ABSTRACT

There was minimum distribution of cardiac defibrillation equipment in the primary response area of the Channahon Fire Protection District. The problem was that the Channahon Fire Protection District did not have an early automatic external defibrillation (AED) program.

The purpose of this applied research project was to determine whether or not it is feasible for the Channahon Fire Protection District to implement an early defibrillation program for its jurisdiction. A descriptive research methodology was used to answer the following research questions, while action research methodology was used to develop the framework for implementing an early defibrillation program:

1. Can the Channahon Fire Protection District impact the survival rate of heart attack victims through an early automatic external defibrillation program?
2. How can the Channahon Fire Protection District financially support an early automatic external defibrillation program?
3. How can the Channahon Fire Protection District make the public aware of the need for an early automatic external defibrillation program?
4. What can the Channahon Fire Protection District do to educate the public first responders on the proper use of automatic external defibrillators?

The principal procedures utilized to complete the research project were a review of the fire service literature contained in magazine articles, fire service journals, and resources of the United States Fire Administration. Also referenced was literature available through the American Medical Association.

The major results of this research were that successful early defibrillation programs involved delivery strategies that focused on rapid intervention as time was the major component
to quality in an automatic external defibrillator program (Browett, 1998). Experts believed that more than three hundred lives a day could be saved if the maximum time to defibrillation were in the five to seven minute range (Newman, 1997). Survival rates for out-of-hospital cardiac arrest are as low as 1.4% (Olson, Fontanarosa, 1999) with current intervention techniques. Other factors that might influence the placement of AED’s included call volume, response-area demography and the distribution of advanced cardiac life support (ACLS) and basic life support (BLS) response times (Becker, Mandell, 1991).

The recommendations resulting from this research included the Channahon Fire Protection District developing a comprehensive plan and framework for implementing an early defibrillation program, specific to its resources and particular needs. These recommendations are based upon results of the research.
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INTRODUCTION

The problem is that the Channahon Fire Protection District does not have an early automatic external defibrillation program. The purpose of this applied research project is to determine whether or not it is feasible for the Channahon Fire Protection District to implement an early automatic external defibrillation program for its jurisdiction. A descriptive research methodology was used to answer the following research questions:

1. Can the Channahon Fire Protection District impact the survival rate of heart attack victims through an early automatic external defibrillation program?

2. How can the Channahon Fire Protection District financially support an early defibrillation program?

3. How can the Channahon Fire Protection District make the public aware of the need for an early automatic external defibrillation program?

4. What can the Channahon Fire Protection District do to educate the public first responders on the proper use of the automatic external defibrillators?

BACKGROUND AND SIGNIFICANCE

Prior to 1947, successful electrical cardiac defibrillation was unknown (Brown, Kellermann, 2000). Today, immediate defibrillation is considered the standard of care for the treatment of ventricular fibrillation and should be undertaken before initiation of other ALS procedures (Brown, Kellermann, 2000). Each year more than 250,000 people die in the United States from coronary artery disease before they reach a hospital (Eisenberg, 2000). Studies show that defibrillation immediately after witnessed ventricular fibrillation results in survival rates
greater than 90%. Each minute that ventricular defibrillation is delayed leads to an almost 10% reduction in survival rates. Unfortunately, survival rates for patients defibrillated after 10 minutes plunge to between 10-20% (Marenco, et al, 2001).

In 1991 the American Heart Association (AHA) described the “chain of survival” that directly impacts a patient’s chances of surviving an out-of-hospital cardiac arrest. This “chain” has 4 links: (1) rapid access to emergency medical services (EMS) through a 9-1-1 telephone system, (2) early cardiopulmonary resuscitation (CPR) by bystanders and first responders, (3) early defibrillation with automated external defibrillators, and (4) early ACLS (intubation and intravenous medications) provided by paramedics, physicians, or nurses at the scene (Stiell, et al, 1999). The AHA Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care currently recommends public access defibrillation (PAD) programs in areas where counter shock or defibrillation cannot be reliably achieved in less than 5 minutes (Marenco, et al, 2001). Patients who have cardiac arrests in public have higher rates of survival of ventricular fibrillation than those with arrests at home. This increased survival may be attributed in part to higher rates of bystander interventions, such as CPR (Becker, et al, 2001). A study concerning the in-flight use of AED’s suggests initial AED training be 3 hours with annual refresher training of 1.5 hours (Rayman, 1998).

