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A Survey of Minnesota Public School's Cardiopulmonary Resuscitation Curriculum

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A SURVEY OF MINNESOTA PUBLIC SCHOOL'S CARDIOPULMONARY RESUSCITATION CURRICULUM

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ABSTRACT

Out-of-hospital cardiac arrest continues to be an event with a high mortality rate. Bystander recognition of cardiac arrest, followed by initiation of CPR and early defibrillation has been shown to be important predictors of survival. Barriers including inadequate training, fear of harming the patient, fear of legal action, and others are prohibitive factors in providing bystander CPR. Minnesota state statute 120B.236 requires CPR education to occur at least one time between grades seven and twelve. Recognizing the importance of quality education for potential bystanders, Bethel University physician assistant students designed a study to understand the details and characteristics of CPR education in Minnesota school districts.

A survey was developed to assess various characteristics of CPR curricula. Researchers emailed all 329 Minnesota superintendents background information on the study with a link to the survey and asked for their schools participation in the study. Researchers received an 8.5% response rate to their survey. Based on this data, 88% of school districts are aware of the requirement for CPR education outlined in statute 120B.236, yet 73% of school districts were unaware that the same statute provides free CPR education resources. The response rate was substantially less than anticipated which does limit the generalizability of these results. Further research should be completed to better understand barriers to implementing CPR curricula. Additionally, Minnesota school districts should be educated as to what resources are available to them when trying to implement a CPR curriculum.

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Introduction

In 2015, there were 347,322 adult out-of-hospital cardiac arrest (OHCA) events and 7,037 pediatric OHCA events which were assessed by emergency medical services (EMS) within the United States (Virani et al., 2020). In 2018, survival from OHCA treated by EMS was 10.4% (Virani et al., 2020). Early initiation of bystander cardiopulmonary resuscitation (CPR) is vital to enhancing the patient's survival following a cardiac arrest (Centers for Disease Control and Prevention [CDC], 2011; Swor et al., 2006). In light of the value of early CPR, Minnesota has a state law which dictates that all students receive CPR education at least once between grades seven and twelve (Cardiopulmonary resuscitation… instruction, 2009/2012). This research aims to determine the level of compliance and the spectrum of education performed under the state statute. This chapter discusses the background of OHCA, defines the problem statement, correlates this research to the medical profession, discusses barriers to challenges surrounding bystander CPR, and defines the terms that will be used throughout the research.

Background

Sudden cardiac arrest (SCA) occurs when there is an unexpected malfunction within the electrical system of the heart (Yannopoulos, n.d.). Due to the electrical malfunction, there is significantly impaired cardiac contractility which leads to cessation of perfusion. Without timely intervention, such as CPR, death may follow a SCA event. Return of spontaneous circulation (ROSC) is the main goal when performing CPR (Yannopoulos, n.d.). Achieving ROSC within 10 minutes of the onset of SCA is associated with improved patient outcomes (CDC, 2011).

The American Heart Association (AHA) first began training bystanders in CPR in 1972 (American Heart Association [AHA], n.d. -a). The AHA implemented their Chain of Survival

Concept in the 1990s providing the framework for improving survival from OHCA events. This concept included early access to care, early CPR, early defibrillation and early advanced care for these individuals (Cummins et al., 1991). As more research around OHCA has been conducted, the AHA has updated their chain of survival concept (American Heart Association [AHA], n.d. - b).

Today, the AHA's chain of survival includes the following six links in this order. They are "activation of emergency response, initiation of high quality CPR, defibrillation, advanced resuscitation, post cardiac arrest care and recovery" (AHA, n.d. - b). Three of these links can effectively be implemented by bystanders including: "activation of the emergency response, high quality CPR, and defibrillation" (Cummins et al., 1991). All of which can greatly increase the chance of survival from OHCA events. Bystander CPR has shown to be a key aspect to improving OHCA survival (Cummins et al., 1991).

Despite the known benefits to providing bystander CPR, the Cardiac Arrest Registry to Enhance Survival (CARES) has reported that many bystanders, even those who are certified, are not performing resuscitation efforts (CDC, 2011). A review by Brady et al. published in 2019 on the role of lay responders in OHCA outlines several barriers bystanders experience to performing CPR such as an inability to determine when CPR is indicated, not wanting to expose the breasts of an individual, fears of legal implications such as sexual assault and civil liabilites, and the potential to contract disease. Patient demographics have been found to impact the rates of bystanders intervening with CPR (Justice et al., 2020; Brady et al., 2019). It was found that being young or being white and experiencing OHCA was associated with increased rates of receiving bystander CPR (Justice, 2020). Lee et al. (2019) found that the education level of the bystander population was a factor in whether or not CPR was initiated. Bystanders who received a higher

level of education were found to have higher rates of performing CPR (Lee et al., 2019). Given the benefits of early CPR, providing education to youth, regardless of their socioeconomic status, is likely to play an important role in OHCA survival.

Problem Statement

The American Heart Association's Chain of Survival identifies early recognition of OHCA and initiation of bystander CPR as critical links for OHCA survival (AHA, n.d.; Brady et al., 2019). Bystander CPR is known to increase OHCA survival, but is only provided in 30-40% of cases (CDC, 2011; Swor et al., 2006). Lay persons do not perform CPR because of the fear of legal concerns, disease transmission, concern for causing harm, lack of confidence in skills, and patient privacy (Bouland et al., 2017). In recognition of these barriers, some states have implemented laws to begin CPR education during secondary education. In the state of Minnesota, state statute 120B.236 requires CPR and AED education for students at least one time between grades seven and 12 as a graduation requirement (Cardiopulmonary resuscitation… instruction, 2009/2012). To the researcher's knowledge, there is no current data about the spectrum of training students receive as a result of this law, nor rates of community resource utilization. This study will seek to determine the extent and compliance of training provided by Minnesota high schools.

Purpose

The purpose of this research project is to determine the spectrum of CPR training during secondary education in Minnesota school districts and to determine if and how school districts utilize community resources outlined in the statute. Under Minnesota state statute 120B.236, Minnesota schools are required to provide at least a one time exposure to CPR including hands on use with an AED and practice CPR with a mannequin (Cardiopulmonary resuscitation…

instruction, 2009/2012). This research project will evaluate the spectrum of training curricula and use of resources in order to evaluate how this law has been implemented in schools and where there are areas of improvement.

Significance of the Problem

With over 350,000 annual occurrences of OHCA and a nearly 90% mortality rate, OHCA remains a significant public health concern (Virani et al., 2020). Since bystander CPR directly correlates to improvement of OHCA survival, it stands to reason that education initiatives to encourage bystander intervention in OHCA likely impacts rates of bystander CPR even though it may be difficult to directly determine the effect of specific initiatives. The authors will survey school districts about the extent of CPR training provided to its students. This research data and its conclusions will be available for use by the Minnesota Resuscitation Consortium, Minnesota Department of Education, Minnesota State legislators, and other interested third parties. Potential uses for this data include determining future revisions to statute 120B.236, developing effective curriculums for CPR education in Minnesota schools, and overcoming barriers to curriculum implementation.

Definition of Terms:

Cardiopulmonary resuscitation (CPR): "consists of the use of chest compressions and artificial ventilation to maintain circulatory flow and oxygenation during cardiac arrest" (Borke, 2021).

Implantable Cardioverter Defibrillator (ICD): "A battery powered device implanted under the skin with wires connected to the heart to deliver an electric shock to restore the heart to a normal heartbeat" (AHA, 2016).

Cerebral Performance Category (CPC): "Score is widely used in research and quality assurance to assess neurologic outcome following cardiac arrest" (Ajam et al, 2011).

End-tidal Carbon Dioxide (ETCO2): "Is the level of carbon dioxide that is released at the end of an exhaled breath" (Richardson, 2016).

Chain of Survival: "Refers to the chain of events that must occur in rapid succession to maximize the chances of survival from sudden cardiac arrest" (Sudden Cardiac Arrest Foundation, n.d.).

Anoxic brain injury: "Complete lack of oxygen to the brain, which results in the death of brain cells after approximately four minutes of oxygen deprivation" (Shepherd Center, n.d.)

Agonal respirations: "Is the medical term for the gasping that people do when they're struggling to breathe because of cardiac arrest or another serious medical emergency" (Roland, 2018).

Resuscitation Outcomes Consortium: "A network of regional research centers in the United States and Canada and a data coordinating center (DCC) in the United States that conducts research focused on cardiac arrest and severe traumatic injury [to] evaluate strategies for treatment of patients with cardiac arrest or life-threatening traumatic injury with the primary focus on the OOH emergency setting" (Idris, 2012).

Conclusion

Early initiation of CPR is critical in determining OHCA outcomes. Chapter one established the background information around OHCA, the purpose of this research, and the significance of the problem. Education initiatives to improve bystander CPR have the potential to increase the rate of occurrence and the effectiveness of bystander CPR, but any effect they have depends on the compliance and methodology of instruction. Chapter two will elaborate on the

background regarding incidence, prevalence, and demographics of OHCA, the effect of bystander CPR, highlight the areas where there is room for improvement, and give statistical data surrounding barriers to performing bystander CPR.

Chapter 2: Literature Review

Introduction

Sudden cardiac arrest impacts many each year, and the result of such an event can be devastating if proper care is not initiated in a timely manner. According to the American Heart Association (AHA), there is a clear positive correlation between early cardiopulmonary resuscitation (CPR) initiation and patient survival to hospital discharge (Cummins et al., 1991b). As beneficial as early CPR initiation is, many bystanders do not initiate CPR and this negatively impacts patient outcomes (CDC, 2011). In this chapter, sudden cardiac arrest (SCA) will be defined, the evidence for bystander CPR is reviewed, discussion about the barriers lay responders experience when deciding to perform CPR as well as describing current high school state regulations on providing CPR education.

Sudden Cardiac Arrest

Sudden cardiac arrest, by definition, is when the heart undergoes an instantaneous and unforeseen malfunction that is associated with its electrical system (Yannopoulos, n.d.). An SCA will disrupt the pumping ability of the heart and impede the heart's ability to perfuse the body. A patient's chance of survival is increased with early initiation of cardiopulmonary resuscitation or chest compressions (Yannopoulos, n.d.). Sudden cardiac arrests are typically divided into two categories which are separated when analyzing patient outcomes based on the physical location of the arrest. The first category encompasses all SCAs that transpire within a medical facility and are referred to as in-hospital cardiac arrests (IHCA). The second category encompasses cardiac arrests that happen anywhere not within a medical facility which are referred to as out-of-hospital cardiac arrest (OHCA) (Høybye et al., 2021).

