

SCHOOL DISTRICT ASSESSMENT FOR SUDDEN CARDIAC ARREST PREPARATION

Manuscript submitted to
The Journal of School Nursing

Paula Dahlen, RN, BSN FNP-S
University of Alaska, Anchorage
School of Nursing

Abstract

A literature review on pediatric sudden cardiac arrest (SCA) suggests that school nurses nationwide are well supported in their responsibilities to manage SCA in school children, despite budget and equipment challenges. In this Masters project, school nurses in a district in the Pacific Northwest completed an online survey to assess their perceptions of personal and organizational preparedness to respond to SCA. As described by the AHA, best practices include: an effective and efficient communication system; coordination, practice, and evaluation of a response plan; risk reduction; training and equipment for CPR and first aid; and in some schools, establishment of an automated external defibrillator (AED) program. Forty-four percent of respondents reported that they have received an adequate amount of resources, support, training and preparation in their school to manage a sudden cardiac arrest event.

Key Words: Sudden cardiac arrest, school age children, emergency action plan, AED, CPR, school nurse, laws

Problem

Sudden cardiac arrest (SCA) is “the sudden cessation of cardiac activity so that the victim becomes unresponsive, with no normal breathing and no signs of circulation” (Hazinski et al., 2004). SCA is always life threatening and is often fatal but there is potential for survival if perfusion and oxygenation are maintained and cardiac function is restored. Sudden cardiac arrest in the pediatric population may have many causes including: congenital, structural or electrical cardiac anomalies and abnormalities, traumatic, hypothermic or hypoxic cardiac injury, electrolyte imbalances, the use of illicit drugs, over the counter medications and stimulants as well as some prescriptions medications (AAP, 2012). Sudden cardiac arrest (SCA) of a child in the school setting is a devastating event that often has witnesses and responders who are children who know the victim. Approximately 5800 children in the United States experience an out of the hospital SCA each year (Griesenbeck, 2011). Adults are also at risk of a cardiac event while working or visiting a school. It is important to note that the teacher is often the only adult in a room of students and therefore the possibility exists that children are initially responding to a SCA event without adult assistance.

Emergency preparedness is the most effective way to manage these unexpected life-threatening events. Drezner et al. (2007) states, “The most important factor in SCA survival is the presence of a trained rescuer who can initiate CPR and has access to early defibrillation” (p.155). Many schools no longer employ a full time nurse or licensed health care provider, leaving the burden of responding to medical emergencies to the school faculty (AAP, 2008; Boudreaux & Broussard, 2012). Poor outcomes in SCA events are common and therefore appropriate immediate response efforts must be optimized. Factors found to be associated with poor outcomes include “poor rescuer recognitions of SCA, inaccurate rescuer assessment of

pulse or respirations, delayed access to AEDs and early defibrillation, and the presence of intrinsic structural cardiac abnormalities, such as hypertrophic cardiomyopathy, which may become more resistant to defibrillation with delays in resuscitation” (Drezner et al., 2008, p.798).

Incidence of SCA in the pediatric population is difficult to quantify with accuracy. There is no mandatory reporting program in place, making data collection inconsistent. Available incidence reports range from 0.5 to 1.0 per 100,000 high school athletes (Maron, 1998), 0.18 per 100,000 per students in general (Lofti et al., 2007) and as high as 4.4 per 100,000 high school athletes in specific districts (Drezner, 2009). Corrado et al. (2006) suggest that some studies have reported a two to two and a half times greater risk of sudden cardiac arrest during athletic competition or exercise, which may contribute to the higher incidence of SCA in the high school population.

Knilians (2011) has reported 25-50 SCA events annually in U.S. high schools. An estimate published by the CDC postulated that 2000 SCA deaths of people under the age of 25 occur annually (Kung et al. 2008). Drezner, Chun, Harmon and Derminer (2008) report 115 annual deaths or one every three days. Despite the wide range of estimated incidence, the result of these devastating events affects families, schools, athletic organizations, and communities on numerous levels (Drezner et al., 2008).

When SCA and other life-threatening events occur in the school setting responding nurses, faculty and staff can reduce their stress and improve outcomes through implementation of a detailed and functional emergency action plan. Though the occurrence of specific emergencies is unpredictable, school nurses should expect and anticipate that emergent situations will eventually (and possibly frequently) happen at their school. A national survey of 1000 randomly selected school nurses by Olympia, Wan & Avner (2005) revealed that in the year prior to the

survey, 68% of school nurses had activated EMS to respond to a medical emergency. In this study, 86% of surveyed schools had an emergency action plan, but 35% had never tested the protocol and only 32% of the schools had accessible AEDs. The recommendations from this study included practicing an emergency action plan (EAP) several times a year, linking all areas of the school campus directly to EMS, assigning roles to school faculty during emergencies, increasing AED availability and providing training to increase the confidence of school nurses when dealing with SCA (Olympia et al., 2005).

