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The Positive Impact of Automated External Defibrillator Application Prior to EMS Arrival

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THE POSITIVE IMPACT OF AUTOMATED EXTERNAL DEFIBRILLATOR APPLICATION PRIOR TO EMS ARRIVAL

BY

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A doctoral project submitted to the faculty of the Medical University of South Carolina in partial fulfillment of the requirements for the degree Doctor of Health Administration in the College of Health Professions

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Chapter 1

Background and Need

In the United States, 610,000 people die each year from heart disease, which is why heart disease is the leading cause of death for men and women. More specifically, Coronary Heart Disease (CHD) is the most common of heart diseases and accounts for over 370,000 deaths each year. A more staggering number is the amount of patients that suffer from heart attacks every year, which equates to nearly 735,000, or one person every 43 seconds (Mozaffarian, 2015)

A heart attack occurs when the heart's muscle cells are abruptly cut off from their blood supply because the coronary arteries that they depend on have become clogged. The medical term is myocardial infarction: Myocardial refers to the myocardium, the collective term for the heart's muscle cells, and infarction is any interruption of blood flow that permanently damages tissue. When a patient suffers from a heart attack, their heart goes into an arrhythmia. The two primary arrhythmias are known as ventricular fibrillation and ventricular tachycardia.

Ventricular fibrillation is when the heart's electrical activity becomes disordered. When this happens, the heart's lower (pumping) chambers contract in a rapid, unsynchronized way (The ventricles "fibrillate" rather than beat). The heart pumps little or no blood (Survived a heart attack, n.d.) The patient will collapse and sudden cardiac arrest will quickly follow. Ventricular Tachycardia is a regular, faster-than-normal heart rate that begins in the hearts lower chambers. In most patients with ventricular tachycardia, the rate is in the range of 170 beats per minutes (BPM) or more. Patients can either be in ventricular tachycardia with a pulse, which does not require cardiopulmonary

resuscitation (CPR) or be without a pulse, which would require CPR (Heart Attack, 2017).

If a patient were to be in ventricular tachycardia or ventricular fibrillation, an Automated External Defibrillator (AED) would be necessary. AEDs are lightweight, battery-operated, portable devices that are easy to use. Sticky pads with sensors (called electrodes) are attached to the chest of the person who is having sudden cardiac arrest. The electrodes send information about the person's heart rhythm to a computer in the AED. The computer analyzes the heart rhythm to find out whether an electric shock is needed. If a shock is needed, the AED uses voice prompts to tell you when to give the shock, and the electrodes deliver it. Using an AED to shock the heart within minutes of the start of SCA may restore a normal heart rhythm. Every minute counts. Each minute of SCA leads to a 10 percent reduction in survival (Sudden Cardiac Arrest, n.d.)

The need for more AEDs is important with the increase in the number of cardiac arrest patients. AEDs should be placed strategically throughout communities to allow bystanders the opportunity to utilize the user-friendly device and potentially save a life (Cervantes, 2017). Learning how to use an AED and taking a CPR (cardiopulmonary resuscitation) course are helpful. However, if trained personnel aren't available, untrained people also can use an AED to help save someone's life. Some people are afraid to use an AED to help save someone's life. They're worried that something might go wrong and that they might be sued. However, Good Samaritan laws in each State and the Federal Cardiac Arrest Survival Act (CASA) provide some protection for untrained bystanders who respond to emergencies. Facility owners who are thinking about buying an AED

should provide initial and ongoing training to likely rescuers (usually people who work in the facility).

It's important to properly maintain an AED and notify local emergency officials of its location (Sudden Cardiac Arrest, n.d.). The Automated External Defibrillator (AED) provides a harmless and efficient method by which patients in the out-of-hospital environment may receive early defibrillation (Myers, 2005). Early defibrillation may be delivered by a variety of people, including bystanders with zero experience, trained or un-trained first responders or certified or licensed clinicians (Myers, 2005). Many organizations, including the AHA have supported placement of AEDs for Public Access Defibrillation (PAD) in any region where cardiac arrest is likely to occur every five years and there is more than a 5-minute response by EMS (Myers, 2005). In North Carolina, twenty-three percent (23%) of all deaths are attributed to heart disease, 11,765 of which are as a result of cardiac arrest (General Assembly of North Carolina Session 2011, 2012).