Sudden cardiac arrest occurs frequently and has a dismal survival rate. According to Virani et al. (2020), there were just under 350,000 adult OHCA events and just over 7,000 pediatric OHCA events in 2015 in the United States. The calculated incidence of OHCA in 2015 is 110.8 per 100,000 individuals (Virani et al., 2020). Data from 2018 suggests that overall survival of OHCA is only 10.4%, with 8.2% surviving with good neurological outcomes (Viriani et al., 2020). As many as 80% of SCAs can be related to coronary artery disease (CAD) (Gräsner, & Bossaert, 2013).

Sudden cardiac arrest can also be described as tachyarrhythmias or non-tachyarrhythmias based on the patient's electrical rhythm as noted on cardiac rhythm monitoring. Tachyarrhythmias include ventricular fibrillation (VF) and ventricular tachycardia (VT) (Patil et al., 2015). Non-tachyarrhythmias include pulseless electrical activity (PEA), asystole and severe cases of bradycardia. Both VT and VF are rhythms that are shockable, and potentially reversible, with the use of a defibrillator. Asystole, bradycardia and PEA are not. For this reason, poorer patient outcomes are reported in patients presenting with non-tachyarrhythmias (Patil et al., 2015).

In recent years, there has been a noted decrease in the incidence of SCAs presenting with VT and VF and an increase in SCAs presenting with asystole and PEAs as the initial rhythm (Patil et al., 2015). This may have a link to environmental, clinical or pharmacological factors. Some examples of this include an increase in physicians prescribing beta blockers to patients which can lower the rate of VT and VF and increase the risk of PEA and asystole arrests. Medical advances such as implantable cardioverter defibrillators for patients who have been diagnosed with systolic heart failure could also contribute to lower reported levels of VT and VF SCA events (Patil et al., 2015). Knowing this, it is hard to determine if there is truly an increase

in asystole and PEA related cardiac arrests as of late or if the rates are similar to what they were in years past, but most VT and VF arrests are being detected or prevented due to technological and pharmacological advances (Patil et al., 2015).

Cardiac Arrest Prevalence by Socioeconomics

The survival rate from OHCAs rarely exceeds 5% and is influenced by multiple factors including "age, gender, initial cardiac rhythm, bystander CPR and early defibrillation," which impact cardiac arrest outcomes. (Vaillancourt et al., 2004). Socioeconomic status, a "measure of an individual's place within a social group based on various factors, including income and education," also impacts OHCA outcomes (Schultz et al., 2018). Schultz states that risk factors for cardiovascular disease are more prevalent among individuals with lower socioeconomic status. While lower socioeconomic status is associated with lower levels of education and increased incidence of cardiovascular diseases (CVD), the impact of socioeconomic status on OHCA outcomes is unclear (Schultz et al., 2018). This section will help readers to better understand socioeconomic status and its impact on OHCA outcomes for patients.

Income and education opportunities may have a great effect on overall health. "Individuals with less education tend to have an increased number of CVD risk factors" (Winkleby et al., 2012). Woodward et al., (2015) investigated 90,000 patients and found those with a primary education had a 34% increased risk for CVD or cardiovascular mortality in their life compared to those that had a tertiary education. Patients with a tertiary education were studied and had an increased chance of alcohol consumption but a decreased chance for smoking, obesity, high blood pressure, diabetes, high cholesterol and overall cardiovascular mortality (Woodward et al., 2015). Despite their past medical history, those with a lower

socioeconomic status were less likely to be referred than those who had a high socioeconomic status to other prevention programs or cardiac rehabilitation. (Schultz et al., 2018)

Mortality differences in low income patients and their relationship to OHCA may be related to the disparities and standards of care they receive. The substandard care can partly be explained by the decreased access to healthcare in the socially disabled. Lack of access has been shown to bring increased risk for heart failure, myocardial infarctions and high readmission rates (Rasmussen, 2007). Patients with financial barriers and overall low income have fewer annual physicals, less compliance with daily medication and fewer overall medical recommendations. Stirbu et al. (2012), studied 15,000 patients admitted for acute myocardial infarction (AMI) and found that patients with a lower household income showed a higher chance for cardiac mortality compared to those in a high socioeconomic home. Low-income areas were less likely to receive a heart catheterization within 24 hours of myocardial infarction than those from a high-income area (Stirbu et al., 2012).

Low neighborhood socioeconomic status was associated with a significantly higher incidence of sudden cardiac arrest based on address of residence as well as location of cardiac arrest (Rasmussen, 2007). For effective deployment of strategies for community-based prevention such as the AEDs and CPR education, socioeconomic status based on income and education attainability is likely to be an important consideration.

Sudden Cardiac Arrest Treatment and EMS Care Termination

Once CPR has begun, the goal is to reach a point where the patient has ROSC (Skinner & Rawal, 2020). If achieved within the first 10 minutes, the outcome of the patient tends to be greater than patients who fail to reach ROSC within 10 minutes. After 30 minutes of CPR without ROSC there is a severe decrease in the likelihood of survival of the patient (Skinner &

Rawal, 2020). Data from 2010 in the Cardiac Arrest Registry to Enhance Survival (CARES) reported 31,583 OHCA from October 1, 2005 to December 31, 2010 (CDC, 2011). Of the 31,583 OHCA patients, 10,895 patients had ROSC in the field and 20,786 patients did not achieve ROSC in the field (CDC, 2011).

From the same CARES data set, 8,326 patients survived to admission to the hospital, 3,042 patients survived to discharge from the hospital and 2,200 patients survived and were reported to have "good or moderate" cerebral performance (CDC, 2011). Brain injury and impaired cerebral function can take place as soon as four to six minutes post collapse in a SCA. Neurologic outcomes are determined using the Cerebral Performance Category (CPC) scale. CPC grades neurologic status from one through four. A CPC one is a good cerebral performance and is able to live independently and CPC four indicates a coma or vegetative state. After a cardiac arrest, CPC one and two are considered to be positive neurological outcomes. These positive outcomes are more likely to occur with early initiation of CPR and short emergency medical service (EMS) response times (CDC, 2011).

Patients will be transported by EMS typically when ROSC is achieved to a hospital where follow-up medical care will continue. There are some instances in which EMS would terminate resuscitation efforts. These could include when a patient has a legal do not resuscitate order, when ROSC has been restored and assisted or spontaneous ventilation per AHA are achieved, when the patient meets the requirements for the determination of death protocol or when medical control advises EMS terminate resuscitation efforts (Skinner & Rawal, 2020). There are several criteria used by EMS to determine when to terminate resuscitation in the pre-hospital environment based on patient factors and data gathered during the arrest. Patient factors influencing termination include patient age over 18 years old and the OHCA was

unwitnessed. Data from the resuscitation leading to termination includes CPR for over 20 minutes without signs of ROSC, the presence of non-shockable rhythms, and $ETCO_2$ less than 10 mmHg during effective CPR (Skinner & Rawal, 2020).

Chain of Survival Concept

According to the AHA's history of CPR webpage, mouth-to-mouth ventilations and chest compressions, what is now known as conventional CPR, was developed in 1960 and formally recommended by the AHA in 1963. Initially, CPR training was only taught to medical professionals. But in 1972, CPR training expanded and large programs dedicated to training bystanders developed. Emergency dispatch operators began giving bystanders CPR instructions over the phone in the 1980's to promote performing CPR prior to arrival of EMS (AHA, n.d. - a). The development of the Chain of Survival concept marked a formal recognition of the role bystanders play in survival of OHCA.

The Chain of Survival concept was introduced by the AHA in October of 1990 (Cummins et al., 1991b). In 1991, the AHA released its scientific statement introducing the Chain of Survival and cited the evidence used to make these recommendations. It was introduced as a concept that provided a framework for improving survival from OHCA events. When introduced, the concept consisted of early access, early CPR, early defibrillation, and early advanced care (Cummins et al., 1991b).

In their 1991 scientific statement, the AHA proposed that strengthening any link in the chain improves OHCA survival. In 2005, the Chain of Survival was updated to early recognition, early CPR, early defibrillation, and post resuscitation care (Nolan, Sor, & Eikeland, 2006). As more research is conducted around cardiac arrest care, the Chain of Survival is updated. Today,

the Chain of Survival consists of six links; “activation of emergency response, high quality CPR, defibrillation, advanced resuscitation, post cardiac arrest care, and recovery” (AHA, n.d. - b).

Activation of emergency response, high quality CPR, and defibrillation are the three links that can involve bystander intervention. All of the links in the Chain of Survival play roles in promoting survival from OHCA events. It is beyond the scope of this literature review to discuss progression of advanced resuscitation, post-cardiac arrest care, and recovery. Additionally, while the authors of this literature review recognize the importance of early recognition and defibrillation, the focus will be on the development of bystander CPR and the role it plays in survival.

Bystander Recognition of OHCA

Proper recognition for the need of CPR is the AHA’s first step in their chain of survival (AHA, n.d. - b). Without proper identification, there is a high likelihood that CPR will not be initiated. There is little research on how bystanders recognize OHCA; therefore, it is hard to examine the likelihood of bystanders to perform CPR or use an AED (Hansen et al., 2017). Due to the little data available on how people perceive CPR and AED use, understanding how bystanders perceive cardiac arrest will be influenced by the biases of medical provider perspectives rather than the perspectives of lay responders (Hansen et al., 2017).

Impact of Bystander CPR

Early CPR has been shown to improve survival from OHCA. In their 1991 scientific statement, the AHA aggregated 17 different studies, which compared survival from cardiac arrest based on early CPR or late CPR. Early CPR was defined as receiving bystander CPR. Late CPR was defined as receiving CPR from an EMS provider rather than from a bystander. On average, late CPR was initiated four minutes later than early CPR. The studies occurred in Norway,

Iceland, Canada, Belgium, and the United States (Cummins et al., 1991b). Even though these studies are over 30 years old, they were foundational in the AHA's recommendation of early bystander CPR as a link in the Chain of Survival. Of the 17 studies, eight specifically looked at survival from shockable rhythms, 10 looked at survival of all rhythms, and one did not report. Two of these studies had both a shockable rhythm cohort and an all rhythms cohort.