Purpose

Currently, nurses in this Pacific NW district care for 48,000 students annually, averaging 2700 student visits daily between the 112 nurses employed (Boots, 2013). Since 2006, all non-charter schools in the respondent's school district have employed a full time nurse. Budget cuts that will require a reduction of the school district's spending by nearly 50 million dollars over the next two years may result in an impact to future nursing coverage (Boots, 2013). SCA events are life threatening, their occurrence is unpredictable and they require rapid appropriate response.

The purpose of this project was to use the responses of school nurses to determine areas of excellence and areas of potential growth in the school district's training, resources and implementation of managing a sudden cardiac arrest event. SCA events can occur during school hours or after school hours and may affect more than just the student population. Having trained faculty and a well established plan in place are critical to positive outcomes.

Background

The cost of implementing a comprehensive EAP that includes education of both staff and students on CPR and AED emergency response procedure is a potential barrier for most school systems. Hazinski et al. (2004) estimated it would cost each school approximately \$7,965 for the

first year and \$3,065 annually to invest in an EAP, which would result in a cost per life savings ranging from \$1,587,670 to \$3,353,110. This cost analysis does not include the immeasurable benefit of providing the school and community with a large number of trained adolescents who can provide CPR and use an AED. Having numerous trained students at school and at extracurricular functions make it not only safer for the students, but for faculty, parents and visitors who are on the campus (Drezner Ashwin, Heistand, Bloomingdale & Harmon, 2009). High school athletic and sporting events carry one of the greatest risks of SCA with 54% of SCA events occurring in high school students and 82% during competition or training (Harmon, Asif, Klossner, & Drezner, 2011)

One example of a program that has been effective in training and responding to SCA in the academic setting is Project ADAM (Automated Defibrillators in Adam's Memory). Project ADAM was started in 1999 after Adam Lemel, a high school student collapsed and died on the gym floor of his high school where there was not a defibrillator available. The program has been implemented in over 800 schools in Wisconsin and now has 7 affiliate programs in other states. As of January 2012, there have been 56 "saves" in schools that are using Project ADAM programs for AED implementation. The program goals consists of developing a comprehensive EAP, recognizing SCA, promoting CPR/AED training for students and staff, and selecting equipment to use for SCA as well as making sure it is accessible and well maintained (Projectadamtennesse, 2012). To date, Project ADAM and its associated partners have had no experiences in which funding could not be found to implement an AED program. Fundraising, parent donations, and local communities are resources available to help fund the program (Berger, 2009).

National laws are limited in regards to AED placement, training and use, as most are

determined at the state level. In November of 2000, President Clinton signed the federal Cardiac Arrest Survival Act that provided civil immunity for Good Samaritans, building owners or renters who attempt to purchase or use an AED to save a life (National Conference of State Legislature, 2012). Even with the support of legislation to improve AED use, there are still inconsistencies in how AED programs are implemented. Current American Heart Association guidelines recommend a lay person AED program implementation in a school if it meets any one of the following three criteria: 1) the probability of cardiac arrest is likely to occur at a minimum of once every 5 years or 2) there is a presence of any student or staff who are at high risk of cardiac arrest or 3) local emergency medical services (EMS) cannot respond to provide services within 5 minutes of collapse (Hazinski et al., 2004). The recommendation for calculating the probability is if there has been an SCA onsite in the past 5 years or based on population demographics.

While AEDs in schools are not mandated in every state, it is becoming more common, with New York becoming the first state to require AEDs in 2003. The National Conference of State Legislature (NCSL) website states that as of January 2012 there were a total of 56 state bills pending or passed which specifically relate to AEDs and cardiac arrest. Despite these laws in place, AEDs are not always being used. In November 2008, a high school soccer player in Florida collapsed and had CPR performed by coaches, a nurse and bystanders, but the AED that was sitting nearby in a golf cart was never used. The student survived but suffered catastrophic brain damage and now lives in a vegetative state. In February 2013, the Florida Appellate Court issued a judgment in favor of the School District, citing §1006.165, Florida Statutes (2008) which requires public schools to maintain AEDs and provide a properly-trained employee on school grounds at all times, does not require that equipment to be used, only to be available. The

court cautions against applying the outcome as a rule since laws regarding provision of prompt medical care are still being discussed and reviewed (Carmody, 2013).