Problem Statement

In a 2016 County Profile, completed by the North Carolina State Department of Commerce, Caswell County had a population in 2014 of 23,614 and has a projected population for 2019 of 23,484. The population isn't projected to increase, but the current population is aging. The quality of life for the residents in terms of healthcare is poor. According to this 2016 study, in 2013, Caswell County only had six physicians, the physicians per 10,000 populations was 2.5.

Today, the County has three primary care physician offices, two in Yanceyville (the town seat) and one in Prospect Hill as well as the Health Department. The County also has ten volunteer fire departments that respond to medical calls to assist the County Emergency Medical Services (EMS) system, but the majority of them do not hold a North Carolina Office of Emergency Medical Services (i.e. Medical Responder, Emergency Medical Technician (EMT), Advanced EMT or Paramedic) certification. In North Carolina, fire and rescue department personnel are only required to have certifications if their respective departments require it. Caswell County currently has zero fire departments that are, at a minimum, providing EMT level care. Each department provides first responder assistance (these fire personnel have completed a 40 hour Emergency Medical Course) but do not possess a certification. The fire departments have not been approved by the current medical director to become EMT level departments, primarily because of the lack of providers, but also because of the internal training that must be done between the EMS system and the fire departments. There is an abundant need for additional training in the county to increase the level of care being delivered by the fire departments because as a rural county, with only three trucks operating twenty-four hours a day, seven days a week, there are times when the average response time for an ambulance can be over sixteen minutes. This delay in EMS response due to location of the ambulances compared to the location of the 911 calls impacts patient's chances of survival greatly.

This research project involves an analysis of data from January 1, 2014 through December 31, 2016 from Caswell County EMS, Caswell County Enhanced 911 Center,

the North Carolina Office of EMS Performance Improvement Center and the patient care reporting system that Caswell County EMS utilizes, known as ESO Solutions, Inc., on patients that received an AED prior to EMS arrival compared to patients that did not receive an AED prior to EMS arrival.

Research Question and Hypothesis

The data consists of all patients that received cardiopulmonary resuscitation (CPR) from January 1, 2014 through December 31, 2016 in Caswell County. I will look at first responders and/or bystanders applying AEDs to patients in cardiac arrest and if an AED was not applied prior to EMS arrival with patients in cardiac arrest and their survival rate as well as patients that only had an AED applied by EMS and their survival rate. The research question that I'm posing is that survival rates would be higher if public access defibrillation programs were more accessible in non-Yanceyville areas. My hypothesis is those patients suffering from cardiac arrest that live in Yanceyville, NC have a better chance of survival than patients that live in other parts of Caswell County, referred to as non-Yanceyville due to the availability of AEDs.

Chapter 2 Literature Review

For victims with VF/VT, survival rates are highest when immediate bystander CPR is provided and defibrillation occurs within three to five minutes of collapse. With every minute that passes, a victim's survival rate is reduced by seven percent (7%) to ten percent (10%) if no intervention measures are taken. An estimated ninety-five percent (95%) of cardiac arrest victims die before reaching the hospital. If intervention measures

are taken, survival rates are much higher; when CPR and defibrillation are immediately performed, survival rates can double (General Assembly of North Carolina Session 2011, 2012). Eighty percent (80%) of all cardiac arrests occur in private or residential settings, and almost sixty percent (60%) are witnessed. Communities that have established and implemented public access defibrillation programs have achieved average survival rates for out-of-hospital cardiac arrest as high as forty-one percent (41%) to seventy-four percent (74%). Wider use of defibrillators could save as many as 40,000 lives nationally each year. Successful public access defibrillation programs ensure that cardiac arrest victims will have an immediate recognition of cardiac arrest and activation of 911 followed by early CPR with an emphasis on compressions, rapid Automatic External Defibrillator (AED) use, effective advanced care, and coordinated care afterward (General Assembly of North Carolina Session 2011, 2012).

As defined by the AHA, the out-of-hospital chain of survival provides a useful metaphor for the elements of the Emergency Cardiovascular Care (ECC) systems concept (CPR & ECC Guidelines, 2017). The AHA describes the five links in the adult out-of-hospital chain of survival as:

- Recognition of cardiac arrest and activation of the emergency response system
- Early cardiopulmonary resuscitation (CPR) with an emphasis on chest compressions
- Rapid defibrillation
- Basic and advanced emergency medical services
- Advanced life support and post-cardiac arrest care

A strong Chain of Survival can improve chances of survival and recovery for victims of cardiac arrest.