Current technology has provided a rather easy-to-use AED that does not require a substantial investment in training or prior knowledge. The original estimated time to train a rescuer to use an AED safely was 4 hours. The actual time required to achieve proficiency may be as little as 1 hour (Brown, Kellermann, 2000). This suggests little impact to most budgets relative to in-service training requirements. Another report suggested that sixth-grade children could safely operate an AED with essentially no training and a group of seniors aged 65 or older
successfully operated an AED safely and quickly in a simulated cardiac arrest situation after viewing a self-instructional 10-minute training video (Eisenberg, 2000). The importance of staged periodic simulated cardiac arrest, especially in low volume areas is an important component of refresher training as well (Hardy, 1989).

The 40 square miles that encompasses the jurisdiction of the Channahon Fire Protection District has a variety of terrain and population density. Primary medical services are provided by two, fulltime ACLS paramedics on a daily basis. The jurisdiction is also shared by four different law enforcement agencies that include the State, County and two municipal police agencies. Response times are a critical element in the chain of survival and by placing AED’s with local law enforcement may be one way to provide an appropriately timely response to cardiac arrest within our jurisdiction. Consideration will also be given to placing AED’s on fire engine companies and selected locations within the jurisdiction.

The significance of this study is threefold. For the first time information that is easily understandable will be provided. The study will also assist the Channahon Fire Protection District Board of Trustees during their deliberations, as they consider an investment in rapid intervention of cardiac arrest through the implementation of an AED program. This study can also serve as a model for future deliberations by other jurisdictions considering the implementation of an AED program.

This research project was completed based upon the requirements of the Executive Planning course in the Executive Fire Officer Program of the National Fire Academy. The problem addressed was based upon class discussions and text examples presented in Module 1, Project Leadership Responsibilities, in the curriculum. In this section the discussion suggested that once there is commitment to a project, the leadership would evolve into team coaching
rather than directly supervising individuals for successful project results. It was also recognized that people achieve results and the careful selection of those people can lead to successful project results. Success is attributed to selecting leaders with strong people skill abilities, and providing training to the team leaders when they are selected. Selecting the appropriate leaders for implementation and oversight of this proposed program will be critical to its success.

**LITERATURE REVIEW**

The first successful electrical defibrillation was documented and described in 1947, when Claude Beck used open-chest massage and alternating current internal defibrillation to resuscitate a 14-year-old boy whose heart was in ventricular fibrillation. “Rapid defibrillation is now considered the standard of care for treatment of ventricular fibrillation” (Brown, Kellermann, 2000). Of the more than 500,000 deaths per year attributed to heart disease and sudden cardiac arrest, upwards of 60% die within the first hour. Unfortunately for about half of these patients with heart disease, sudden death is the first indication they have of their disease (Forte, 1989). Survival rates for out-of-hospital sudden cardiac arrest are as low as 1.4% (Olson, Fontanarosa, 1999). Some experts believe that more than three hundred lives a day could be saved if the maximum time to defibrillation were in the five-to-seven minute range (Newman, 1997). In a study by Stults, et al, results suggest the maximum time to initial defibrillation should be no more than six minutes (Forte, 1989). The inherent time delays associated with delivery of EMS with the resulting delays to onset of CPR and defibrillation preclude a significant impact on sudden cardiac arrest mortality (Eisenberg, 2000). Response times by EMS may be slowed as well because of elevators, traffic, or other inhibitors and can be from 15 to 20 minutes (Weigel, 1987). Any defibrillation protocols must include frequent patient reassessment by the EMS responder as well as underscore the vital importance of rapid treatment
of patients in ventricular fibrillation (Bocka, Swor, 1991). Research revolving around cardiac resuscitation has been slow and deliberate for the almost 40 years since cardiopulmonary resuscitation was described. Despite other investigations into various other therapies during this time, CPR and defibrillation are the only interventions that have been “convincingly demonstrated” to improve the long-term survival chances for sudden cardiac arrest patients (Olson, Fontanarosa, 1999). Dissemination of AED’s is currently the “only practical means to ensure rapid defibrillation” (Eisenberg, 2000). The “chain-of-survival” as described by the AHA in 1991 includes four links, of which, rapid defibrillation is the most important single factor in determining survival of the patient in sudden cardiac arrest or ventricular fibrillation (Santin, 1994). This “chain” has three other links that include rapid access to EMS through a 9-1-1 telephone system, early CPR by bystanders and/or first responders, and early ACLS (intubation and intravenous medications) provided by paramedics, physicians, or nurses at the scene (Stiell, et al, 1999). A key to success is to take an integrated systems approach that strengthens every link in the chain-of-survival. This system should include support and commitment from the EMS community and the public, involvement of medical directors and other EMS personnel in the planning process, development of medical control strategies, flawless initial AED training, followed by appropriate periodic refresher training and application of a careful program design with total systems commitment (Hardy, 1989).