Literature Review

Having an EAP in place can dramatically affect the outcome of a medical emergency. Best practices described by the American Heart Association (2004) in their Scientific Statement for the key components of a medical emergency plan include “1) creation of an effective and efficient campus-wide communication system; 2) coordination, practice, and evaluation of a response plan with the school nurse and physician, athletic trainer, and local EMS agency; 3) risk reduction; 4) training in and equipment for CPR and first aid for the school nurse, athletic trainers, and teachers and CPR training for students; and 5) in schools with a documented need, establishment of an AED program (p.288).” Numerous groups have reached consensus about these key steps including the American Heart Association, The National Association for Sport and Physical Education and the National Athletic Trainers’ Association (Hazinski et al., 2004; Casa, et al., 2012; NASPE, 2011). Key elements of a successful EAP include “establishing an effective communication system, training of anticipated responders in CPR and AED use, access to an AED for early defibrillation, acquisition of necessary emergency equipment, coordination and integration of on-site responder and AED programs with the local EMS system, and practice and review of the response plan” (Drezner et al., 2007, p. 155).

Hallstrom & Ornato (2004) found that in public locations, where one-fifth of out-of-hospital SCA occur, having an emergency response plan that involves adequate training with an AED doubled the number of survivors to hospital discharge. Defibrillation is the strongest determinant of survival for a SCA, increasing survival rates from 41% to 74% if provided in the first 3-5 minutes after collapse. For each minute delay in defibrillation, survival rates decrease by

7-10% (Drezner et al., 2009). Drezner et al. (2008), using a linear-by-linear association test for trend found significant improvement in survival rates ($p = .035$ for all cases of SCA as well as in confirmed SCA, $p = .018$) with increased AED use, suggesting that with further training and use of AEDs, survival rates of SCA could continue to improve. The authors also found that of the survivors of SCA, 93% had received defibrillation, providing evidence that emergency planning, access and education of AEDs, as well as prompt use of them is essential for improving survival rate of SCA (Drezner et al., 2008).

The goal should be to reach a response time of less than one minute from collapse to EMS call, first aid and CPR as appropriate, and in case of SCA, shock time of less than three minutes from initial collapse (Markenson & Domeier, 2003). Anderson, Clark, Hester & Mann (2011) suggests that AED skills drills should be part of any school based AED program. They should be practiced as regularly as fire drills, safe shelters drills in case of tornados or earthquakes and school evacuations. Having this annual training keeps everyone competent in their skills should they ever be needed. Swor, Grace, McGovern, Weiner & Walton (2012) suggested that not recognizing seizure activity and agonal breathing as signs of cardiac arrest either delayed or completely prevented an AED from being used on the victim. Incorporating this valuable information into AED training can prevent poor outcomes.

Project Method

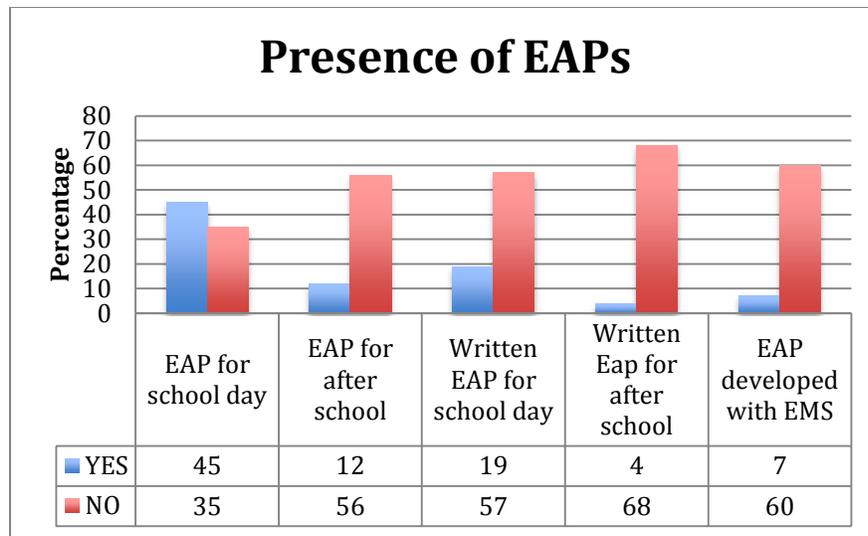
The project was a community-based assessment of a Pacific NW school district's nurses training and education for SCA. An online, 19-question Qualtrics survey was sent to the elementary, middle and high school nurses in the school district via email from the school district's Health Director. The survey was a mix of multiple choice, Likert and open-ended questions that were adapted from a survey by Nowlan (2012) by removing specific demographic

questions about athletic trainers and their years of experience, education and training. The survey was reviewed and feedback was provided by two school nurses and also Dr. Drezner, to check for content validity. The survey was also evaluated for content validity using the five themes for best practices identified in the literature review to ensure that all five themes were adequately addressed.