According to the AHA, 16 of 17 studies showed positive odds ratios between 1.7 and 11.5 for cardiac arrest survival to hospital discharge with bystander CPR (Cummins et al., 1991b). One study in Milwaukee found an odds ratio of survival to discharge with bystander CPR of 1.0 likely because the Milkwaukee emergency response system had response times that allowed EMS providers to start CPR, on average, just two minutes later than bystanders started CPR (Cummins et al., 1991b). Even though the one study had an odds ratio of 1.0, it is still supportive of the survival benefit of early CPR because even late CPR in this study occurred earlier than late CPR in the other studies referenced by the AHA. Regardless of study size, geographic location, and presenting rhythm, there was still a positive correlation between bystander CPR and increased survival to hospital discharge (Cummins et al., 1991b).

Conventional bystander CPR has been performed with chest compressions and mouth-to-mouth ventilations. In 2008, the AHA began recommending compression only CPR rather than conventional CPR (AHA, n.d. - a). A study published in the Journal of the American Medical Association (JAMA) in 2010 analyzed OHCA survival to hospital discharge. Data was gathered between 2005 and 2009 for adults with presumed cardiac causes of cardiac arrest not witnessed by EMS in the state of Arizona (Bobrow et al., 2010).

Babrow et al. (2010) performed a prospective cohort study comparing no CPR, conventional CPR, and compression only CPR. In 5 years, 5,272 people met study inclusion

criteria and 4,415 participants were included in the analysis. People were excluded from analysis because bystander CPR was provided by a medical professional (779 people), EMS response time was not available (47 people), failure to document CPR technique (18 people), outcome data was not collected (9 people), unknown if the OHCA was witnessed (1 person), unknown ECG data (1 person), or for more than one of the preceding reasons (2 people) (Bobrow et al., 2010). The transparency of exclusion raises the validity of data collected by Bobrow et al. (2010) because the reasons for exclusion ensure that the same data was collected for each participant and they can adequately compare survival outcomes between the 3 different cohorts.

Bobrow et al. (2010) found that compression-only CPR for presumed cardiac etiology OHCA was superior to conventional CPR, but conventional CPR is still superior to no bystander CPR. The crude survival odds ratio as compared to no bystander CPR for conventional CPR was 1.55 and for compression-only CPR was 2.81. Other factors were identified which influence survival such as a witnessed arrest (adjusted odds ratio of 4.26), shockable rhythm during the arrest (adjusted odds ratio of 5.16), and experiencing OHCA in a public location (adjusted odds ratio of 1.48) (Bobrow et al., 2010). These findings show that bystander CPR is a major factor for survival OHCA, but other factors such as presenting rhythm, location of event, and if the event was witnessed also impact survival. That said, early CPR is still a major component for survival of presumed cardiac etiology of cardiac arrest.

Non-cardiac causes of cardiac arrest include etiologies such as respiratory arrest, drug overdose, and ischemic or hemorrhagic stroke. These conditions generally have higher mortality rates in cardiac arrest than cardiac etiologies (Panchal et al., 2012). In a prospective cohort study of 880 non-cardiogenic cardiac arrests across 5 years comparing no bystander CPR, conventional CPR by bystanders, and compression only CPR by bystanders it was found that there was no

significant survival difference between the cohorts (Panchal et al., 2012). Regardless of occurrence or method of bystander CPR, survival to discharge for non-cardiogenic OHCA was 3.3% as compared to a 7% survival to discharge for cardiac causes of OHCA (Panchal et al., 2012). The low survival regardless of CPR intervention in non-cardiogenic causes suggests that this is a fate of the disease processes rather than a failure of intervention. CPR is an intervention performed on someone who would otherwise die. Even though bystander CPR showed no benefit in non-cardiogenic causes of OHCA, that does not erase the benefit of bystander CPR. Further, Panchal et al. (2012) reports that the research is underpowered to evaluate outcomes for non-cardiogenic causes of cardiac arrest and, as such, cannot provide enough evidence to overcome preceding recommendations for bystander CPR.

More recent evidence for the benefits of bystander CPR come from an analysis of the Denmark cardiac arrest registry published in the New England Journal of Medicine in 2017. The retrospective analysis looked at quality of life 1 year post OHCA. It included all adults (18 years of age or older) who were 30 days survivors of cardiac arrest from 2001 - 2012 (Kragholm et al., 2017). Kraghol et al. (2017) related bystander intervention with rates of anoxic injury, nursing home admission, and death to determine the impact of bystander intervention on quality of life one year post cardiac arrest. Bystander intervention had lower absolute risk of death, occurrence of anoxic brain injury, and rate of nursing home admission within one year than no bystander intervention (Kragholm et al., 2017). This further reinforces the role that bystanders play in OHCA. Their intervention not only increases survival to discharge, but also improves patient quality of life 1 year after the OHCA event.

Bystander use of an Automatic External Defibrillator

Of the 350,000 OHCA events that occur in the United States annually, more than 100,000 of the 350,000 yearly events happen outside of the patient's home. Of those 100,000, only 45.7% receive the immediate care they need before EMS arrive (Pollack et al., 2018). Bystanders can help a cardiac arrest victim's chances of survival by calling 9-1-1, starting chest compression or using an Automatic External Defibrillator, otherwise known as an AED (CDC, 2021). During a cardiac arrest, the electrical activity in the heart is disrupted. An AED automatically analyzes the heart rhythm in people who are experiencing cardiac arrest and when appropriate, it delivers an electrical shock to restore the heart to its normal rhythm (Mao & Ong, 2016). Every second is vital because without adequate blood flow, the heart, brain and other vital organs aren't receiving enough oxygenated blood needed for cellular function. This is especially true regarding areas where it takes emergency responders longer to get to the patient.

Multiple research efforts have shown the benefits of having AEDs accessible for use by members of the public (Mao & Ong, 2016). From 2011-2015, Ross Pollack of John Hopkins Medicine looked at nearly 50,000 OHCA events that occurred in major U.S. and Canada cities. Him and his research team used these patients to form a subgroup of those that took place in public, were witnessed and shockable. When patients had a shock delivered by a bystander, 66% survived to hospital discharge (Pollack et al., 2018). Without bystander intervention, 70% of cardiac arrest patients either died or survived with impaired brain function (Pollack et al., 2018). The summary showed bystanders make a critical difference in assisting cardiac arrest victims before emergency responders can get to the scene. The study speaks on the importance of continuing to educate the general population as the higher public interest in this training means the more lives that could potentially be saved.

Why Bystanders Do Not Perform CPR

The CARES registry uses EMS agencies to report data about OHCA across the United States. Between October of 2005 and December of 2010, 40,274 OHCA events were recorded in the CARES registry (CDC, 2011). Of those recorded, 8,585 cases were removed from analysis due to lack of hospital outcomes or because they had non-cardiogenic etiologies. The remaining 31,689 cases were then analyzed by several characteristics. Even though this is prospective observational data, it is a large patient population that was diverse according to age, sex, and race. The large data pool speaks to its reliability, especially in identifying trends in cardiac arrest care. It should be noted that EMS agencies give data to the CARES registry voluntarily(CDC, 2011). This may indicate the presence of bias as agencies which participate in national registries to improve outcomes may be more progressive in their treatments or may have their own cardiac arrest survival improvement programs which may skew data towards survival.

Of the 31,689 OHCA events in the CARES registry, only 10.6% were witnessed by a 9-1-1 provider. The CARES registry does not define what a 9-1-1 provider is, but it is assumed to be an EMS provider given that it is EMS agencies which participate in the CARES registry; not police or non-EMS fire departments. The other 89.4% of OHCA events were either unwitnessed (52.7%) or witnessed by a bystander (36.7%) (CDC, 2011). This means that 89.4% of cases were first identified by a lay person (not a 9-1-1 responder) and thus had the opportunity for bystander CPR. Only 33.3% of cases had bystander CPR and only 3.7% had bystander AED application (CDC, 2011). Despite the well documented benefits of bystander CPR, it still did not occur in over 50% of cases first identified by lay persons according to the CARES registry (CDC, 2011).

The reasons bystanders do not always perform CPR when confronted with an OHCA event are varied and mutli-factorial. In a 2006 survey of 684 OHCA bystanders in Michigan, Swor et al. found bystander CPR occurred in 33.6% of OHCA events. Further, they found that 54.1% of bystanders were trained in CPR, but only 35.1% of CPR trained individuals actually performed CPR (Swor et al., 2006). These results suggest that simply being trained in CPR may not make a person more likely to perform CPR when faced with an OHCA. Swor et al. (2006) found that characteristics such as public location, witnessed arrest, having a high school education, and CPR training within five years were significant positive predictors of performance of bystander CPR. Swor et al. (2006) acknowledges that they had survey response bias because it was easier to locate bystanders for OHCA events that occurred in private homes. Additionally, respondents' thoughts for why they did or did not perform CPR were not assessed. The surveys from Swor et al. (2006) only looked at a set of objective characteristics which may influence the performance of bystander CPR.

A 2019 survey of people in a compression only CPR class compared pre- and post- class confidence and likelihood of performing CPR and perceptions of barriers to CPR (Bouland et al., 2017). Surveys were handed out at the start and end of the training. Survey data collected prior to training sessions is informative about public perceptions of CPR. The survey showed that respondents had several barriers to performing CPR. These barriers include fear of being sued, risk of contracting a disease, hurting a person by doing CPR incorrectly or unnecessarily (Bouland et al., 2017). Factors such as prior CPR certification and knowing someone who experienced a SCA were associated with lower barriers to performing CPR (Bouland et al., 2017).

Completing a survey about confidence in performing CPR directly after completing the training likely leads to false elevations in confidence. Although the authors found statistically significant changes in likelihood to perform CPR and perception of barriers after training, caution should be used in relying on these outcomes due to this bias. These results would be more valid if respondents were surveyed a month or more after the training to see if attitudes were sustained after leaving the classroom. Caution should be taken when extrapolating secondary results from this survey. The survey was small and 62 of the 300 surveys were discarded due to missing data (Bouland et al., 2017). As such, there is a risk of both respondent bias and that this survey is underpowered to draw conclusions about causative factors that influence perceptions of CPR.

A 2019 review article published in the New England Journal of Medicine further examined the role of bystander intervention in OHCA. The review proposed that lay responders frequently do not perform CPR because they do not recognize when a person is experiencing a cardiac arrest (Brady et al., 2019). Cardiac arrest may initially appear as syncope or seizure and the person may continue to have agonal respirations (Brady et al., 2019). The review proposes that simply teaching starting CPR for someone who is pulseless and apneic may be a reason why bystander CPR is delayed or does not occur because this approach fails to include variations of OHCA presentation (Brady et al., 2019).