With the development of self-instructing AEDs, the concept of defibrillation beyond conventional EMS and ambulance crews to non-medically trained personnel is spreading rapidly as is sometimes generalized within the concept of Public Access Defibrillator (PAD) programs. A few studies have investigated the use of PAD by untrained lay rescuers, with promising results. Whitfield *et al*. presented data regarding the use of 681 AEDs, which were located in 110 public places, that showed that VF was the first recorded rhythm in 82% of 146 cases and that 25% of 177 patients with witnessed out of hospital cardiac arrest survived to hospital discharge. Cardiac disease is the most common cause of mortality in the western world, and the majority of cardiac deaths are due to out-of-hospital cardiac arrest (OHCA). In Sweden, there are an estimated 5,000-10,000 OHCAs each year, which represents a major public health problem. The majority of studies have investigated OHCA only from cardiac causes, some have included all types of OHCA while others have only considered witnessed OHCAs and/or those with VF as the first registered rhythm. In general, overall survival from OHCA is low with about 5-10% of patients surviving, with the exception of a few controlled settings (e.g. some cities, airports). Previous investigations have shown that a majority of patients with OHCA do have symptoms prior to the arrest. The most common symptoms are angina pectoris, dyspnea, nausea/vomiting and dizziness or syncope. These are very similar to the symptoms of acute myocardial infarction. Sudden cardiac death was found to be the first manifestation of heart disease amongst 40-60% of all patients in

population-based studies from Maastricht, the Netherlands and Framingham, MA, USA. Similar data have been reported from the UK.

The AHA has identified three important areas that have been shown to be most significant. First, the importance on agonal breathing during the first minutes of cardiac arrest should be stressed. It has been demonstrated that both lay rescuers and healthcare professionals have difficulty in determining the presence or absence of adequate or normal breathing in unresponsive victims. As a consequence, delays in recognition of the cardiac arrest lead to delays in calling emergency dispatch centers as well as in initiating CPR and defibrillation. The effects of early CPR on survival have been demonstrated repeatedly. Early CPR doubles or even triples survival after out of hospital cardiac arrest. Furthermore, studies show that bystander CPR prior to ambulance arrival improves survival rates in patients with pre-hospital VF or VT. The CPR protocol has been slightly modified over time, and the ventilation/compression ratio changed from two ventilations/15 compressions to two ventilations/30 compressions in 2005. This ratio remained unchanged in the recently published CPR guidelines; however the importance of good chest compressions and minimal "hands-off time" was highlighted.

The mechanisms underlying cardiac arrest are numerous and can be divided into cardiac and non-cardiac causes. Establishing the etiology of the condition is difficult. Because the vast majority of OHCA patients die outside the hospital or in an emergency department, many do not undergo an autopsy; and in a large proportion of cases, there is a lack of information about comorbidities and medication. Despite increased emphasis on

both primary and secondary prevention, and particularly implantable cardioverter defibrillators (ICDs), in the majority of patients it is not possible to predict an OHCA prior to an event (Hollenberg, 2013).

Although defibrillation has been identified as the major predictor of survival in out of hospital cardiac arrest, it is extremely time-dependent (Powell, 2004). The increase in survival has been particularly marked amongst patients found with a shockable rhythm (Hollenberg, 2013). The Medtronic Foundation completed a study that included 1900 volunteer responders from 993 community units in 24 North American regions. In this study, volunteers trained and equipped to provide early defibrillation in a structured response system increased the number of survivors to hospital discharge after OHCA in public locations (Public Access Defribrillation Programs in the Community, n.d.). PAD programs can improve survival for OHCA, but the effectiveness of defibrillation does diminish over time, making the availability of the device and the time it takes to bring it to the side of the patient very important considerations when determining exact locations for AEDs (Public Access Defribrillation Programs in the Community, n.d.)

While EMS providers will bring a defibrillator to the scene of the emergency, they may not always be able to reach the patient quickly. The cardiac arrest victim's chances of survival decrease with every passing minute (Public Access Defribrillation Programs in the Community, n.d.). Early defibrillation can be lifesaving. Modern defibrillators were designed to be used by the public. Anyone can successfully save lives with use of an AED simply by following the voice prompts from the machine. AEDs can

be found in many locations in your community including grocery stores, airports, shopping malls, and public buildings. The devices are most useful if they are conspicuously placed in the open, much the same as fire extinguishers (Public Access Defribrillation Programs in the Community, n.d.)