The project population was a convenience sample of the school nurses in the Pacific NW school district who voluntarily responded to the survey. This project was conducted in accordance with the university's IRB for protection of human subjects, using informed consent. The project was approved appropriately by the school district before administration of the survey.

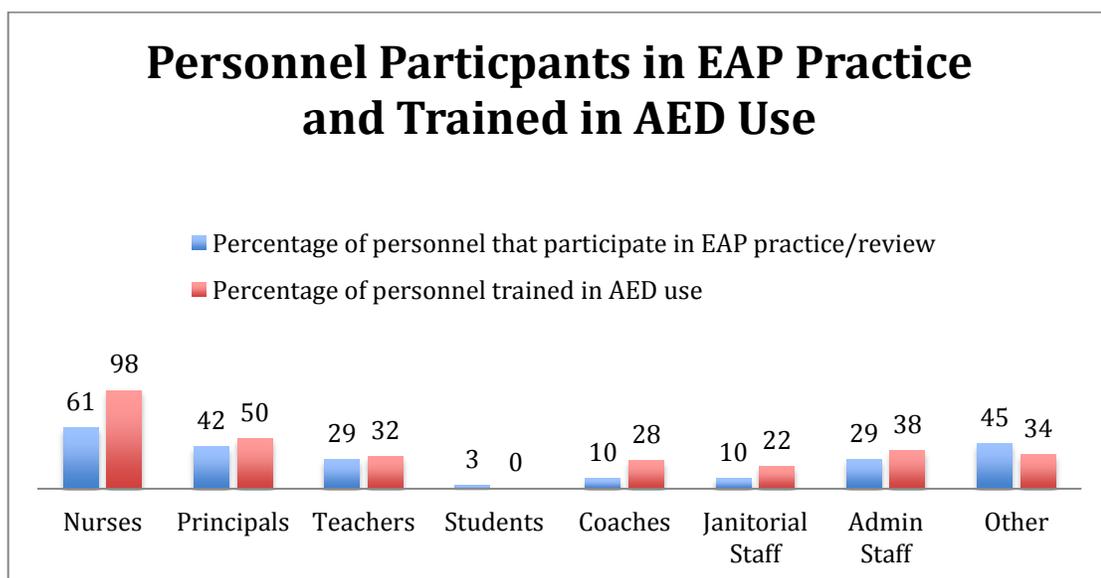
Results

There were 50 responses to the survey; 63% were elementary school nurses, 8% middle school nurses, 14% high school nurses and 14% that fell into the other category (substitute, health treatment nurse, etc.). Of the elementary school nurses population in the district, 53%, responded, while 40% of possible middle school nurses and 86% of possible high school nurses responded to the survey. Of the nurses that responded, 78% were full time, 12% part time, 4% substitute, and 6% health treatment nurses. Results from questions regarding the presence and development of emergency action plans are depicted in the chart below. Most schools have an EAP in place for the school day, but not for after school hours. There is also a lack of written EAPs and development with local EMS.



Nurses reported that 39% never practiced their EAP, 23% practiced yearly, and all other responses indicated minimal practice of their EAP. Elaboration on responses included, “training with CPR class is all that I am aware of”, “only when taking CPR/AED recertification trainings”, “BLS for staff members renewed every two years”, “don’t have a plan”, and “never reviewed.”