Becker et al. (2019) surveyed CPR course participants prior to class to evaluate their perceptions about CPR. They found that the primary barriers to performing CPR were that respondents were concerned about injuring the patient, exposing female breasts during CPR in public, being accused of sexual assault, lacking CPR skills, and causing injury to theirselves (Becker et al., 2019). Also of note, there is considerable self reported discomfort associated with

performing CPR in public and private settings. In those with prior CPR training, 23.7% report discomfort with CPR in public, and 18.7% report discomfort with CPR in private. In those without CPR training, 39.1% report discomfort with performing CPR in public, and 24.1% report discomfort with performing CPR in private (Becker et al., 2019).

A 2018 publication in *Circulation* used data from the Resuscitation Outcomes Consortium registry to evaluate gender disparities in receiving bystander CPR in public (Blewer et al., 2018). Blewer et al. (2018) stated that males were more likely to receive bystander CPR than females when the OHCA event occurred in public, but the gender disparity was not present when the OHCA event occured in a private setting. This was attributed to an increased likelihood that the bystander in a private setting had a personal relationship with the patient. Males had an adjusted odds ratio of 1.27 for receiving CPR in public (Blewer et al., 2018). Blewer et al. (2018) found that this was statistically significant. These findings correlate with survey data from Becker et al. (2019) that people have gender specific concerns with providing CPR to women and that people are more likely to perform CPR in a private setting.

Race and Socioeconomic Disparities in Bystander CPR

Over the years, there have been numerous research studies that have identified a correlation between race/socioeconomic status and the incidence of bystander CPR. These studies have shown that these disparities exist in all communities. An article published in 2020 in the Journal of the American College of Emergency Physicians Open (JACEP Open), compared data from 25 years prior to current data to identify any change in bystander initiated CPR based upon race and socioeconomic status. This data was collected between 2012 and 2018 and excluded any persons <18 years old, non-cardiac causes of CA, those who were presumed to be

dead upon arrival and did not receive CPR, and cases within a healthcare facility or witnessed by a healthcare provider (Justice et al, 2020).

In order to compare geographic location, Justice et al. (2020) used 6 equally weighted factors to develop the Economic Hardship Index. The factors that comprised this index were "unemployment (per-centage of the population who are unemployed), dependency (per-centage of the population under the age of 18 and over the age of 64), education (percentage of persons over the age of 25 who have less than a high school education), income (income per capita), crowded housing (percentage of occupied housing with > 1 person per room), and poverty (percentage of families below the poverty line)" (Justice et al., 2020). This index was adjusted to a 100 point scale, of which a higher number indicated an increased occurrence of hardships thus equaling a lower socioeconomic status, and vice versa. Justice et al. (2020) compared OHCA characteristics of white and black populations and found that there were similar rates of bystander-witnessed events, presence of a shockable rhythm, and arrival times of EMS between both groups; but black individuals were 14.2 percent less likely to receive CPR than their white counterparts. Disregarding race, young people who's SCA was witnessed in a public location were more likely to receive bystander CPR (Justice et al., 2020). White individuals were also linked to having their OHCA in areas that scored low on the Economic Hardship Index (Justice et al, 2020).

Justice et al. (2020) also found a statistically significant discrepancy between bystander initiated CPR dependent on race and socioeconomic status. While this study was conducted in Memphis where the majority of the population is black, the researchers distinguished a correlation between the economic hardship index and bystander CPR, noting that increased hardship leads to decreased bystander CPR rates (Justice et al, 2020). In conclusion of this

article, the researchers were not able to make a statistically significant correlation of CPR rate over time due to the omission of inadequate documentation of the compared data. What they did identify is that there has been an increase in overall bystander CPR by 18.7% between the 25 year comparison (Justice et al, 2020). While this was research performed in a specific location, these disparities are present throughout the United States.

According to the AHA there are 356,000 cardiac arrests per year and only 37 percent of those instances were witnessed by lay persons (American Heart Association [AHA], 2018). In order to have the best outcomes from sudden cardiac arrest, it is important that the event is witnessed. However, even when these events are witnessed by bystanders, only about 40.7 percent of the time bystander initiated CPR is carried out (AHA, 2018). This problem was identified in Minnesota and was studied to understand how to improve rates of bystander CPR.

Allina Health Emergency Medical Services (AH-EMS) responds to thousands of calls each year, of which about 550 of those are OHCA (Boland et al, 2017). The purpose of this study by Boland et al. (2017) was to promote the use of AED, to convey the importance of fast CPR, and to determine if communities that participated in the Heart Safe Communities Program had higher incidences of bystander CPR implementation that resulted in better survival rates following OHCA. Heart Safe Communities is a national program that started in 2002 and is active in 16 different states along with many colleges and universities (HEARTSafe, n.d.).

To become part of these programs, communities need to put together an action plan that they can implement that addresses the key areas regarding cardiac arrest (Boland et al., 2017). Typically these action plans include, recognition of cardiac arrest, CPR and AED training events, increasing the number of AED in the community, and registering available AEDs (Boland et al., 2017). Communities earn “heartbeats” when they carry out their action plans and gain the heart

safe community designation once they have accumulated enough heartbeats (Boland et al., 2017). During the study performed by AH-EMS, there were 46 designated communities and 20 communities pending designation in the state of Minnesota. In the region that AH-EMS covers there were 17 designated heart safe communities. Within those communities were 1,081 AEDs and 44,293 (9%) CPR trained community members (Boland et al., 2017).

During the course of study, 294 OHCA occurred. Of those, 174 occurred in communities with a heart safe designation. Of these cases, ⅓ of the time bystander CPR was initiated and AED used in 5% (Boland et al., 2017). There was a 12% and 14% increase in CPR and AED use, respectively, in communities that were designated heart safe as compared to ones that were not. However, Bourland et al. (2017) concluded that the increased survival rate was attributed to the actions performed by the EMS rather than attributed to bystander initiated CPR. Therefore this difference in percentage was not statistically significant enough to verify that heart safe communities had a positive impact on OHCA survival rates (Boland et al., 2017). While there is still controversy regarding whether bystander initiated CPR was effective, proper identification and increased initiation of CPR is the goal of the Heart Safe Communities Program.

CPR Training in High School Students

If bystander CPR is not initiated in a timely manner many who suffer an OHCA will not survive to the hospital. It is known that bystanders who had previous CPR education are more likely to perform CPR (Meissner et al., 2012). Only 2.4% of the United States population is trained in CPR annually. This low rate of training reduces the likelihood that OHCA patients will receive bystander CPR (Brown et al., 2017). Policies which require CPR education for secondary students can increase the incidence of bystander CPR occurrence and potentially OHCA survival (Virani et al., 2020).

Currently 40 states in the United States have laws requiring CPR education as a high school graduation requirement (American Heart Association [AHA], n.d. - c). There is no consistent requirement of a particular method of implementation of such laws among the states (Brown et al., 2017). Most states implement a hands-on method to teaching CPR as recommended by the AHA, but this is not true of all states. Depending on the state, the instructor may or may not be required to be certified to teach CPR and state laws often do not specify a duration requirement of the training (Brown et al., 2017).

Meissner et al. (2012) looked at the effectiveness of CPR education in the high school population. The study analyzed 132 teenagers of whom took part in a two-hour training that discussed the background of sudden cardiac death (SCD) and provided hands-on CPR training (Meissner et al., 2012). Effectiveness was measured by comparing the initiation of proper chest compressions prior to the two-hour training, immediately following the training and then again assessed CPR skills four months post training. All of the scenarios were kept consistent to be able to assess confidence and retention among students. Prior to the training only 29.5% of the students were performing proper chest compressions, immediately following the training 99.2% of the students were performing proper chest compressions and four months later 99% of the students were still performing proper chest compressions when being assessed (Meissner et al., 2012). The high school population is a valuable target population for learning CPR because of the large-scale setting it encompasses, the ability to reach people of various socioeconomic status and when taught effectively is shown to be retained among this population (Brown et al., 2017; Meissner et al., 2012).

Minnesota state statute 120B.236 states that, beginning in the 2014-2015 school year, Minnesota school districts are required to provide a one time education on CPR as well as

instruction on the usage of an AED for all students in grades seven through 12 (Cardiopulmonary resuscitation… instruction, 2009/2012). Certification is not needed as a result of the education. The education must be in line with the most current and up to date material and follow the American Heart Association or American Red Cross guidelines. Minnesota state statute 120B.236 also states that psychomotor skills must be incorporated into the instruction in some aspect, a non-hands on cognitive only education would not satisfy this statute. The previous version of the law only encouraged schools to provide training. Students were not required to be CPR-certified under the bill.

Under this statute the Minnesota Resuscitation Consortium must provide resources to the school districts to complete the training if requested (Cardiopulmonary resuscitation… instruction, 2009/2012). All of Minnesota's neighboring states have state laws in place requiring high school CPR education. Wisconsin, South Dakota and North Dakota all do not require that the students' CPR education leads to certification but requires hands-on education and the state law is very comparable to that of Minnesota's (AHA, n.d. - c). The state of Iowa requires that prior to the completion of 12th grade all students have completed a CPR course that has led to certification (Iowa Department of Education, n.d.).

Although there are various states that have state laws in place requiring CPR education, there is no formality to ensure that schools are abiding with their state's regulations (Brown et al., 2017). It is suggested that even within each state there are many barriers such as funding and access to adequate training materials that can lead to various levels of CPR comprehension from school to school. More research is needed to better understand what the most effective way is to teach CPR to this population so that when faced with the decision to initiate CPR they feel confident in the skills that have been obtained (Brown et al., 2017).

Conclusion

Sudden cardiac arrest in the pre-hospital setting occurs frequently, is associated with a high mortality rate, and is known to disproportionately impact people of low socioeconomic standing and low levels of education due to increased incidence of cardiovascular disease (Morrison et al, 2016). As established in the AHA's chain of survival concept, treating OHCA relies on bystander recognition of the OHCA event, initiation of CPR, and early use of an AED (Nolan, Sor, & Eikeland, 2006). It is well established that bystander intervention in OHCA events is a positive predictor of survival and improved neurological outcomes (Kragholm et al., 2017). Bystanders experience many barriers to initiating CPR such as fear of harming the patient, fear of contracting disease, feeling incompetant about their skills, and concerns about sexual assault for exposing patients' breasts (Swor et al., 2006).

One legislative attempt to overcome these barriers has focused on educating students on CPR in school. Multiple states have implemented laws which require students to gain CPR education during their primary or secondary education. In Minnesota, the law was implemented in 2014 requiring students to have hands-on CPR training and exposure to an AED between grades seven and 12 (Cardiopulmonary resuscitation… instruction, 2009/2012). However, there is no current data about Minnesota school compliance with the law, nor the effectiveness of the training. This research will seek to evaluate Minnesota school district compliance with this law, the spectrum of CPR education they provide, and the effectiveness of this training.