By the early 1970’s, the concept of early defibrillation intervention in sudden cardiac arrest was beginning to take hold. Additionally, rapid defibrillation was shown to have a correlation to a higher level of neurologic function and quality of life in those patients who survived (Forte, 1989). A number of studies ensued and one subsequent study showed that only 6% of sudden cardiac arrests managed by BLS medics survived to hospital discharge, while 22%
managed by ACLS paramedics survived to discharge. Time to initial defibrillation was cited as a critical component in these outcomes (Forte, 1989).

Florida has taken a lead in promoting the PAD movement. A bill was presented to the governor for signature that would legalize the ownership and use of AED’s by trained laypersons (Ostrow, 1997). The priorities must be clear and people should “recognize that early defibrillation with AED’s is an area of patient care worth the investment—even if, in some cases, this means choosing to delay the purchase of another piece of equipment” (White, 1995).

There are many components that will impact decisions concerning the implementation of a Public Access to Defibrillation (PAD) program or similar effort to establish an early AED intervention program. These components include the financial viability of a project of this nature and that will clearly impact the potential scope of the program. In fact, U.S. Senate Bill 1275 was passed out of committee on August 1, 2001. This bill would provide $50 million for communities to establish PAD programs (Gong, 2001). California, Maine, and Maryland already have instituted varying levels of PAD programs (Newman, 1997). In addition to start up costs, the financial burden of maintenance, replacement batteries, data acquisition and transfer system, electrodes, initial training, and continuing refresher courses must also be factored in (Clinchy, 1993). It is clear that laypersons that may be trained to use AED’s may go months or years without witnessing an arrest or operating and AED. The AED operation therefore, needs to be intuitive for timely delivery of the intervention (Marenco, et al, 2001).

Educating the public as well as other public safety officials such as police and firefighters is another program implementation consideration. Police department-based first responder defibrillation programs continue to expand. In Rochester, Minnesota survival rates for sudden cardiac arrest have increased to 58% soon after program implementation (Newman, 1997). To
help save lives in St. Louis, it became obvious that they needed to involve everyone in the community to make the program successful (Pratt, 1999). Involvement of decision makers at all levels as well as the general public will make a significant impact on survival of the patient in sudden cardiac arrest. By providing rapid defibrillation hospital survival can improve by preventing the adverse effects of prolonged cessation of circulation that contribute to mortality after initial resuscitation (Groeneveld, et al, 2001).

The decision of determining optimal device deployment locations and identifying AED training candidates will be a significant challenge for any PAD (Groeneveld, et al, 2001). The fiscal impact of an AED saturated community might exceed the financial resources of a jurisdiction, so consideration of AED assignments become necessary. Some factors to consider include EMS call volume, EMS response-area demography, and the distribution of BLS and ACLS response times (Becker, Mandell, 1991).

Balanced against the context of duty, businesses that may consider placing an AED on their premise must contemplate whether a legal obligation to render medical aid to patrons exists (Lazar, 1997). Absent their commitment to the value of a PAD, the possibility of placing an AED on their premise rapidly diminishes. The risk of improper use of an AED is clearly diminished when contrast against the clear advantages. “Dead people do not get ‘deader’, they just stay dead” (Browett, 1998). Time is such a major component in a quality AED PAD program that the only way to reduce time is to have more AED’s out there, closer to the patient, with someone available to use it (Browett, 1998). One study suggests that little may be gained however, if public access defibrillation programs siphon off vital resources from aspects of EMS that might benefit a wider range of patients (Brown, Kellermann, 2000). Some business sectors, including common carriers such as airlines, passenger rail lines, cruise ships, as well as
innkeepers and some commercial business establishments may be compelled by law to render a minimum level of first aid care and to timely summon outside emergency medical assistance (Lazar, 1997). Another seemingly logical location for AED’s would be a physician’s practice that sees older adults or patients with recognized heart disease. However, it appears that there are too few sudden cardiac arrests in these locations, dentists’ offices, and other medical specialties to justify the routine placement of AED’s there (Becker, et al, 2001).