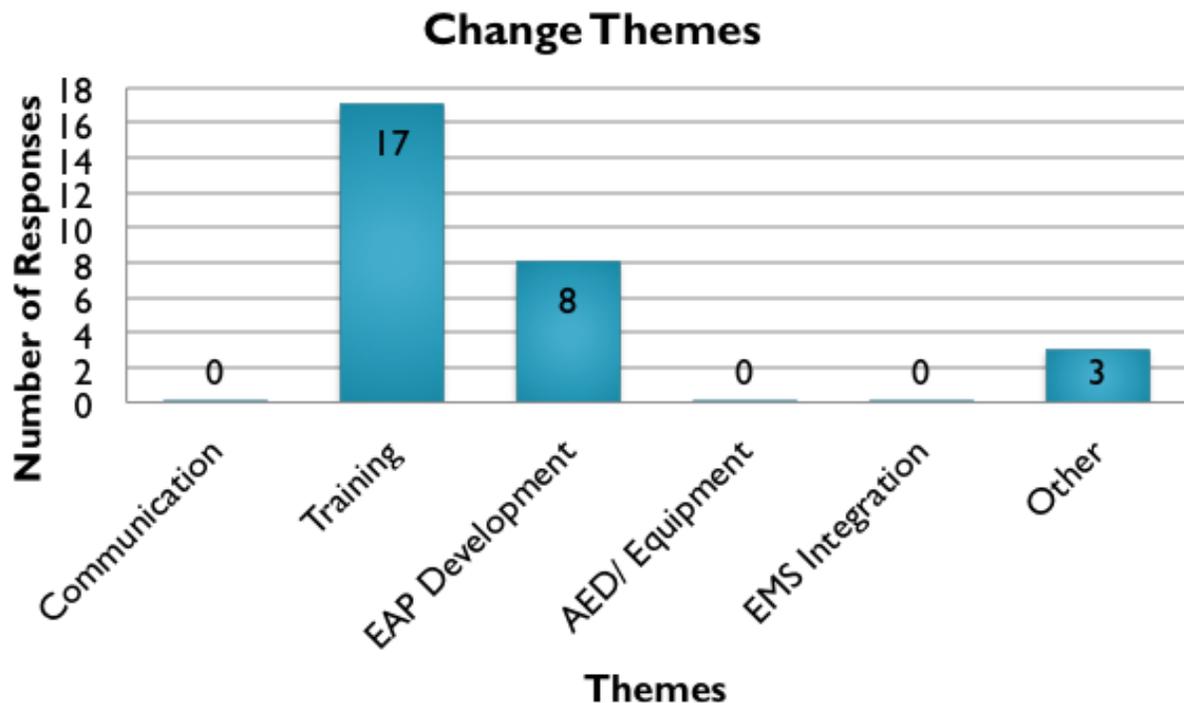
The following chart breaks down by personnel the percentages of those trained to use AEDs and those that participate in EAP practice/review.



All school nurses reported access to one or more AEDs, with 92% of participants stating they had access to at least one AED. When asked about the location of AEDs, 68% of respondents stated that AEDs are easily accessible for after school activities, with locations varying from the nurses' office, main office, gym and hallways. The majority of participants said that they were unsure if their school's AED is integrated into local EMS. However, two-way communication is well established in most schools as 90% of responses indicated this is available.

A Kruskal-Wallis test was conducted to discover whether there is a difference between school nurses at elementary, middle and high schools in their perception of adequate resources to manage a SCA. The result was found to be non-significant. A Spearman's rank order test was also conducted to learn if there is a relationship between frequency of training and the relative confidence in the resources the nurses have received to manage SCA. A two-tailed test of significance indicated there was a small negative correlation that was statistically significant $r(48) = -.299, p = .048$. In other words, those who had more training were more likely to state that they were less confident about managing SCA, than those with less training.

Most nurses agreed that they have adequate resources, support and training to manage a SCA event. The twenty-eight responses to the open-ended question asking for training suggestions or policy changes revealed two major themes. The first is that the nurses would like additional training for all staff (61%) and secondly to have a written EAP developed and posted (29%).



Responses to a general question for feedback in response to the education and training for SCA resulted in diverse comments. Some of those included:

- “There are many more children who have anaphylactic reactions in the schools than cardiac arrest. Yet, nationwide there are more AEDs than epi-pens . . . just something to think about”
- expired pads are not being replaced
- AED accessibility needs to be looked at
- training students
- “just who will use the AED on me if I’m the person having the cardiac arrest”
- “This is important and we are more than adequately trained, there are other more important issues”
- There is no health info on school faculty/staff in case of emergency.