The challenge with PAD lies in ensuring the potential rescuers are aware of AED locations and understand their role in using the devices. Having an action plan is critically important to the successful use of an AED. That action plan should be tailor-made for the area in which it serves. AEDs must be distributed so that the AED can be retrieved and placed on the victim as soon as they collapse. Local EMS systems can pinpoint good locations for AEDs in conjunction with health departments, schools, local governments, churches, and local businesses (Public Access Defribrillation Programs in the Community, n.d.)

In monitored settings such as cardiac rehabilitation facilities where defibrillation can be accomplished immediately, survival rates approach 80% compared to only 2% to 5% survival after twelve minutes from collapse in community settings (Powell, 2004). Although other research suggests that rapid defibrillation with AEDs in the hands of first responders improves patient outcomes, most Emergency Medical Services are still incapable of providing treatment within an acceptable time frame (e.g. Caswell County EMS due to response times) (Powell, 2004).

This spread of AEDs in public places to nonmedical persons is rapidly increasing (Hollenberg, 2013). An example of a public place would be the Phoenix Sky Harbor

International Airport. In 2001, the airport implemented a PAD program. The airport, which sits on 3,000 acres, has three terminals. An estimated 100,000 passenger's travel through the facility every day. Add to that another 125,000 of their friends, families and drivers, and employees, and you have one busy airport. In fact, Phoenix Sky Harbor International Airport had more than 38.5 million passengers in 2010, according to the city's aviation department. The facility has its own police unit, a cadre of volunteers and fire department units staffed by paramedics. Add in bystanders willing to do CPR and use an AED, and the likelihood that some medical professionals would be passing through, and Sky Harbor seemed like a perfect incubator for the program. The program started with 55 AEDs at Sky Harbor. Today, 90 devices are strategically located throughout the facility. Each is mounted in a large, white box with a glass front and a heart with a lightning bolt through it. Each unit is only about a two-minute walk from the next. Since the program started, 34 incidents of witnessed v-fib SCAs have happened at the airport, with 26 of those patients surviving and being released from the hospital without neurological deficits (Huff, 2011).

Another location that was studied was casinos in Las Vegas. The sample contained 148 subjects with confirmed cardiac arrest. None of them were children, and therefore no cases were excluded because of the age and weight criteria. One hundred five subjects had an initial cardiac rhythm of ventricular fibrillation, 17 had pulseless electrical activity, and 26 had asystole. No subjects whose initial cardiac rhythm was not ventricular fibrillation survived to discharge from the hospital (Valenzuela, 2000). Of the

148 subjects in the total group, 17 (11 percent) were pronounced dead at the scene, 60 (41 percent) were pronounced dead in the hospital emergency department, 15 (10 percent) were admitted to the hospital and died before discharge, and 56 (38 percent) survived to discharge from the hospital (Valenzuela, 2000).

School systems have also realized the importance of having AEDs present. A two-year prospective study from the National Registry for AED Use in Sports surveyed a total of 2,149 high schools that were questioned quarterly and asked to submit any reports of SCA. Of these, 95% of schools confirmed their participation for the entire two-year study period. Cases of SCA were reviewed to confirm the details of the resuscitation. The primary outcome was survival to hospital discharge. School-based AED programs were present in 87% of participating schools and in all but one of the schools reporting a case of SCA. Fifty-nine cases of SCA were confirmed during the study period including 26 (44%) cases in students and 33 (56%) in adults; 39 (66%) cases occurred at an athletic training facility during training or competition; 55 (93%) cases were witnessed and 54 (92%) received prompt cardiopulmonary resuscitation. A defibrillator was applied in 50 (85%) cases and a shock delivered onsite in 39 (66%). Overall, 42 of 59 (71%) SCA victims survived to hospital discharge, including 22 of 26 (85%) students and 20 of 33 (61%) adults. Of 18 student-athletes 16 (89%) and 8 of 9 (89%) adults who arrested during physical activity survived to hospital discharge. The conclusion of their study was that high school AED programs demonstrated a high survival rate for students and adults that suffered SCA on school campuses (Drezner, 2013).