In the hope of improving passenger survival, some airlines have installed AED’s on aircraft since the early 1990’s (Groeneveld, et al, 2001). Though no regulations currently require airlines to carry AED’s (Rayman, 1998), as early as 1986, British Caledonian Airlines installed 14 AED’s on their wide-body international flights. They have trained approximately 120 senior flight attendants in a two-week training course (Mink, 1987). With predictions that the number of U.S. airline passengers will increase from 500 million to over 800 million to the end of this decade, assessing the need for in-flight medical care becomes more important. Developing and implementing rational recommendations for aircraft medical equipment is confusing, because of the lack of a database that documents the frequency, type and outcomes of in-flight medical events (Rayman, 1998). In August of 1997, the Aerospace Medical Association (AsMA) convened a task force to develop the suggested contents of an in-flight emergency medical kit (EMK). Beyond the suggested medications and other components, the AsMA also recommended that AED’s be carried on long haul, over-water routes. It felt that a broader recommendation couldn’t be made until more information on the in-flight need for AED’s and their effectiveness becomes available (Rayman, 1998).
PROCEDURES

Definition of terms

ACLS. Advanced cardiac life support. Generally refers to a higher level of EMS field care that includes drug therapy intervention, advanced airway management techniques and advanced electrocardiograph interpretation skills. Usually provide by emergency medical technicians-paramedic (EMT-P’s).

AED. Automatic external defibrillator.

AHA. American Heart Association.

BLS. Basic life support. A lower standard of skills than ACLS emergency medical services. Usually provided by emergency medical technicians-basic (EMT-B’s).

Cardiac arrest. A condition in which the heart has stopped or beats so inefficiently that it cannot sustain life.

CPR. Cardiopulmonary resuscitation. A technique that combines rescue breathing and chest compressions, generally on a cardiac arrest victim or other pulseless, non-breathing victim.

Defibrillation. The process of passing a direct current electrical charge through the heart in order to bring pulseless ventricular tachycardia or ventricular fibrillation to an end and return the heart to a more normal rhythm.

EMS. Emergency medical service systems. A network of community resources and medical personnel that provides emergency care to victims of injury and sudden illness. An adjunct service provided by many fire departments within their current scope of mission. Level of care provided within an EMS service may be EMT-B or EMT-P.
**PAD.** Public access defibrillation program. A program that supports the placement of AED’s in a variety of public venues including bowling alleys, golf courses, hotel, airports, casinos and shopping malls.

**Ventricular fibrillation.** Rapid discharges of many electrical foci in the heart, resulting in a trembling of the heart muscle, ineffective contractions and no cardiac output. Also considered cardiac arrest. Failure to restore effective pumping of the heart will result in the death of the victim.

**Assumptions and limitations**

The limitations of this research project primarily involve financial restraints and additionally, the willingness of the decision-makers to make strategic judgements for the planning to go forward. A variety of decision-makers in a number of various political subdivisions need to be a part of the planning stages, which requires their support of the program concepts. The time to develop the components of the early automatic external defibrillator program, select the person(s) responsible for pursuing the implementation, and then evaluating the subsequent steps to take is a limitation. Another significant limitation is the fact that the best way to reduce deaths from heart disease is through prevention, not action with an AED after a sudden cardiac arrest. Given choices between spending upwards of $3000 to purchase an AED for the home or spending a comparable amount of money on a bicycle, a smoking cessation program, a health club membership, or treatment of hypertension, most people might be better served by choosing one of the latter options.

Another limitation is understanding the importance of CPR by bystanders or first responding fire or police officers. Providing a broad based, trained cadre of the general public is a valuable component as well.
A necessary assumption in this study includes having a qualified person available and willing to take on the responsibility of plan development and implementation. This also assumes this person has the ability and authority to monitor and alter the plan as appropriate to achieve the desired objectives originally developed. This would probably best be done by a select but limited committee, comprised of potential public safety partners.

The successes of early AED intervention programs have not taken into consideration or adjusted for differences in the severity of the victims’ underlying cardiac disease, concurrent medical problems or behavioral risk factors. This also is a limitation in determining program effectiveness.

**Research methodology**

The research methodology used for this research paper was descriptive research. The information gathered through the literature reviews of the historical research was used as a basis for considering the implementation of an early automatic external defibrillator program. This was the application to the reality of the difficulties involved when considering a new program of this nature. The comparison of the developed plan to programs and efforts of other jurisdictions was compiled. The success of components of their efforts was reviewed and recommendations were made.