Discussion

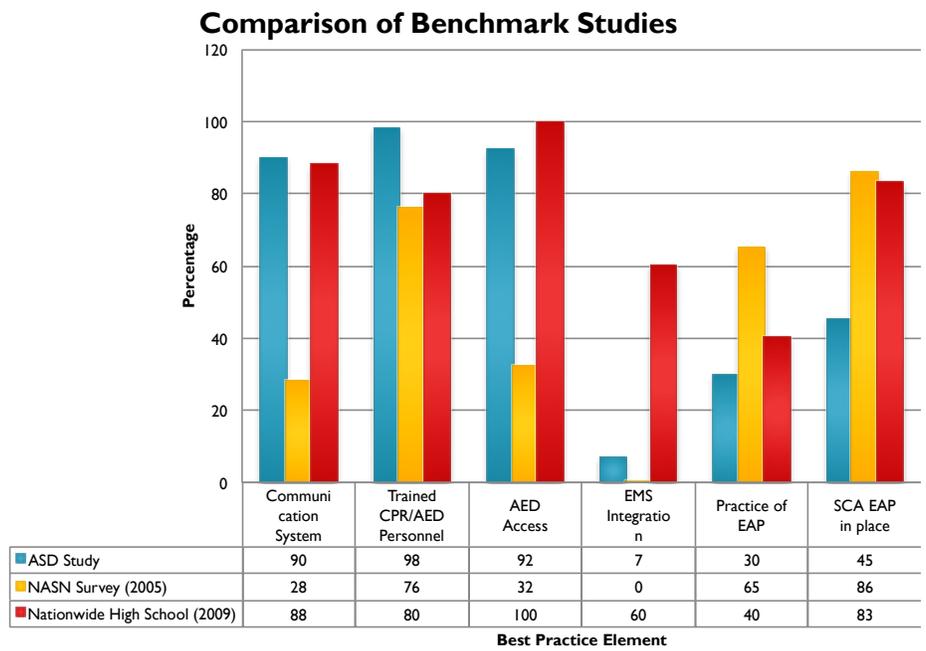
In Michigan, Swor et al. (2012) evaluated 30 school-based SCA events in a retrospective study to assess the use of AEDs. An AED training program was in place for 84% of the schools interviewed and 93.3% of schools stated that specific people were in place to operate the AED during the SCA events. In 19 of the 30 interviews, an AED was available for use. In 11 cases the AED was used with a survival rate of 4 out of 11. For the eight events in which an AED was not placed, bystanders stated that they noted seizure activity and agonal respirations and did not identify SCA. These findings suggest the importance of educating staff on proper identification of SCA and the need for immediate placement of an AED. Safety drills are an important part of every school with an emphasis usually placed on fire, natural disaster and lock down drills. An EAP is a plan for the undiagnosed cardiac patient, adult or child. In this district, there is not a standardized district training drill or plan in place, but each school is allowed to practice drills that they feel are important and necessary for their situation. One of the roles that nurses serve in is as an advocate for safety. Creating, collaborating and implementing a comprehensive EAP is one way that nurses can tangibly provide a safe environment for students and visitors.

AAP (2008) recommends collaboration with local EMS systems when placing emergency equipment within a school so that EMS is familiar with the resources available at that facility. Rothmier, Drezner and Harmon (2007) studied high schools in Washington State to measure AED prevalence, location, training and coordination of AED placement with local EMS. The researchers found that only 25% of schools coordinated AED placement with an outside medical agency and 6% of schools coordinated with local EMS. Results from the district surveyed in this project suggest that most nurses did not know if their plans and equipment had been coordinated or integrated with local EMS. The results of this project are consistent with findings of the 2007

study.

The Spearman’s rho results provided a new and unexpected finding. An expected result would have been to see an increase in confidence in managing a SCA with more training rather than a decline. One could speculate that these results are due to fear, previous training, or previous nursing experience, but because the negative correlation is not very strong it is really hard to know. This is an area that could serve as a platform for further research.

The following graph shows the results of this project compared with a large survey conducted by the National Association of School Nurses as well as a nationwide study of high school nurses in relative performance of the five benchmark elements of successful EAPs. The PNW district in this project ranked highly in communication system access, trained CPR/AED personnel and AED access. Respondents suggested a lack of EMS integration. But the question in the survey allowed school nurses to answer with “unknown” as a response, which may limit comparisons. The district’s results are comparable to the others displayed and provide important feedback for areas of improvement and clarification.



This PNW district does have in place an efficient and effective communication system with specific staff trained in the use of CPR/AEDs. The district recently announced that CPR Anytime is being written in to the district's curriculum, which will generate 3500 trained CPR/AED providers every year that the curriculum is used, providing a large community of educated laypersons who can make a positive impact on SCA survival outcomes.

Major themes that resulted from the open-ended questions include: 1) desire for standardized and mandatory CPR/AED training for all staff; 2) written and posted EAP for both school hours and after school hours activities; and 3) regular practice of a SCA drill.