More than 55 years ago, Physio-Control, the world leader in the development,

manufacture, sale and service of external defibrillator/monitors and emergency medical response products and services, pioneered defibrillation technology. In the late 1950s the company founder, Dr. Karl William Edmark, developed a device that sent a direct current (DC) electric shock through the heart to terminate ventricular fibrillation. This first DC defibrillator became the prototype for medical devices used by emergency medical services and hospitals around the world. Ten years later Physio-Control dramatically changed the face of emergency medical care forever with the introduction of the first portable defibrillator / monitor (CPR Savers, n.d.). The physio-control AED's are widely used in EMS systems, especially in Caswell County. Caswell County has (5) LifePak 15 monitors. The LifePak 15 monitors/defibrillators is the new standard in emergency care for ALS teams who want the most clinically innovative, operationally innovative and LIFEPAK TOUGH device available today. The 15 integrates Massimo Rainbow SET technology that monitors peripheral capillary oxygen saturation (Sp02), Carbon Monoxide and Methemoglobin, includes a metronome to guide CPR compressions and ventilations and provides an option to escalate energy to 360J (CPR Savers, n.d.). The industry's only combination of lifesaving tools specifically designed to work together, the Physio-Control System of Care captures vital patient and equipment information from our LIFEPAK® 15 monitor/defibrillator during a call, transmits it through the LIFENET® System, and manages that information with CODE-STAT™ 9.0 software for post event review. The System of Care helps you to improve survival for cardiac arrest patients by providing critical information that can be used to increase CPR performance. The LIFEPAK 15 device records compression and ventilation data, defibrillation shocks,

EtCO2 and vital signs. This information and patient data are sent via the LIFENET System to your QI team who can review it using CODE-STAT 9.0 software to evaluate hands-on time. The result is a strengthened feedback loop with EMS teams. Increasing hands-on time leads to increased survival, according to published studies (CPR Savers, n.d.). This monitor is incredible and has been a team player in cardiac arrest patients throughout the world.

A study completed by the Swedish Registry for Cardiopulmonary Resuscitation concluded that in a two-year period, a total of 804 OHCAs occurred in public locations in Stockholm County where 1,828 AEDs were available. The incidence of public OHCAs was similar in residential (47.3%) and non-residential areas (43.4%). Fewer AEDs were present in residential areas than in non-residential areas (29.4% vs. 68.8%). In residential areas the median distance between OHCAs and AEDs was significantly greater than in non-residential areas (288 meters vs. 188 meters). Their conclusion was that the majority of public OHCAs occurred in areas classified as residential areas with limited AED accessibility (Fredman, 2017).

According to one observational study, only a portion of OHCAs will occur in areas suitable for PAD—estimates of between 17 and 26% have been made due to poor correlation between risk of OHCA by location and placement of AEDs. In urban areas, 3-25% of OHCAs occurred within 100m of a public access AED. In Philadelphia, it was estimated that 70-80% of OHCAs would occur within a 3-minute walk of an AED (Fredman, 2017).

In Japan, a large number of PADs have been deployed, and training of basic life

support has been given to lay people, resulting in increased neurologically intact survival rates. AED use by laypersons has been permitted for the defibrillation of patients with OHCA since 2004, and PAD deployment in public places has subsequently increased rapidly. The estimated cumulative number of PADs in Japan exceeded 500,000 in 2014. Fire departments throughout the country give training of basic resuscitation procedures such as chest compression and AED use to more than 1,700,000 community people every year. Consequently, bystander defibrillation of patients with OHCA greatly increased during the past decade: 46 incidents were reported in 2005, and 1,030, in 2014. This accounted for 21.6% of patients with bystander witnessed OHCA with a shockable rhythm, although this still represents a small proportion of all bystander witnessed cases, accounting for only 4.1% (Nakahara, 2016).

Among patients with bystander-witnessed OHCA with a shockable rhythm, 10.5% survived with intact neurological function in 2005, which increased to 23.0% in 2014. A study analyzing nationwide registry data estimated that 9% of neurologically intact survival was attributable to bystander defibrillation in 2012. Some observational studies based on the same registry showed that bystander defibrillation with a PAD greatly improved 1-month neurologically intact survival rates among those with a shockable rhythm (Nakahara, 2016).