Additionally, questionnaires based upon the checklist in the appendix were distributed to potential partners in Will County, Illinois. Informal discussions were also held with members of the agencies that touched on many aspects of the checklist. Though the checklist questionnaire was sent to all of the potential AED partners, this number may still be inadequate to draw valid conclusions and to insure validity.
A majority of respondents had already anticipated pursuing an AED program in the future strategic goals of their organization. The majority of respondents also anticipated the expense of this adjustment to their mission. This provides an opportunity to save costs associated with these adjustments, by moving toward a consolidated purchase before an AED program is implemented.

RESULTS

The results of the checklist questionnaires are inadequate to insure their validity, based on the number that was distributed. However, those returned questionnaires had similar responses to many of the significant checklist items, indicating a commonality of concerns and focus. This was also the case in the informal discussions that were held. The members of those agencies involved in the informal discussions echoed the opinions of the written, questionnaire checklist respondents. Though by virtue of the limited responses some conclusions can be drawn, further interviews must be made to achieve an adequate sampling of data.

Other results indicate that the success of early defibrillation programs are dependent upon the rapid response of bystanders and first responders, early recognition of sudden cardiac arrest and early intervention of ventricular fibrillation with defibrillation. Our jurisdiction is generally able to provide an appropriately rapid response, once the EMS system is activated, which is one of the links in the “chain-of-survival.” Local police agencies are willing to participate in this program and are anticipated to reduce the response times of first responders. The Channahon Fire Protection District intends to broaden its offering of CPR training in the community as well.

Research question 1. Results indicate that there are a number of successful strategies to be employed when considering how the Channahon Fire Protection District can impact the survival rate of victims of sudden cardiac arrest through the implementation of an early
defibrillation program in its jurisdiction. Using other jurisdiction’s results from early AED intervention programs, the CFPD will be able make informed decisions in how to best measure the impact of implementing an early AED program. Identifying the number of victims of sudden cardiac arrest within our primary EMS response area over the past decade will provide raw numbers of our actual exposure experience to this type of patient. From those figures, we can draw conclusions of our potential response times, based upon the geographical distance from our fire station, and estimate the number of patients who we would have reached within the recommended time frames. Based upon computer-aided dispatch reports we can extrapolate the amount of time that would have been saved, had the local law enforcement agency responded concurrently with our fire-based EMS. These figures would then provide an approximate number of theoretically “savable” victims under an early AED intervention program.

Research question 2. The Channahon Fire Protection District can financially support an early defibrillation program through numerous strategies. The first strategy moves forward on the basis of local, budgeted funding supporting program implementation and all associated costs. These funds are taken from the local Fire/EMS budget. The second strategy involves a partnered approach that would provide funds from both the Channahon Fire Protection District budget and the local business community. The third strategy would provide the early AED intervention program funding totally through contributions from both the business community and the residential population at large. The fourth strategy would base the funding upon available grants from the private sector as well as the public sector.

Research question 3. The Channahon Fire Protection District can make the public aware of the need for an early defibrillation program through a number of avenues. The program can be included in the regular routine of public encounters at the various service clubs and church
organizations. The program benefits can be explained during open, public forums held to educate the public, specifically regarding the advantages of an early AED intervention program. The local newspapers and cable television systems can be utilized as well.

**Research question 4.** The Channahon Fire Protection District can educate and train public first responders on the proper use of automatic external defibrillators through a comprehensive program of training. Including an appropriate AED training model of the selected field AED will provide hands-on exposure to an actual device. Following the guidelines of the manufacturer as well as the directives of the project’s medical director will provide further guidance to the instructors and students. Scheduling the training during regular work hours for the students will ease the burden on them and the employers. These strategies will provide a strong foundation that will help insure a successful program from the implementation perspective.

**DISCUSSION**

The review of trade journals, magazine articles, and specific publications revealed that successfully evaluating the feasibility of implementing an early automatic defibrillation program for the Channahon Fire Protection District will be a complex task.

The first consideration is selecting the appropriate individual or committee to be the coordinator or overseer of the process. This person will need the support of the local politicians as well as the local chiefs of the police, fire, and EMS agencies. This program coordinator should have a level of authority that would allow an appropriate amount of autonomy in the decision making process.

