( VT^* N = \_

12. Initial rhythm asystole \( N = 11 \)

13. Other initial rhythms \( N = 1 \)

14. Determine presence of bystander CPR: yes or no for each subset

15. Any Return of Spontaneous Circulation (ROSC) \( N = \_

16. Never achieved ROSC \( N = 14 \)

17. Efforts ceased
   a. expired in field \( N = \_
   b. expired in ED \( N = 14 \)

18. Admitted to ICU/ward \( N = \_

19. Expired in hospital
   a. total \( N = \_
   b. within 24 hrs \( N = \_

20. Discharged alive \( N = \_

21. Expired within one year of discharge, \( N = \_

22. Alive at one year \( N = \_

*VF and VT should be recorded separately through template

Recommended Utstein Style Template for reporting data on cardiac arrest
Table 2:

1. Population served by EMS system \( N = 16 \)

2. Confirmed cardiac arrests considered for resuscitation \( N = 3 \)

3. Resuscitations not attempted \( N = \) __

4. Resuscitations attempted \( N = 3 \)

5. Cardiac etiology \( N = 3 \)

6. Non-cardiac etiology \( N = \) __

7. Arrest witnessed (bystanders) \( N = 3 \)

8. Arrest not witnessed \( N = \) __

9. Arrest witnessed (EMS personnel) \( N = \) __

10. Initial rhythm VF* \( N = 1 \)

11. Initial rhythm VT* \( N = \) __

12. Initial rhythm asystole \( N = 2 \)

13. Other initial rhythms \( N = \) __

14. Determine presence of bystander CPR: yes or no for each subset

15. Any Return of Spontaneous Circulation (ROSC) \( N = 1 \)

16. Never achieved ROSC \( N = 2 \)

17. Efforts ceased
   a. expired in field \( N = \) __
   b. expired in ED \( N = 2 \)

18. Admitted to ICU/ward \( N = \) __

19. Expired in hospital
   a. total \( N = \) __
   b. within 24 hrs \( N = \) __

20. Discharged alive \( N = \) __

21. Expired within one year of discharge. \( N = \) __

22. Alive at one year \( N = \) __

*VF and VT should be recorded separately through template

Recommended Utstein Style Template for reporting data on cardiac arrest
Table 3:

1. Population served by EMS system \( N = 167 \)

2. Confirmed cardiac arrests considered for resuscitation \( N = 30 \)

3. Resuscitations not attempted \( N = \) __

4. Resuscitations attempted \( N = 30 \)

5. Cardiac etiology \( N = 30 \)

6. Non-cardiac etiology \( N = \) __

7. Arrest witnessed (bystanders) \( N = 20 \)

8. Arrest not witnessed \( N = 10 \)

9. Arrest witnessed (EMS personnel) \( N = \) __

10. Initial rhythm: VF \( N = 11 \)

11. Initial rhythm: VT \( N = \) __

12. Initial rhythm: asystole \( N = 15 \)

13. Other initial rhythms \( N = 4 \)

14. Determine presence of bystander CPR: yes or no for each subset

15. Any Return of Spontaneous Circulation (ROSC) \( N = 2 \)

16. Never achieved ROSC \( N = 28 \)

17. Efforts ceased
   a. expired in field \( N = \) __
   b. expired in ED \( N = 28 \)

18. Admitted to ICU/ward \( N = 2 \)

19. Expired in hospital
   a. total \( N = \) __
   b. within 24 hrs \( N = \) __

20. Discharged alive \( N = \) __

21. Expired within one year of discharge \( N = \) __

22. Alive at one year \( N = \) __

*VF and VT should be recorded separately through template

Recommended Utstein Style Template for reporting data on cardiac arrest
Table 4:

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Population served by EMS system N=45</td>
</tr>
<tr>
<td>2.</td>
<td>Confirmed cardiac arrests considered for resuscitation N=6</td>
</tr>
<tr>
<td>3.</td>
<td>Resuscitations not attempted N=</td>
</tr>
<tr>
<td>4.</td>
<td>Resuscitations attempted N=6</td>
</tr>
<tr>
<td>5.</td>
<td>Cardiac etiology N=6</td>
</tr>
<tr>
<td>6.</td>
<td>Non-cardiac etiology N=</td>
</tr>
<tr>
<td>7.</td>
<td>Arrest witnessed (bystanders) N=4</td>
</tr>
<tr>
<td>8.</td>
<td>Arrest not witnessed N=1</td>
</tr>
<tr>
<td>9.</td>
<td>Arrest witnessed (EMS personnel) N=</td>
</tr>
<tr>
<td>10.</td>
<td>Initial rhythm VF N=4</td>
</tr>
<tr>
<td>11.</td>
<td>Initial rhythm VT N=</td>
</tr>
<tr>
<td>12.</td>
<td>Initial rhythm asystole N=2</td>
</tr>
<tr>
<td>13.</td>
<td>Other initial rhythms N=0</td>
</tr>
<tr>
<td>14.</td>
<td>Determine presence of bystander CPR; yes or no for each subset</td>
</tr>
<tr>
<td>15.</td>
<td>Any Return of Spontaneous Circulation (ROSC) N=4</td>
</tr>
<tr>
<td>16.</td>
<td>Never achieved ROSC N=2</td>
</tr>
<tr>
<td>17.</td>
<td>Efforts ceased</td>
</tr>
<tr>
<td>18.</td>
<td>Admitted to ICU/ward N=2</td>
</tr>
<tr>
<td>19.</td>
<td>Expired in hospital</td>
</tr>
<tr>
<td>20.</td>
<td>Discharged alive N=1</td>
</tr>
<tr>
<td>21.</td>
<td>Expired within one year of discharge. N=</td>
</tr>
<tr>
<td>22.</td>
<td>Alive at one year N=1</td>
</tr>
</tbody>
</table>