Chapter three will discuss the methodology behind this research. This research will primarily be conducted with surveys of Minnesota school district administrators to establish the law compliance and spectrum of CPR education provided. Surveys will also be conducted with

Minnesota college students who recently graduated from Minnesota high schools to determine the effectiveness of the CPR education they received during secondary education.

Chapter 3: Methodology

Introduction

Minnesota requires cardiopulmonary resuscitation (CPR) education in the school curriculum between seventh and twelfth grade for graduation. Currently, there is no data about the modality of training, what educational year it commonly occurs in, or what resources are utilized by school districts. The goal of this research is to determine the spectrum of CPR curriculum present in Minnesota schools in accordance with Minnesota state statute 120B.236 and assess the knowledge base possessed by school districts about resources outlined in the same statute. This chapter outlines the survey design, the target population, how the research to be conducted, the data to be collected, and limitations of the design.

Study Design

This study used a mixed methods approach. Researchers used quantitative data to draw conclusions on the quality of CPR education in grades seven through twelve in Minnesota school districts. A survey was used to collect data surrounding the current CPR curriculum in Minnesota school districts. Researchers created a survey that looks at the current spectrum of CPR education. Some school districts may not have CPR education implemented into their current curriculum and others may go as far as their implemented CPR education leading to a national CPR certification. Due to the wide array of education implemented, this can lead to varying levels of CPR preparedness in students. Through the questions in the survey, our research aims to determine if there are any patterns based on location and size of the district, if there are any identifiable barriers to CPR education noted or if Minnesota school districts were aware of Minnesota state statute 120B.236.

The results of this survey are anonymous and cannot be linked back to the school district as no direct identifiers are being collected and researchers are asking for the minimum necessary information to minimize possibilities of indirect identification. Researchers hope that maintaining anonymity allowed participants to answer truthfully despite the theoretical risk of legal action in the event a school district is identified as not complying with state statute 120B.236. Researchers used the data collected to draw conclusions on the current state of CPR education in Minnesota. The results are displayed in chapter four of this research and discussed further in chapter five.

Population

The population of this study is Minnesota school district officials that are involved with CPR education within their school district. An email that includes an introduction to the research, informed consent and background information on Minnesota state statute 120B.236 was sent from researcher Ryan Deering's Bethel University issued email address to all 329 identified Minnesota school districts superintendents and will be asked to respond both anonymously and honestly. The survey describes details about the Minnesota CPR training requirements in accordance with Minnesota state statute 120B.236 but included questions to gather details on what grades CPR training is being taught, who is doing the teaching and what is the overall style of training. The study was designed to be taken on the participants' own time and independently to produce the most accurate and honest results. The survey was emailed to the superintendent of each Minnesota school district. The superintendent was asked to complete the survey if they feel they have the knowledge of their district's current CPR curriculum or forward the survey to a school official that they have deemed more fit to accurately participate in the survey. The

profession of the participant and their connection to the CPR education was collected in the survey.

This survey did not assess the effectiveness of CPR, but rather the overall participation in CPR training in grades seven through twelve. All completed surveys that have been conducted regardless of answers were considered relevant and selected for data analysis. The only criteria for exclusion was incomplete surveys in which the participant chooses to forgo total competition.

Experimental Procedures

The purpose of this research was to determine an overall percentage of Minnesota high schools abiding by the Minnesota state statute 120B.236 and to what degree they are fulfilling this statute. To do this, the researchers created a survey that was administered through an online survey (see appendix B) platform called Qualtrics. There was a Qualtrics setting enabled so that an individual email address cannot respond to the survey more than one time. This survey, with informed consent, was distributed via email to the superintendents listed on the publicly available list from the website hosted by the Minnesota Department of Education, where they completed the survey or forwarded it to the faculty member that is/was in charge of their school's CPR course. Ryan Deering sent the initial survey to the superintendents on May 4, 2022 at 10:00am CST. A follow up email was sent out two weeks later on May 18, 2022 at 10:00am CST.

After the completion of the surveys, a statistical analysis of the data collected was performed. This analysis gave insight into rates of statute compliance, correlations between compliance and population density, and present barriers of curriculum implementation. Analysis included comparison of the experimental compliance distribution to an assumed standard deviation, chi square evaluation of what grade the CPR education occurs in, and a breakdown of

perceived barriers to implementation and other relevant statistical evaluations of CPR curricula. The results of this analysis are presented in chapter four and used by the researchers to draw conclusions for discussion in chapter five.

The analysis of compliance assumes that compliance falls in a standard distribution and compares the compliance rates to the standard distribution. It is felt that assuming a standard deviation is appropriate as it is reasonable to assume that the majority of school districts were compliant with graduation requirements. The researchers expect that a minority of districts are going above and beyond to offer certification and a minority of districts are not recognizing the presence of this specific requirement and are thus non compliant. The left tail of the distribution is non-compliance or under compliance and the right tail of the distribution is going above the requirements of the law and exposing students more than once or providing a national certification. The first standard deviation is assumed to be compliance with the letter of the law. The second standard deviation to the right is assumed to be over compliance, but not ending in certification. The second standard deviation to the left is assumed to be under compliance, but still having a CPR curricula. The third deviation to the right is assumed to be overcompliance ending in national certification. The third deviation to the left is assumed to be non-compliance.

The statistical analysis provides direct comparison between responses to describe information about the nature of CPR curricula across Minnesota schools. The comparison has taken into consideration what grade the school districts have chosen to implement their education. Since there are six possible grades to do this education, researchers will assume that the distribution should be equal across grades. It is expected that 16.6% of schools will provide their CPR education in each of the grades seven through twelve. A chi square test has been used to support or reject a null hypothesis that the CPR curriculum of Minnesota schools will occur at

equal rates in all grades. Rejection of this null hypothesis will provide information that school districts disproportionately include CPR in a certain grade.

The statistical analysis has also provided a simple statistical breakdown of several other factors. The breakdowns have included who is instructing the CPR curriculum and barriers to CPR curriculum implementation. There is an analysis about awareness of Minnesota State Statute 120B.236 including knowledge of the law, requirements, and availability of community resources to aid in compliance. The analyses which provide breakdown are informational for the interested parties and are hypothesis generating for future research.

In order to protect the participants in this research, there were a number of protocols in place. This includes volunteerism, informed consent, anonymous response, and Bethel University's Internal Review Board (IRB) approval. The survey was distributed to schools and it was up to the discretion of the schools to decide if they would like to participate in providing answers. There were three demographic questions at the end of the survey which could potentially be linked back to the school, however these were optional and up to the participant if they wished to answer them. Prior to the start of the survey, each participant was provided with an informed consent which they had agreed to before they were able to continue the survey. This informed consent discussed the risk and benefits of the survey (see appendix D). By using the survey platform Qualtrics, all identifying information was refrained from collection, thereby making the answers anonymous. In addition to this, all answers were collected individually and not grouped by respondents, further making it hard to correlate answer groups to a school district. Finally, the researchers have gone through the IRB process to obtain IRB level two which was approved by Christy Hanson, PA-C, Ed. D. This required all researchers and

participants in this research to achieve basic Collaborative Institutional Training Initiative (CITI) certification.

To ensure the participants privacy and confidentiality, the researchers have used a secure survey tool, Qualtrics. All data collected from the study is available, and only available to those directly involved in the research. This includes, but was not limited to the researchers, research committee members, and research director. The data is stored in Qualtrics under password protection and only accessible to the research team during the statistical analysis and conclusion of the project. This is to remain under secure protection and is only to be used for A Survey of Minnesota School District's Cardiopulmonary Resuscitation Curriculum and Resulting Effectiveness, unless permission is granted from all participants to use their answers for future research regarding CPR education in Minnesota.

Data Collection

Data collection for this research were collected from the results of the survey that researchers have procured via Qualtrics. The survey was sent to the superintendent at all Minnesota school districts via their school affiliated email from Ryan Deering's Bethel University issued email address. The contact information of the superintendents was obtained from the publicly available list from the website hosted by the Minnesota Department of Education. The superintendent may choose to forward the survey link for participation to another member of the school district of whom they deem to have a better understanding of the current CPR curriculum in grades seven through twelve.

Prior to the participants responding to the survey they were asked to read the informed consent and the background information on the purpose of the data collection that is attached to the survey. Participants did have to check a box that states that they have read, understand and

agree to participate in order to access the survey. Participants also had to be made aware that they may choose to withdraw participation in the survey at any time by exiting the survey. If a participant chose to withdraw from the survey without completing it entirely no data was collected from that participant. If the participant chose not to answer any questions within the survey, questions that were answered were still analyzed and used in this research study.

Researchers took measures to minimize the risk that any of the results that were supplied by the schools participating in the survey can be traced back to their school district. Directly identifiable information such as information about each specific school district, their name or location was not collected. The results of this survey remained completely anonymous to researchers and the completed survey responses are only to be accessible to researchers and the expert panel assisting with this research and data analysis. The data has been used to gather information regarding the spectrum of current CPR education within grades seven through twelve in Minnesota and overall compliance, or lack thereof, with Minnesota state statute 120B.236.

The survey consists of 11 multiple choice questions that were answered by the responding party. The survey was written by the Bethel University Physician Assistant students involved with the research and was approved by Kim Harkins, and Tammie Haveman (PA-C, MPAS, Assistant Professor) to minimize any ethical concerns and to ensure the survey produced results that are advantageous to the purpose of this research. The survey questions were submitted to the Bethel University IRB to ensure ethical compliance with research involving human subjects. This project has been granted IRB approval by Christina Hanson (PA-C, Ed. D.), Bethel University's Physician Assistant Program Director and research coordinator prior to

data collection. The survey took an estimated five to ten minutes to complete. Data collection took place from May 04, 2022 through May 31, 2022.

Questions were aimed at understanding CPR education in grades seven through twelve, when CPR education takes place in their school district, what type of training is incorporated, who teaches CPR education and if the education results in national certification. Some demographics were collected to see if there was correlation between population density and the type of CPR education students are receiving. Researchers hope that with the questions included in the survey they were able to identify any barriers to CPR education. If participants are unsure of an answer to a specific question, there was an option for them to choose ‘unknown’.

The researchers have determined that this survey had face validity. Researchers can claim validity because the questions that were assessed in the survey are only relating to Minnesota State Statute 120B.236 and understanding how Minnesota school districts are implementing this into their curriculum. Reliability of this research and the results that will be collected is largely dependent on the amount of participants that choose to complete this survey as well as the mindset and understanding of the current CPR curriculum in the participants' school district.