There are numerous problems associated with the implementation of an early AED intervention program. The first step is to understand the catalyst for considering this program.
This catalyst should be that there are studies showing that defibrillation immediately after witnessed ventricular fibrillation (sudden cardiac arrest) results in survival rates that are greater than 90% (Marenco, et al, 2001). Other reported survival results for sudden cardiac arrest are in the range of 1%-20%, with the variation attributed partly to community differences in the “chain-of-survival” as described by the AHA. This “chain” as described, has four links; rapid access to the EMS system through a 9-1-1 telephone system, early cardiopulmonary resuscitation by bystanders and first responders, early defibrillation intervention with automatic external defibrillators and early advanced cardiac life support (intubation and intravenous medications) provided by paramedics, nurses, or physicians at the scene (Stiell, et al, 1999). A study of out-of-hospital sudden cardiac arrests in Ontario, Canada indicated that there was only a 2.5% survival rate (Stiell, 1999). The inherent time delays associated with delivery of EMS and the resultant delays to onset of CPR and rapid intervention of defibrillation preclude a significant impact on sudden cardiac arrest mortality (Eisenberg, 2000).

The advantage of sudden cardiac arrest is that most of these episodes are associated with ventricular fibrillation, which is the heart arrhythmia most likely to be successfully treated by rapid defibrillation (Eisenberg, 2000). The key is to be able to provide this rapid intervention of defibrillation. Another study showed that 6% of sudden cardiac arrests survived to discharge as compared to 22% of another group who survived to discharge. Time to initial defibrillation intervention was cited as a critical factor in the survival rates of those patients ((Forte, 1989). Its clear that the ability to deliver a rapid intervention in the cases of sudden cardiac arrest is a critical link in the chain-of-survival and should be longer than six minutes from onset of ventricular fibrillation (Forte, 1989). This requires a rapid delivery of ACLS or an equally rapid delivery of trained bystanders or other first responders. Bystanders will play a part in any public
access to defibrillation program, but will be dependent on the appropriate dissemination of AED’s (Eisenberg, 2000). Many states are already participating or anticipating PAD programs in their jurisdictions (Newman, 1997). Other public first responders, such as police officers or firefighters may also provide the required rapid intervention. AED’s can be used by people of all levels of medical training and should be utilized by firefighters, who are close to their communities through the many lifesaving roles they already serve in (Pratt, 1999). The International Association of Fire Chiefs also recognized the critical importance of including firefighting forces in AED PAD programs. They endorsed the proposal that every fire suppression unit in the United States have an AED as part of its carried equipment (Santin, 1994). However, equipping every BLS fire company with an AED would probably exceed the financial resources of most jurisdictions (Becker, Mandell, 1991).

With the costs associated with massive distribution of AED’s being an obvious implication to program success, the decision of appropriate allocation must be made. Factors such as the call volume in the area, demographics of the response area and distribution of ACLS and BLS units may also be taken into account (Becker, Mandell, 1991).

The distribution of AED’s in police patrol vehicles is another avenue to consider when distribution is weighed. This concept promotes the expended role of police officers, though minimally medically trained, can provide the necessary rapid intervention in the event of sudden cardiac arrest (Marenco, et al, 2001). Providing police officers with AED’s in Rochester, Minnesota and Pittsburgh, Pennsylvania has produced a higher rate of survival in sudden cardiac arrest when compared with other historical controls (Brown, Kellermann, 2000).

The researcher believes that a careful review of existing services provided to the citizens of the Channahon Fire Protection District must be conducted. There is only one ACLS equipped
ambulance manned during any 24-hour period within the jurisdiction of almost 40 square miles. This statistic alone presents an obvious case of inequitable disbursement of resources due to the financial limitations imposed upon the fire district.

The checklist in the appendix for the consideration of implementing an early intervention program with automatic external defibrillators is the first of its kind in the jurisdiction. It is composed of the issues that should be considered during preparation of a PAD AED plan. From this checklist an overall strategy will emerge and assist the Channahon Fire Protection District in achieving the goals and objectives established through review of the it’s needs. These checklist guidelines are a compilation of recommendations based on the information gathered in this research. It is clear that to move forward without a plan for considering an AED program is a plan for failure. The provided checklist will generate an outline to a solid, reliable, working plan for many PAD AED program strategies.

It is clear to the researcher that by following the checklist in the appendix, the Channahon Fire Protection District should consider the implementation of an early intervention with automatic external defibrillators program. Having only one defibrillator available in our jurisdiction is a substantial inequity relative to resource management that must be addressed by the trustees of the Channahon Fire Protection District.