A study in Hong Kong concluded that an AED is clinically effective in improving the survival outcome of OHCA. Cost effectiveness is nonetheless dependent on multiple factors. In Hong Kong, there is a need to implement a PAD program in order to shorten

the time to defibrillation, with itself being a predictor of survival. Based on the best available evidence for Hong Kong, strategic planning, e.g. matching the incidence of OHCA with AED placement, ensuring accessibility, and establishing an AED registry with an infrastructure of AED maintenance are recommended. Unguided placement of AEDs is discouraged because it is likely a waste of resources. In parallel, public engagement is essential. Early defibrillation is just one of the links in the chain of survival. From the community perspective, basic life support by a bystander, eg CPR, deserves continued encouragement despite the increased bystander CPR rate to nearly 30% over the past 14 years. It is because high-quality layperson CPR may help prevent degeneration to asystole (Fan, 2017).

Chapter 3- Methods

Data abstracted from the North Carolina Office of EMS Performance Improvement Center confirmed a total of 135 patients suffered cardiac arrest in Caswell County from January 1, 2014 to December 31, 2016. Of the 135 patients, 77 were male and 58 were female, according the paramedic provider documentation.

To test my hypothesis, a chi-square test will be used to perform an analysis of patients in Yanceyville, NC versus non Yanceyville, NC patients. This test will determine if survival is greatest in a geographic area in Caswell County. I suspect I will find that survival is greatest in Yanceyville versus non-Yanceyville patients because AED's are more readily available and response times of the EMS service are less than non-Yanceyville areas. The location of the AEDs is a prime concern for this rural County.

The County EMS service operates three ALS trucks and the volunteer fire departments respond to medical calls as needed. There are a total of ten fire departments and each department has a County issued AED. The courthouse has an AED and the local College has two. The courthouse, college and EMS base are all located in the City of Yanceyville. Yanceyville accounted for over 40 incidents, but the 95 other incidents occurred in rural settings in which response times are greatly impacted by distance from the EMS base.

Chapter 4-Results

The chi-square test concluded that there was a higher percentage of patients who recovered if treated by an AED prior to EMS arrival. Out of the 29 people who were treated prior to EMS, 51.72% recovered (ROSC=1) and 48.28% did not recover (p-value=0.0363).

Table of AED_PTA_EMS by ROSC			
AED_PTA_EMS	**ROSC**		
Frequency Row Pct	**0**	**1**	**Total**
0	50 70.42	21 29.58	71
1	14 48.28	15 51.72	29
Total	64	36	100
Frequency Missing = 35			

Statistics for Table of AED_PTA_EMS by ROSC

Statistic	DF	Value	Prob
Chi-Square	1	4.3832	0.0363
Likelihood Ratio Chi-Square	1	4.2873	0.0384
Continuity Adj. Chi-Square	1	3.4747	0.0623
Mantel-Haenszel Chi-Square	1	4.3394	0.0372
Phi Coefficient		0.2094	
Contingency Coefficient		0.2049	
Cramer's V		0.2094	

Effective Sample Size = 100

Frequency Missing = 35

WARNING: 26% of the data are missing.

The chi-square also concluded that there was not a higher percentage of patients who recovered if treated by EMS. Of the 68 patients treated with an AED by EMS, 72.06% of the patients did not recover (ROSC=0) while 27.94% did. (P-value=0.0144). This may be explained by EMS response times due to distance from cardiac arrest for rural areas or who were more likely to die regardless. We were not able to control or account for this in these data.

Table of AED_BY_EMS by ROSC			
AED_BY_EMS	ROSC		
Frequency Row Pct	0	1	Total
0	15 46.88	17 53.13	32
1	49 72.06	19 27.94	68
Total	64	36	100
Frequency Missing = 35			

Statistics for Table of AED_BY_EMS by ROSC

Statistic	DF	Value	Prob
Chi-Square	1	5.9899	0.0144
Likelihood Ratio Chi-Square	1	5.8813	0.0153
Continuity Adj. Chi-Square	1	4.9467	0.0261
Mantel-Haenszel Chi-Square	1	5.9300	0.0149
Phi Coefficient		-0.2447	
Contingency Coefficient		0.2377	
Cramer's V		-0.2447	

The data analysis also concluded that there was not a higher percentage of patients who recovered if they lived in Yanceyville. Of the 36 patients who had ROSC, there was a higher percentage of patients who Recovered (ROSC=1) who lived outside of Yanceyville. (58.33% Outside of Yanceyville versus 41.67% in Yanceyville, p-value=0.0363).