Researchers informed each superintendent to either complete the survey themselves or to forward the survey and the corresponding information to a school official of whom they feel is the most knowledgeable in what the current CPR curriculum is within their school. This way only one survey per district was completed. The intent is that each questionnaire is answered by the party within the school that is most knowledgeable of this information to increase the validity of the results. The target response rate for this survey is ten percent in order to provide the minimum number of responses to generalize the results. Researchers could not guarantee that respondents participating are not answering survey questions with a bias due to it being

correlated with the school's compliance with a current state law and possible ramifications that could stem from that.

In an attempt to increase reliability and to minimize bias, researchers have exposed the theoretical risk to the responding participants and explained how researchers have taken measures to not collect data that can expose the school district to the answers in which they gave in the survey for their protection. The goal of this study was to simply understand overall compliance with Minnesota state statute 120B.236 and the spectrum of CPR education in Minnesota school districts, not to expose schools of which were not aware and/or complying with Minnesota state statute 120B.236.

Direct data from the survey will only be available to the Bethel University Physician Assistant students and their chosen expert panel assisting with data analysis. The expert panel that may be assisting in analyzing the data collected includes Kim Harkins, program manager for the Center of Resuscitation Medicine, Tammie Haveman, Clinical Faculty at the Bethel University Physician Assistant Program and Donald Hopper, statistician with Bethel University. The data collected was analyzed and resulted. The data will have no identifiable information but was published and can be used for further research studies that may look to make changes to Minnesota state statute 120B.236 to ensure that a more cohesive and comprehensive approach to CPR education is taken in all Minnesota schools.

Limitations and Delimitations of Study Design

Research is of value when the findings from a sample can be generalized to a meaningful population. At the very least, it should be possible to generalize from the sample to the population from which the sample was drawn (Andrade, 2021). Surveying a percentage of Minnesota public high schools and observing their participation in CPR education according to

state statute is a powerful opportunity because it provides the ability to obtain data from those who are directly impacted by the statute. When the population addressed cannot be described or when the sample is contaminated with biases, findings from surveys may be misleading and therefore could not be generalized (Andrade, 2020). This section outlines the limitations and delimitations of this study.

Limitations to this study center around the voluntary and unaccountable nature of internet-based surveys. When participants answer questionnaires, respondents may have chosen not to answer surveys because of being overwhelmed with survey requests or due to lack of incentive (Peytchev, 2010). This limitation was addressed by including a purpose statement in the survey request about the value of the data being gathered. This could have still resulted in a skewed response due to a selection bias due to preferring those who agree with the purpose of the study. For example, those who agree that CPR should be a high school graduation requirement were more likely to complete the survey.

There may have been an unwillingness to disclose accurate information as they may want to be correct and being incorrect may cause embarrassment (Bowling, 2005). The survey asked questions about compliance with a state statute. As such, survey recipients may have dismissed responding to avoid opening an organization up to perceived or actual legal implications or investigation. In the same vein, those who do respond may have falsified their responses due to the same perceived or actual legal implications associated with failure to comply with a state statute. The researchers have attempted to minimize this limitation by not collecting information which could be used to identify the respondent and the organization they work such as names, gender, city or county, and name or number of the respondent's school district.

While this survey was designed to understand the spectrum of CPR curricula in Minnesota schools, it was not designed to evaluate the effectiveness of that education, nor the students retention of CPR knowledge. The survey was not collecting information regarding student performance or participation. Along those lines, this survey was not collecting information about pass rates for certification exams. The researchers were not looking to identify specific community resources outside of what is listed in Minnesota state statute 120B.236. Questions about utilization of free community resources used in CPR education such as resources from the Minnesota Resuscitation Consortium and generic titles such as 'paramedic', 'EMT', 'police officer', and 'firefighter' were used in the survey, but refrained from identifying specific agencies. Refraining from identifying specific agencies kept the scope of this research generalizable.

Conclusion

Based on the data collected through the previously described techniques, the researchers sought to provide insight into how Minnesota school districts approach their CPR curriculum and how they utilize available resources. Chapter four will display the results of this methodology and chapter five will contain a discussion of those findings. The analysis of this data includes rates and extent of statute compliance and what community resources school districts utilize. The researchers have described details about the CPR training such as in what grades CPR is being taught most frequently, what training programs are used, the modalities of training, and what barriers exist for school districts when trying to implement this curriculum. The results of this survey are available for use by the Minnesota Resuscitation Consortium, Minnesota Department of Education, Minnesota school districts, and any other interested parties

to help inform how to improve access to resources, how to implement CPR curricula, and how to ensure students get this valuable education.

Chapter 4: Results

Introduction

Researchers sent surveys to over 300 schools and received a less than 10% response rate. The response rate was reasonably lower than what was expected and planned for, but there are still trends worth exploring within this data set. Of the data that was collected, it was analyzed to determine when in the curriculum CPR is being taught and who is teaching it, to estimate the spectrum of compliance to Minnesota state statute 120B.236, and to identify demographic trends which may be used to inform policy makers about which populations struggle to implement this curriculum. Of note, it was originally planned that we would analyze the spectrum of compliance by comparing the data to a standard deviation bell curve. Due to a response rate that was lower than expected and inconsistent responses concerning the spectrum of CPR education, researchers elected to forgo the comparison to the standard deviation as the collected data was not sufficient to analyze the spectrum in this manner. While the low response rate challenges the generalizability of this data set, data gathered here is potentially hypothesis generating for further research and may reveal large gaps in policy or understanding of the statute in question.

Demographics

Researchers sent the survey to 329 school district superintendents in Minnesota. 32 districts responded to the survey. Four respondents did not consent and did not continue with the survey. 28 of 329 eligible districts participated in the survey for a participation rate of 8.5%. Six respondents stopped participating in the survey at various points in the survey; including two respondents who consented and then never participated in the survey. Blank responses were omitted from result calculations.

21 of the 28 consenting respondents completed the demographic questions at the end of the survey. Of those respondent school districts, two considered themselves to be urban school districts, five considered themselves to be suburban school districts, and 14 considered themselves to be rural school districts. The percentage of students participating in free or reduced lunch was used as a proxy estimator of socioeconomic status of the school district. The estimation being that a school district of higher socioeconomic status would have less students participating in a free or reduced lunch program. Of the 21 respondent school districts, only 16 of them were able to answer this question. Of those, seven school districts had 10 - 25% of students participating in a free or reduced cost lunch, seven school districts had 26 - 50% of students participating in a free or reduced cost lunch, and two school districts had over 50% of students participating in a free or reduced cost lunch program.

School Districts reporting percent of students in a reduced or free lunch program	Rural	Suburban	Urban	**Total**
>50%	2	0	0	2
26 - 50%	4	2	1	7
10 - 25%	5	2	0	7
Unknown	3	1	1	5
Total	14	5	2	**21**

Table 1. Comparison of respondent school district population densities and the percent of their students participating in a free or reduced lunch program. There were 21 respondents who filled out demographic information. 33.3% of schools had under 25% of students in a free or reduced lunch program. 33.3% of schools had between 25 and 50% of students in a free or reduced lunch program. 9.5% of schools had over 50% of students in a free or reduced lunch program.

Data Analysis

This study sought to determine the extent of CPR training and education provided by Minnesota high schools in accordance with Minnesota state statute 120B.236. Initially, the study aimed at gaining an understanding of the quantity of Minnesota school districts that were simply aware of Minnesota state statute 120B.236. Researchers found that 23 of the participating school districts were aware of Minnesota state statute 120B.236 mandating CPR education between grades seven through twelve (see **Figure 1**). Three of the participating school districts were unaware of the law and two participants left this question blank. Based on completed responses, 11.5% of school districts indicated they were unaware of the current law about CPR education in Minnesota.

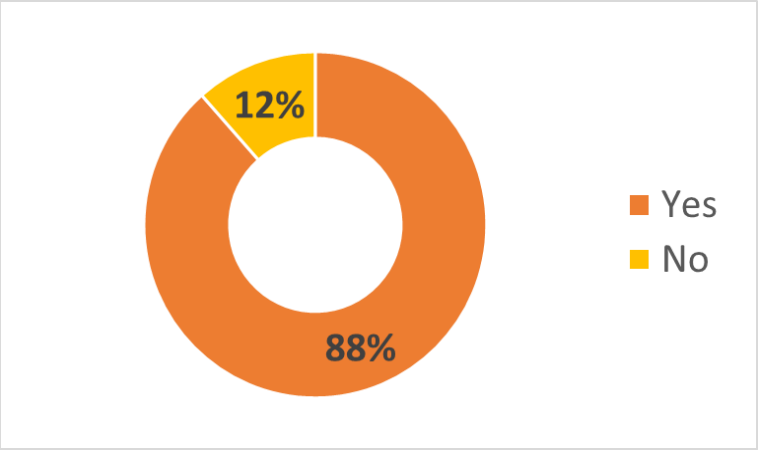

Figure 1. Percentage of school districts aware of MN statute 120B.236 mandating one time CPR education between grades seven and twelve. There were 26 respondents for this question. Twenty-three of the 26 respondents were aware of the current Minnesota law requiring CPR education.

Of the 23 school districts who responded to the survey only six school districts were aware that one can request CPR course materials (such as videos and/or mannequins) through the Minnesota Resuscitation Consortium (MRC) free of charge (see **Figure 2**). Of note, 14 respondents who reported they were aware of the MN statute 120B.236 also reported that they

were unaware that the statute offered free resources through the MRC. Three of the respondents who expressed awareness of statute 120B.236 left this question blank.

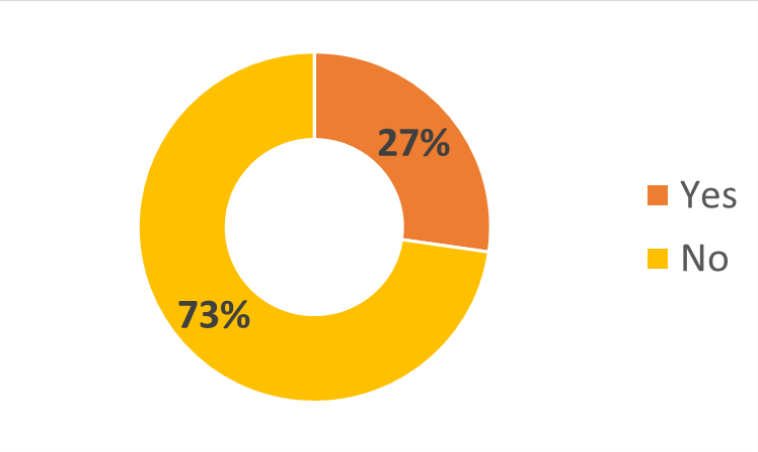

Figure 2. Percentage of school districts aware that MN statute 120B.236 offers resources from the Minnesota Resuscitation Consortium free of charge for CPR education. Of the 22 respondents for this question, only six of them were aware of the ability to access free resources for CPR education through the Minnesota Resuscitation Consortium.