The financial support necessary to implement and maintain an AED program will be a factor in evaluating the feasibility. Initial considerations will include determining the number of AED units will be necessary to deploy, in order to adequately insure coverage in our primary response jurisdiction. Additionally, the number of people to be trained in the operation of AED’s, the costs associated with maintenance and upkeep of the selected AED unit, costs associated with refresher training of personnel as well as other peripheral costs like additional
insurance liability coverage will also need consideration. Key components of appropriate deployment include trying to reduce dispatch time intervals, more efficient deployment of AED’s introduced into the program, and early defibrillation by first responders (Stiell, et al 1999).

Deployment considerations in the Channahon Fire Protection District will not be based upon a controlled, randomized study of comparing our fire and police personnel using different defibrillators (Bocka and Swor, 1991). Given our predicted, small number of exposures to sudden cardiac arrest, program results will need to be interpreted with caution. So many variables exist in the successful resuscitation of the patient population that definitive conclusions should not be made regarding program success or failure. At least two studies did not examine or adjust for differences in the victims’ severity of underlying cardiac disease, concurrent medical problems, or behavioral risk factors (Olson and Fontanarosa, 1999).

Even with some serious underlying medical problems, data supports the placement of AED’s in dialysis treatment centers (Becker, et al, 2001). Other data shows that patients with cardiac arrests in public have higher rates of survival of ventricular fibrillation than those with arrests at home (Becker, et al, 2001). Public placement or availability of AED’s is then another factor in developing a deployment strategy.

The initial purchase price of current AED’s on the market range from $1400-$3500. Current average salaries for surrounding police officers and firefighters are between $16 and $24 per hour. These rates will be factored into training costs; both initial and refresher.

Public education programs should be implemented concurrent with the introduction of the AED program. The public education or awareness program should consider offerings of new CPR classes and updates for those who may already hold their CPR card. Some low rates of
bystander CPR are felt to have contributed to poor survival rates in one study (Marenco, 2001). Bystander or first responder CPR should be a component of any early AED intervention program.

**RECOMMENDATIONS**

Research question 1 considered the impact an early defibrillation intervention program would have on the survival rate of sudden cardiac arrest victims in the Channahon Fire Protection District. The results determined that there is a high probability that an early intervention AED program would have a positive impact on sudden cardiac arrest victims in the jurisdiction of the Channahon Fire Protection District.

My recommendations are that after reviewing the checklist in the appendix a committee of appropriate policy makers and local public safety department heads gather to develop a strategy for implementing an early AED program. A substantial portion of the research has supported the positive influence early intervention has on sudden cardiac arrest through defibrillation. Gathering the historical exposure within our jurisdiction will provide data relative to the potential number of sudden cardiac arrests we may encounter in the future. Review of other databases available to consider will provide firm times associated with EMS and ACLS response to these incidents. The two times that need to be reviewed are the time the call for aid was received at the dispatch center and the time EMT’s arrived at the patient’s side with defibrillation equipment. Those numbers will correlate with the time that an early defibrillation intervention could have taken place. Those times that exceed the recommended maximum of eight minutes to defibrillation will provide the number of sudden cardiac arrest victims that would be considered “savable.” This is the number that the local policy makers should consider in their deliberations concerning implementing an early AED program.
Local evaluation of appropriate medical facilities may also be considered. Though most medical and dental practices experience few sudden cardiac arrests of patients, dialysis centers have a much higher rate of experience. Data has shown that these patients have a good survival rate when early intervention with defibrillation is provided. Distribution of an AED within these facilities may add to the CFPD’s deployment strategy.

Evaluating other jurisdiction’s experience with implementation of early intervention automatic external defibrillator programs will also provide considerations for the CFPD’s strategies.

I also recommend the use of the checklist from the appendix that can provide an appropriate guide for early AED program development. New concerns or parameters regarding an AED program may arise irregularly and should drive appropriate alterations to this checklist.

Research question 2 inquired into how the Channahon Fire Protection District could financially support an early defibrillation program. The results found that a number of strategies could be considered for funding and supporting an AED program. The first strategy to consider is total program funding through current fiscal budgetary means. That would infer a reduction in or elimination of an existing program. Generally, that would be true. There are limited, discretionary funds available for a new program of this type. The amount of those discretionary funds would not be sufficient to wholly fund the start-up costs associated with this program. However, this funding strategy would be the most desirable because the timetable for implementation will be wholly in the hands of the CFPD. As chief of the Channahon Fire Protection District, I will make the needed budget adjustments during the next fiscal year to accommodate the necessary share of the appropriate financial considerations required to implement an early AED intervention program.
The second strategy would involve a financial contribution from the CFPD and additional financial contributions from the business community within the jurisdiction. These amounts could be adjusted depending on the ability or willingness of the various business concerns to contribute. The partnerships could range from tens of dollars to thousands of dollars. Some law enforcement agencies within the jurisdiction of the CFPD may even already be considering an AED program. Partnering with those agencies should provide a level The CFPD could then determine the amount of funding that would be necessary from their budget in order to support the scope of the program as described by the deployment schedule.