*VF and VT should be recorded separately through template
Recommended Utstein Style Template for reporting data on cardiac arrest
ST. JOHN

Table 5:

1. Population served by EMS system \( N = 7 \)

2. Confirmed cardiac arrests considered for resuscitation \( N = 2 \)

3. Resuscitations not attempted \( N = \)____

4. Resuscitations attempted \( N = 2 \)

5. Cardiac etiology \( N = 2 \)

6. Non-cardiac etiology \( N = \)____

7. Arrest witnessed (bystanders) \( N = 2 \)

8. Arrest not witnessed \( N = \)____

9. Arrest witnessed (EMS personnel) \( N = \)____

10. Initial rhythm asystole \( N = \)____

11. Initial rhythm VF* \( N = \)____

12. Initial rhythm VT* \( N = \)____

13. Other initial rhythms \( N = \)____

14. Determine presence of bystander CPR: yes or no for each subset

15. Any Return of Spontaneous Circulation (ROSC) \( N = \)____

16. Never achieved ROSC \( N = 2 \)

17. Efforts ceased
   a. expired in field \( N = \)____
   b. expired in ED \( N = 2 \)

18. Admitted to ICU/ward \( N = \)____

19. Expired in hospital
   a. total \( N = \)____
   b. within 24 hrs \( N = \)____

20. Discharged alive \( N = \)____

21. Expired within one year of discharge. \( N = \)____

22. Alive at one year \( N = \)____

*VF and VT should be recorded separately through template

Recommended Utstein Style Template for reporting data on cardiac arrest
Table 6:

1. Population served by EMS system \( N = 26 \)

2. Confirmed cardiac arrests considered for resuscitation \( N = 5 \)

3. Resuscitations not attempted \( N = \) __

4. Resuscitations attempted \( N = 5 \)

5. Cardiac etiology \( N = 5 \)

6. Non-cardiac etiology \( N = \) __

7. Arrest witnessed (bystanders) \( N = 5 \)

8. Arrest not witnessed \( N = \) __

9. Arrest witnessed (EMS personnel) \( N = \) __

10. Initial rhythm \( VF^* N = 3 \)

11. Initial rhythm \( VT^* N = 1 \)

12. Initial rhythm asystole \( N = 2 \)

13. Other initial rhythms \( N = \) __

14. Determine presence of bystander CPR: yes or no for each subset

15. Any Return of Spontaneous Circulation (ROSC) \( N = 4 \)

16. Never achieved ROSC \( N = 2 \)

17. Efforts ceased
   a. expired in field \( N = \) __ or if transported
   b. expired in ED \( N = \) __

18. Admitted to ICU/ward \( N = 4 \)

19. Expired in hospital
   a. total \( N = \) __
   b. within 24 hrs \( N = \) __

20. Discharged alive \( N = \) __

21. Expired within one year of discharge. \( N = \) __

22. Alive at one year \( N = \) __

*VF and VT should be recorded separately through template

Recommended Utstein Style Template for reporting data on cardiac arrest
WHITMAN COUNTY

Table 7:

1. Population served by EMS system \( N = 351 \)

2. Confirmed cardiac arrests considered for resuscitation \( N = 60 \)

3. Resuscitations not attempted \( N = \_\_\_ \)

4. Resuscitations attempted \( N = 60 \)

5. Cardiac etiology \( N = 60 \)

6. Non-cardiac etiology \( N = \_\_\_ \)

7. Arrest witnessed (bystanders) \( N = 42 \)

8. Arrest not witnessed \( N = 17 \)

9. Arrest witnessed (EMS personnel) \( N = \_\_\_ \)

10. Initial rhythm VF* \( N = 22 \)

11. Initial rhythm VT* \( N = \_\_\_ \)

12. Initial rhythm asystole \( N = 32 \)

13. Other initial rhythms \( N = \_\_\_ \)

14. Determine presence of bystander CPR: yes or no for each subset

15. Any Return of Spontaneous Circulation (ROSC) \( N = 9 \)

16. Never achieved ROSC \( N = 51 \)

17. Efforts ceased
   a. expired in field \( N = \_\_\_ \)
   b. expired in ED \( N = \_\_\_ \)

18. Admitted to ICU/ward \( N = \_\_\_ \)

19. Expired in hospital
   a. total \( N = \_\_\_ \)
   b. within 24 hrs \( N = \_\_\_ \)

20. Discharged alive \( N = \_\_\_ \)

21. Expired within one year of discharge. \( N = \_\_\_ \)

22. Alive at one year \( N = \_\_\_ \)

*VF and VT should be recorded separately through template

Recommended Utstein Style Template for reporting data on cardiac arrest