The study also sought to understand when in the curriculum CPR was being included with the thought that this could help with implementation of CPR curricula for districts which struggle with finding room in the curriculum. There were a total of 43 responses from a total of 21 respondents. Twelve respondents reported that CPR was taught in a single grade. Seven of those twelve taught CPR in the tenth grade. Four respondents reported the district included CPR in the curriculum in four or more grades. Through the use of a CHI square analysis, it was found that a significant number of schools taught CPR in the tenth grade. The p-value for the number of districts teaching CPR in the tenth grade was 0.013 which is statistically significant (see **Table 2**). However, this is a statistically significant result with a relatively small sample size.

Grade	Observed (O)	Expected (E)	(O-E)^2/E
7	3	7.16	2.42
8	7	7.16	0.00
9	5	7.16	0.65
10	16	7.16	10.91
11	6	7.16	0.19
12	6	7.16	0.19
		X^2	14.36
		p-value	0.013

Table 2. CHI square analysis of grades when CPR is taught. There were 48 total responses. Five responses answered "not applicable" indicating that they did not teach CPR. There were 43 experimental responses from 21 respondents which indicates that respondents taught CPR more than once in their curriculum. A statistically significant number of school districts taught CPR in the 10th grade.

This study also sought to gain understanding about details of the CPR curriculum such as who was the instructor, were they a certified CPR instructor, did the CPR class result in CPR certification for the students in the class, and if so, which curricula were used for the certifications. The majority of instructors used to teach the CPR curriculum in responding school districts were health teachers, followed by outside sources such as local EMTs, paramedics, or firefighters, and the minority of respondents used physical education teachers. Regardless of the professional role of the CPR instructor, over 80% of them were certified to teach CPR. Four of the health teachers made up the one “unsure” and three “no” responses regarding CPR instructor certification.

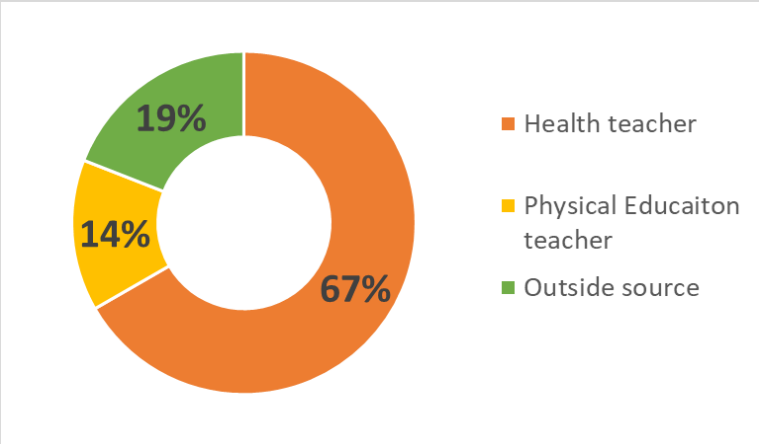

Figure 3. Sources of CPR instructors. Outside sources indicated local first responder groups such as EMS, police, or fire departments. 14 of the 21 respondents indicated health teachers were the primary CPR educators. Four respondents used outside sources and three respondents used physical education teachers.

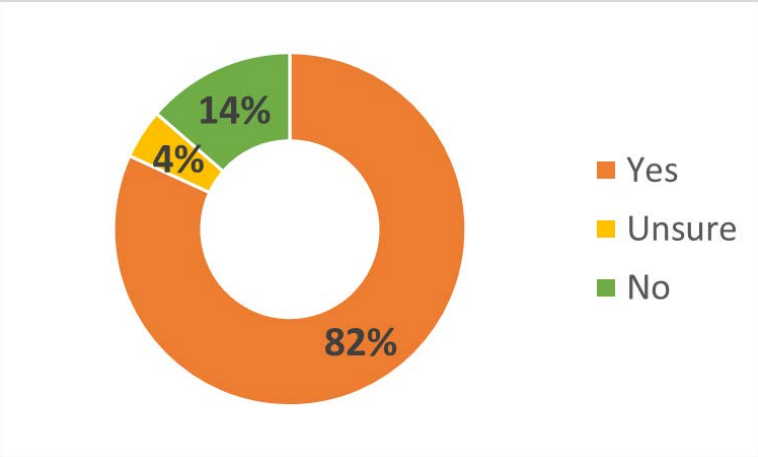

Figure 4. Percentage of instructors who are certified to teach CPR. A significant majority of CPR instructors were certified to teach CPR.

Despite the fact that the majority of teachers were CPR instructors, only 13 respondents indicated that their CPR curriculum resulted in their students getting CPR certified (see **Figure 5**). CPR certification is not a current requirement for MN statute 120B.236. Of the 11 respondents who indicated that their curricula does not result in certification, eight of those courses were taught by health teachers and three responses regarding the instructor were left blank. As displayed in **Figure 6**, schools that had CPR curricula that resulted in certification were near evenly split between using the American Heart Association and American Red Cross.

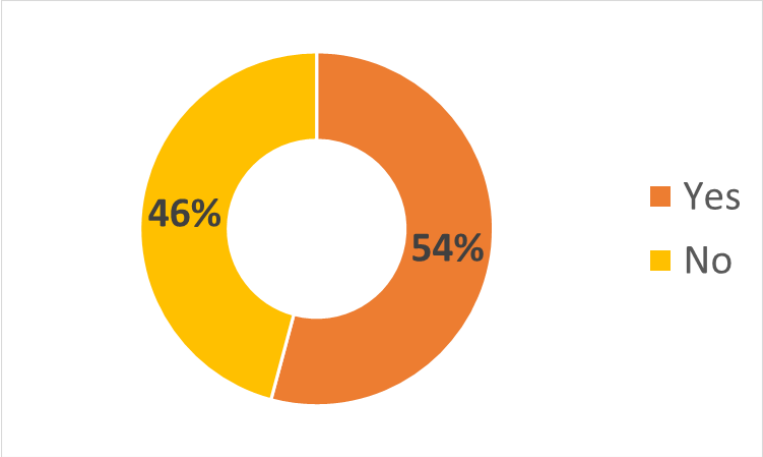

Figure 5. Percent of MN high school CPR curricula which result in student certification in CPR. Reflects the spectrum of CPR education in MN schools. Of school districts with a CPR curriculum in place, over half result in certification.

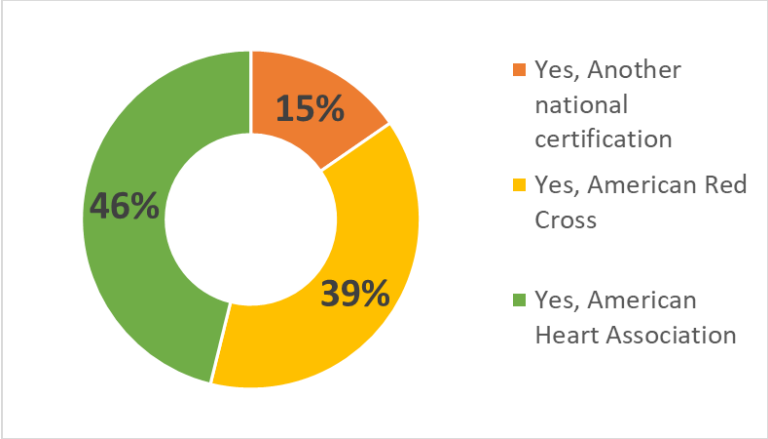

Figure 6. Breakdown of certifications obtained by national organizations. The American Heart Association and American Red Cross are utilized almost evenly.

Summary

Based on these results with a notably small response rate, it appears that the majority of school districts are aware of MN statute 120.236 mandating CPR education between grades seven and twelve, yet were unaware that the statute grants free CPR education resources to school districts should they request those resources. School districts which have managed to implement the CPR curriculum have most often been able to fit it in within the 10th grade curriculum and usually have a health teacher, or occasionally a physical education teacher, as the

instructor. Notably, the majority of instructors are CPR instructor certified and over half of responding school districts noted that their CPR curriculum results in CPR certification for the students. These results show that there is a wide spectrum of CPR education in Minnesota school districts which ranges from no education, which was the minority of respondents, through full CPR certification of the students, which was over half of respondents who had a CPR curriculum in place. These results are certainly hypothesis generating and may help inform further research.

Chapter 5: Discussion

Introduction

Discussion sections in research papers are one of the most important chapters for it provides reason for the research and explains the data found by the researchers. Not only is it a place for the researchers to interpret the data and find trends, but it is a place where the researchers can explore the underlying meaning behind the research. In this section, the researchers will explain and summarize the results, address their theorized limitations and if they encountered any unexpected limitations, and discuss the potential for further research.

Summary of Results

There was an 8.5% response rate to the survey that was created to collect data surrounding the current CPR curriculum in MN school districts. This survey was sent to all 329 current MN school district superintendents of whom could pass the survey along to a staff member whom they deemed more fit to answer the survey if applicable. It was statistically significant that the majority of the responding MN school districts are teaching some form of CPR education in grade ten. Very few school districts taught in grade seven. Researchers also 88% of respondents were aware of Minnesota state statute 120B.236 and its requirements, but 73% of respondents were unaware that the same statute had language providing free CPR resources for school districts. Additionally, it was the minority of respondents who did not have a CPR curriculum in place. Of the respondents with a CPR curriculum in place, over half of them resulted in CPR certification for the students.

Limitations

All research is subjected to limitations. As such, it is beneficial to know what potential limitations you might and will encounter during the research process. In chapter three, the

researchers discussed some limitations that they theorized they might encounter during the research process. Prior to dispersing their survey, one of the major limitations that the researchers were concerned about was the number of voluntary participants that would respond to the survey. With only distributing about 300 surveys and little to no incentive for participants to complete the survey, the researchers expected there to be a lower response rate.