Implications for School Nurses

Nurses are in a unique position to be both caregivers and educators. Providing the best care to patients whether in the hospital or school requires that nurses perform to the highest level of training they have received. To best protect themselves nurses can ensure that they have created a safe environment for students and faculty alike by maintaining their training in CPR and AED use, as well as providing training to other staff and students. As school budgets are becoming tighter and nursing positions are becoming fewer, the role of the nurse may change from an active participant in managing a SCA event to becoming more of an advocate of the implementation of an emergency action plan if there is not one already created.

Nurses' responsibilities are not only to themselves but also to the community in which they serve. If an EAP, annual training or adequate equipment does not exist already within a school, nurses can empower themselves to collaborate with other nurses and local EMS to create a plan, implement training and explore options to obtain proper equipment. Promoting a health fair that would allow for a variety of health needs to be discussed and addressed with students and faculty in a positive, fun, learning environment is an activity that can be coordinated with

numerous community resources.

School nurses can also work in conjunction with pediatric providers who care for children with cardiac problems to develop a cardiac action plan so they are aware of which students may be at higher risk of a SCA and can provide the best support and evaluation of those patients. These plans specify the student's diagnosis, medications, pertinent medical history, any limitations that may exist for the child and specific instructions for managing cardiac concerns. These can be reviewed annually with the provider and school nurse.

Staff development opportunities can provide a place for nurses to provide training for the faculty about numerous topics including sudden cardiac arrest symptoms and signs, common mistakes in identifying SCA and best practices in those events. Helping staff recognize that cardiac arrest can result from more common medical emergencies such as asthma, anaphylaxis, choking, seizures and trauma may increase awareness and strengthen the weight of why preparation is so important. In schools where an SCA has occurred or there is a higher risk of a SCA event, nurses could collaborate with local providers to provide debriefings and further education to students and faculty.

Nurses can also encourage public awareness of SCA and the use of AEDs. Helping the community become more aware of the use of AEDs and the exponential benefit in long-term survival can create safer environments across the community as well as in the schools. Primary prevention is possible by educating students and staff about the potential dangers of SCA from consuming medications that are not their own, energy drinks and illicit drugs. Long QT syndrome, a genetic cardiac arrhythmia, can cause sudden death and can be triggered by physical and emotional stress, as well as some medications (National Heart, Lung, and Blood Institute, 2011). School nurses work in an environment that has a high potential for numerous emergencies.

If there were no risk of emergencies, perhaps schools would not employ nurses. Nurses are uniquely trained professionals who can differentiate between life-threatening illnesses and common childhood injuries.

Conclusions

The results of this project suggest that this school district is well prepared in regards to AED presence and accessibility, communication, and overall resource/training provided to nursing staff for management of sudden cardiac arrest. Results are consistent with what other studies have revealed in previous years. Nurses have a unique vantage point from which they can implement change, make improvements and provide the opportunity for best possible outcomes in unpredictable, yet inevitable medical emergencies. Improvements could be made in the district by implementing routine, standardized training for students and faculty for the use of EAPs and AEDs, increasing the number of staff and students who are trained, as well as collecting medical information on faculty to make providing care to them safer and more effective. As school nursing becomes a more challenging role in managing the health care needs of chronically ill children as well as medical emergencies, school nurses can be proactive in their preparations by working together with nurse practitioners, physicians, physician assistants, EMS and school faculty to answer questions, establish and implement training to better prepare the faculty and students, as well as community members.

REFERENCES

- American Academy of Pediatrics. (2008). Medical emergencies occurring at school. Council on school health. *Pediatrics*, 122(4), 887-894.
- American Academy of Pediatrics. (2012). Pediatric sudden cardiac arrest. *Pediatrics*, 129 (4), 1094-1102. doi: 10.1542/peds/2012-0144
- Anderson, M., Clarke, B., Hester, C. R. and Mann, J. (2011). Automated external defibrillator drills. *NASN School Nurse*, 26, 346-350. doi: 10.1177/1942602X11409418
- Berger, S. (2009). Automated external defibrillators utility, rational, and controversies. *Pacing and Clinical Electrophysiology*, 32, S75-S79.
- Boots, M. T. (2013, December, 14). School nurses on front line of health care as district seeks cuts. Retrieved from <http://www.adn.com/2013/12/14/3231234/school-nurses-can-be-first-line.html>
- Boudreaux, S. and Broussard, L. (2012). Sudden cardiac arrest in schools: The role of the school nurse in AED program implementation. *Issues in Comprehensive Pediatric Nursing*, 35(3-4), 143-152. DOI: 10.3109/01460862.2012.708214
- Carmody, L. F. (n.d). Florida appellate court holds school district has no affirmative duty to use AEDs at athletic events. Retrieved from: <http://www.rumberger.com/?t=11&la=2320>
- Casa, D. J., Guskiewicz, K. M., Anderson, S.A., Courson, R. W., Heck, J. F., Jimenez, C. C., McDermott, B. P., Miller, M. G., Stearns, R. L., Swartz, E. E., and Walsh, K. M. (2012). National athletic trainers' association position statement: Preventing sudden death in sports. *Journal of Athletic Training*, 47(1), 96-118.
- Corrado, D., Basso, C., Schiavon, M. and Thiene, G. (2006). Does sports activity enhance the risk of sudden cardiac death? *The Journal of Cardiovascular Medicine*, 7(4), 228-233.