Table of ROSC by Yanceyville			
ROSC	Yanceyville		
Frequency Row Pct	0	1	Total
0	50 78.13	14 21.88	64
1	21 58.33	15 41.67	36
Total	71	29	100
Frequency Missing = 35			

Statistics for Table of ROSC by Yanceyville

Statistic	DF	Value	Prob
Chi-Square	1	4.3832	0.0363
Likelihood Ratio Chi-Square	1	4.2873	0.0384
Continuity Adj. Chi-Square	1	3.4747	0.0623
Mantel-Haenszel Chi-Square	1	4.3394	0.0372
Phi Coefficient		0.2094	
Contingency Coefficient		0.2049	
Cramer's V		0.2094	

Effective Sample Size = 100

Frequency Missing = 35

WARNING: 26% of the data are missing.

Lastly, the chi-square concluded that there was a higher percentage of patients treated with an AED prior to EMS arrival (AED_PTA_EMS) if they lived in Yanceyville. (69.44% in Yanceyville versus 30.56% outside of Yanceyville, P-value<0.0001). Again, we believe that this is contributed to volunteer firefighters, law enforcement that are stationed primarily in Yanceyville as well as the administrative staff stationed in Yanceyville.

Table of AED_PTA_EMS by Yanceyville			
AED_PTA_EMS	**Yanceyville**		
Frequency Row Pct	**0**	**1**	**Total**
0	83 83.84	16 16.16	99
1	11 30.56	25 69.44	36
Total	94	41	135

Statistics for Table of AED_PTA_EMS by Yanceyville

Statistic	DF	Value	Prob
Chi-Square	1	35.4433	<.0001
Likelihood Ratio Chi-Square	1	33.8726	<.0001
Continuity Adj. Chi-Square	1	32.9684	<.0001
Mantel-Haenszel Chi-Square	1	35.1808	<.0001
Phi Coefficient		0.5124	
Contingency Coefficient		0.4560	
Cramer's V		0.5124	

Sample Size=135

Limitations

Limitations that affect the ability to draw general conclusions from the study include the small sample size. The data could only be provided from January 1, 2014 to December 31, 2016 due to no access to previous electronic patient care reports. Another limitation is that the data collected did not account for ROSC obtained for 35 patients due to the result of ROSC not being documented by the EMS service.

Abstract for submission to The Journal of Emergency Medicine for Clinical Reviews (Abstract should have separate headings for Background, *Objective of the Review, Methods and Conclusions and be no more than 250 words)*

THE POSITIVE IMPACT OF AUTOMATED EXTERNAL DEFIBRILLATOR APPLICATION PRIOR TO EMS ARRIVAL

Background

In the United States, 610,000 people die each year from heart disease, which is why heart disease is the leading cause of death for men and women. More specifically, Coronary Heart Disease (CHD) is the most common of heart diseases and accounts for over 370,000 deaths each year. A more staggering number is the amount of patients that suffer from heart attacks every year, which equates to nearly 735,000, or one person every 43 seconds (Mozaffarian, 2015)

Objective of the Review

My research project involved an analysis of data from January 1, 2014 through December 31, 2016 from Caswell County EMS, Caswell County Enhanced 911 Center, the North Carolina Office of EMS Performance Improvement Center and the patient care reporting system that Caswell County EMS utilizes, known as ESO Solutions, Inc., on patients that received an AED prior to EMS arrival compared to patients that did not receive an AED prior to EMS arrival. The sample size was 135 patients.

The research question that I posed is that survival rates would be higher if public access defibrillation programs were more accessible in non-Yanceyville areas. My

hypothesis is those patients suffering from cardiac arrest that live in Yanceyville, NC have a better chance of survival than patients that live in other parts of Caswell County, referred to as non-Yanceyville due to the availability of AEDs.

Methods

A chi-square test was performed and concluded that of those that lived in Yanceyville, did not have a greater chance of survival, even though this area had more AED's available. Of the 36 patient who obtained ROSC, there was a higher percentage of patients who Recovered (ROSC=1) who lived outside of Yanceyville (58.33% Outside of Yanceyville versus 41.67% in Yanceyville, p-value=0.0363) Furthermore, the data concluded that there was a higher percentage of patients treated prior to EMS arrival if they lived in Yanceyville (69.44% in Yanceyville versus 30.56% outside of Yanceyville, p-value<0.0001)

Conclusion

This paper in fact concluded that more patients living outside of Yanceyville had a better chance of survival even though there are fewer AED's. I believe that this is attributed to an extensive amount of volunteer firefighters in this area, versus in the city of Yanceyville.

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