The third strategy would be based on 100% of the program being funded by the business community as well as the general residential population. A drawback of this approach is that implementation of the program may be delayed until all of the funding is secured. Presently there doesn’t exist a guideline for this type of timetable. Therefore, this strategy may be less attractive for a program of this type.

The fourth strategy would base program funding upon available grants from the private sector as well as the public sector. The timeframes for writing the grant proposals, receiving the grant, purchasing the appropriate equipment, and training the participants would be negative influences upon this strategy. Those events are almost serial in nature and would elongate the program implementation. This strategy would be undesirable, only because of the timetable that would be dependant upon the serial nature of the funding, procurement, and training process. However, if this is the only viable funding mechanism available, program implementation may be delayed, but certain in its disposition.

The checklist in the appendix should be reviewed regularly and adjusted based on new funding mechanisms or concepts that develop. As unforeseen problems arise during the funding
or budgetary phase, these should be added to the appendix checklist. This will continue to
develop and mature this checklist so it can remain a cornerstone for decision-makers.

Research question 3 asked how the CFPD could make the public aware of the need for an
early defibrillation program. Introducing the AED program components into our regular and
routine encounters with the public at the various service clubs, church organizations, and other
public venues will be the primary avenue for indoctrination of the public. The CFPD will also
organize open public forums for the primary purpose of introducing the new AED program.
Articles will be generated for the local newspapers of general circulation as well. We will also
develop and produce program segments for the local public access cable television
programming.

As the checklist in the appendix develops with adjustments and maturity it could be
incorporated into a multi-jurisdictional approach to include crossing of county and even state
political boundaries.

Many more departments could combine their efforts and utilize the partnering approach
described above to implement a much broader range of accessible AED’s. This would lead to a
more efficient use of resources that would provide for a much broader and comprehensive
exposure of the public to AED’s. This would clearly impact the survival rates of those patients
experiencing sudden cardiac arrest.

Research question 4 asked how the Channahon Fire Protection District would educate the
public first responders on the proper use of automatic external defibrillators. Once the make and
model of the automatic external defibrillator is selected, the appropriate number of training
models would be purchased for instructional purposes. The number to be purchased would
depend on the number of participants that would be participating, from the public safety
viewpoint. If all of the firefighters and police officers within the jurisdiction of the CFPD will be expected to render early AED intervention aid, then all would need to be trained. As chief of the CFPD, I would train all of our personnel and promote and support the training of all law enforcement officers who patrol our jurisdiction.
REFERENCES


### APPENDIX

**Early Automatic External Defibrillator Program Checklist**

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
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<tbody>
<tr>
<td>Has your community experienced victims of sudden cardiac arrest?</td>
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<tr>
<td>Does your community have a 9-1-1 emergency telephone system?</td>
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<tr>
<td>Does your community have a BLS or ACLS EMS system?</td>
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<td>Are the local police officers trained at any level of EMS?</td>
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<tr>
<td>Would local police officers willingly participate in an AED program?</td>
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<tr>
<td>Do the police concurrently respond to calls for EMS service?</td>
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<tr>
<td>Do firefighters or EMT’s respond as first responders to calls for EMS?</td>
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<tr>
<td>Is ACLS response frequently delayed due to other calls for service?</td>
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<tr>
<td>Can the local police training budget absorb AED training costs?</td>
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<tr>
<td>Can the local fire service training budget absorb AED training costs?</td>
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<tr>
<td>Would the business community support start-up costs associated with an early AED intervention program?</td>
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<tr>
<td>Does your department have CPR instructors?</td>
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<tr>
<td>Can your department provide public CPR instruction?</td>
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<tr>
<td>Does your EMS medical director support early AED intervention?</td>
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<td>Does your local CATV system allow outside programming?</td>
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<td>Do you have in-house personnel who can write articles for local newspapers?</td>
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<tr>
<td>Do your department make routine contact with the public through service clubs, churches or other public forums?</td>
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<tr>
<td>Does your department have access to computer aided dispatch data?</td>
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