To hopefully combat this potential issue, a purpose statement was formulated and sent with the survey to inform the participants about the importance of this research in hopes of a more robust response. It was evident that even with a purpose statement, the researchers only achieved a 8.5% response rate. Secondly, the researchers were limited to the hope of truthful responses. While it would be nearly impossible to assess whether or not the participants were responding truthfully, the researchers tried to mitigate this by not collecting identifiable information for the respondents. With potential for untruthful or false responses due to embarrassment or fear of legal action for not complying with the state statute, it can be assumed that not 100% of the survey responses are 100% accurate.

Before sending out the survey, the final limitation that the researchers were concerned about was not evaluating the effectiveness nor retention of the CPR classes. Gathering information about the process of how and who teaches the CPR classes and to what extent the class is taught is highly important to the research. However, without gathering the effectiveness and retention of information from the class based on each class technique, it is hard to give advice on the best way to teach CPR classes to high school students. Upon completion of the survey, the researchers identified an additional limitation that might have impacted their final results, that being the time that the survey was dispersed.

The survey was originally sent out on May 4, 2022 and then again on May 18, 2022. With this time being close to the end of the school year for these schools, our response rate might have been skewed due to the respondents' time in correlation to the end of school activities. Limitations in research projects are an aspect that is inevitable. However, knowing the potential limitations before conducting the study to potentially adjust the research or mitigate the effects of the limitations is essential for the research to be as beneficial as possible.

Further research

The survey that was created to assist researchers with data collection was sent to all superintendents of Minnesota school districts. However, there was only an 8.5% response rate and some of those responses chose not to respond to any portion of the survey. Due to this researchers do not feel that adequate data was collected to demonstrate the full spectrum of CPR training that is taking place in Minnesota school districts in grades seven through twelve. However a statistically significant amount of schools that responded to the survey taught CPR education in grade 10. Of the responses gathered in the data only 11.5% of schools were aware of Minnesota state statute 120B.236. Given the low response rate and the possibility that potential respondents chose to not participate due to possible legal ramifications, the 11.5% percent is most likely an underestimate of the number of schools who are unaware of Minnesota state statute 120B.236. Thus, the intent of this statute is not fully recognized if the intended education is not happening in Minnesota school districts.

Researchers did not gather enough statistically significant data to draw any other strict conclusions. Researchers believe that further research is needed in this area to see if there could be changes made to Minnesota school district CPR curriculum that could enhance bystander CPR rates and thus improve the chances of survival in the event of an out of hospital cardiac

arrest (OHCA). Additionally, efforts should be focused on improving awareness of the statute, access to community resources, and implementation of a CPR curriculum.

Closing

Out of hospital cardiac arrests have a high mortality rate, but with adequate recognition and initiation of proper CPR, chances of survival can be significantly improved. This research study aimed to determine the possible correlation between the spectrum of CPR training or lack thereof and CPR initiation. Researchers were attempting to determine the spectrum of CPR training in grades seven through twelve in Minnesota school districts. In closing, due to the 8.5% response rate of this research survey primary researchers feel that more participation is needed in this area in order to adequately answer the research question in which they wished to answer within this research. In order to present an accountable answer, researchers believe that further data collection is needed in order to fully determine the spectrum of CPR curriculum in Minnesota school districts.

Overall Conclusion

All in all, cardiovascular disease continues to be the leading cause of death world-wide (Virani et al., 2020). CPR is a crucial lifesaving tool during times of an emergency that can significantly increase the chance of survival when initiated promptly and accurately after a cardiac arrest. The current issue at hand is not enough people have the necessary knowledge and confidence to perform CPR if prompted to. Minnesota state statute 120B.236 makes an effort to at minimum expose Minnesota high school students in grades seven through twelve to proper instruction on CPR and AED (automated external defibrillator) education at a young age that could additionally allow them to enhance their psychomotor and cognitive learning through hands-on training. Even though many schools are aware of the statute requirements, they are

unaware that the statute has language which provides free CPR education resources to Minnesota school districts which request them. This oversight needs to be addressed and resolved if we want to truly save lives using CPR.

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APPENDIX A

Survey

Survey

1. In what grade does your school district implement CPR classes? (choose all that apply)
    a. 7
    b. 8
    c. 9
    d. 10
    e. 11
    f. 12
    g. N/A
2. Minnesota state statute 120B.236 currently requires that all Minnesota schools have a CPR curriculum at some point within students' education between grades seven through twelve as a graduation requirement. Is your school district aware of the current MN State Statute 120B.36?
    a. Yes
    b. No
3. What does your current CPR class consist of? (select all that apply)
    a. Hands on CPR training
    b. Hands on AED training
    c. One time video presentation
    d. CPR video presentation
    e. AED video presentation
    f. Only video presentation, no hands on
    g. We currently do not have a CPR curriculum in place
    h. None of the above
4. Does your CPR class result in certification (certification is not a requirement of MN statute 120B.236)?
    a. Yes, American Heart Association
    b. Yes, American Red Cross
    c. Yes, Another National Organization
    d. No
5. Who teaches the CPR curriculum?
    a. Health teacher
    b. Physical Education teacher
    c. Outside source
    d. None of the above

6. Is the CPR instructor a certified CPR instructor?
    a. Yes
    b. No
    c. Unsure
7. Were you aware that you can request CPR course materials through the Minnesota Resuscitation Consortium free of charge?
    a. Yes
    b. No
8. If you do not currently have a CPR curriculum, are any of the following limitations to implementation? (select all that apply)
    a. Qualified Instructor
    b. Access to equipment
    c. Time in curriculum
    d. Finances
    e. Other
    f. N/A we currently have a CPR curriculum in compliance with MN statute

Demographic Questions

This section is needed in order to be able to compute data and determine if there are any trends based on demographics. This is completely anonymous and cannot and will not be traced back to your school.

1. Which of the following best describes the population density of your school district?
    a. Urban
    b. Suburban
    c. Rural
2. Which role best describes the position in the school district of the survey respondent?
    a. Superintendent
    b. Principal
    c. Teacher
    d. School Nurse
    e. Other
3. What percentage of your students participate in free/reduced lunch?
    a. 0%
    b. <10%
    c. 10% - 25%
    d. 26% - 50%
    e. >50%
    f. Unknown

APPENDIX B

Research Background & Informed Consent Form

Research Background & Informed Consent Form

Research Background Information:
You are invited to participate in a survey regarding the current cardiopulmonary resuscitation (CPR) curriculum within your school district. From this survey we hope to determine the spectrum of current CPR curriculum in Minnesota public schools in accordance with Minnesota state statute 120B.236.

Minnesota state statute 120B.236 currently requires that all Minnesota public schools have a CPR curriculum at some point within students' education between grades seven through twelve. This statute as of current does not outline a specific teaching method or require a national CPR certification to be the end result of the training. The training length is also not outlined in this statute. With the lack of direction within this law, Minnesota public schools are likely approaching CPR education in various ways, thus leading to various outcomes. The intent of this study is to better understand the spectrum of CPR education within Minnesota public schools to determine if there are identifiable patterns or areas for improvement.

This survey is being sent to all current Minnesota public school superintendents. You were selected for this survey because you are the superintendent at the school or the superintendent deemed you to be more knowledgeable with the current CPR curriculum for grades seven through twelve within your school district.

If you decide to participate in this survey, you will answer 11 multiple choice questions regarding CPR education within your school district. This survey should take an estimated 5-10 minutes to complete. We truly appreciate your time and honesty to help us collect this important information. This survey is completely anonymous and answers cannot be traced back to any school district.

Purpose:
The purpose of this survey is to get a better understanding of the current CPR education or lack thereof in Minnesota public schools. Currently there is a barrier to bystanders performing CPR. The results of this survey will be published and will be accessible to organizations who may use the data to make changes to Minnesota state statute 120B.236 to make a more effective approach to CPR education within Minnesota public schools.

Risks of Participation:
Since researchers are evaluating compliance with MN state statute 120B.236, there is a small theoretical risk of legal action or threat to individual employment status depending on the employee’s school district policies. The risk is only present if it becomes possible to identify a school’s specific response of non-compliance. Researchers have taken measures to minimize risk

to participants by collecting the minimum necessary demographic information. Researchers are not collecting or retaining directly identifiable information about participants or their school districts including name, location, district name or number, or contact information. If at any time the participant wishes to discontinue their participation in the survey they can simply exit the survey and their results will not be collected.

Benefits:
Participants will be contributing information about the current state of CPR education within their school district and their efforts to help train students this life saving skill. This information may then be used to improve CPR education in Minnesota schools in the future and may increase funding for such education.

Confidentiality:
Your participation in this study is voluntary and completely anonymous. The results of this survey cannot be traced back to you or the school district in which you represent. The data collected will be accessible to the Bethel University Physician Assistant Graduate Program for their master's thesis research project. The data collected from this survey will only be accessible to the Bethel Physician Assistant Students for analysis and reporting of findings.

Our findings may be shared in presentations and publications, both of which will not contain any identifiable information.

Summary:
Your participation in this survey is voluntary. Your participation in this study will not affect your relation with Bethel University in any way. We thank you for your consideration in helping us improve CPR education for the students in Minnesota.

This research study has been reviewed and approved in accordance with Bethel's Levels of Review for Research with Humans. If you have any questions about the research, your rights as a participant please call:

Primary Researchers:

Ryan Deering: (612) 518-9228
Nikole Hemish: (507) 819-1932
Spencer Pearson: (608) 449-4931
Joshua Vollmar: (920) 883-0328

IRB approved by Christina Hanson, Bethel University's PA Program Director

Please print or save this screen of consent for your records.

Agreement to Participate:

Participation in this survey is completely voluntary and you may choose to withdraw at any time. By continuing, you are confirming that you have read, understood and agreed to participate in this research study.

To agree, click the button that will prompt you to begin the survey. We truly appreciate your time.

APPENDIX C

Bethel University IRB Approval

Bethel University IRB Approval

Christy Hanson <c-hanson@bethel.edu> Thu, Feb 24, 2022, 4:34 PM
to me, Ryan, Josh, Spencer, Peter, Tammie

Nikole, Ryan, Josh, and Spencer,

I am writing this letter to confirm program director Level 2 IRB approval of your project entitled, " A Survey of Minnesota Public School's Cardiopulmonary Resuscitation Curriculum," based on the application submitted on 2/23/2022.

This approval is good for one year from today's date. You may proceed with data collection and analysis. Please let me know if you have any questions.

Sincerely,

Christina B. Hanson, EdD, PA-C
Physician Assistant Program Director
Bethel University | Graduate School
651.635.1013
3900 Bethel Drive, St. Paul, MN 55112