Drezner, J. A., Rao, A. L., Heistand, J., Bloomingdale, M. K., and Harmon, K. G. (2009).

Effectiveness of emergency response planning for sudden cardiac arrest in united states high schools with automated external defibrillators. *Circulation, 120*, 518-525.

Drezner, J. A., Chun, J. S. D. Y., Harmon, K. G. and Derminer, L. (2008). Survival trends in the united states following exercise-related sudden cardiac arrest in the youth: 2000-2006. *Heart Rhythm, 5*, 794-799.

Drezner, J. A., Courson, R. W., Roberts, W. O., Mosesso, V. N., Link, M. S. and Maron, B. J. (2007). Inter-association task force recommendations on emergency preparedness and management of sudden cardiac arrest in high school and college athletic programs: A consensus statement. *Journal of Athletic Training, 42*(1), 143-158.

Griesenbeck, K. (2011). Be the beat: A free CPR and AED resource for schools. *NASN School Nurse, 26*(2), 92.

Hallstrom, A.P., Ornato, J. P. (2004). Public-access defibrillation and survival after out-of-hospital cardiac arrest. *New England Journal of Medicine, 351*(7), 637-646.

Harmon, K.G., Asif, I. M., Klossner, D., and Drezner, J.A. (2011). Incidence of sudden cardiac arrest in national collegiate athletic association athletes. *Circulation, 123*(15):1594-600.

Hazinski, M. F., Markenson, D., Neish, S., Gerardi, M., Hootman, J., Nichol, G., Taras, H., Hickey, R., O'Connor, R., Potts, J., van der Jagt, E., Berger, S., Schexnayder, S., Garson, A., Doherty, A. and Smith, S. (2004). Response to cardiac arrest and selected life-threatening medical emergencies. The medical emergency response plan for schools; A statement for healthcare providers, policymakers, school administrators, and community leaders. *Circulation, 109*, 278-291.

Knilians, T. K. (2011). Sudden cardiac death in the young athlete. Retrieved from:

<http://www.docslide.com/sudden-cardiac-death-in-the-young-athlete/>

Kung, H. C., Hoyert, D. L., Xu, J. Murphy, S. L. (2008). Deaths: final data for 2005. *National Vital Statistics Report*, 56(10), 1-120.

Lofti, K., White, L., Rea, T., Cobb, L., Copass, M., Yin, L., Becker, L. and Eisenberg, M.

(2007). Cardiac arrest in schools. *Circulation*, 116, 1372-1379. doi:

10.1161/CIRCULATIONAHA.107.698282

Maron, B. J., Gohman, T. E., and Aeppli, D. (1998). Prevalence of sudden cardiac death during competitive sport activities in Minnesota high school athletes. *Journal of the American College of Cardiology*, 32, 1881-1884.

Markenson, D. S., Domeier, R. M. (2003). The use of automated external defibrillators in children. National Association of EMS Physicians Pediatric Task Force and Standards and Clinical Practices Committee. *Prehospital Emergency Care*, 7, 258–264.

National Association for Sport and Physical Education. (2011). Position statement: Availability & access to automated external defibrillators in schools during participation in physical activity. Retrieved from: <http://www.aahperd.org/naspe/standards/upload/Availability-Access-to-AEDs-Final-5-5-11.pdf>

National Heart, Lung and Blood Institute. (2011). What is long QT syndrome? Retrieved from: <https://www.nhlbi.nih.gov/health/health-topics/topics/qt/>

National Conference of State Legislature. (2012). Retrieved from: <http://www.ncsl.org/issues-research/health/laws-on-cardiac-arrest-and-defibrillators-aeds.aspx>

Olympia, R. P., Wan, E. and Avner, J. R. (2005). The Preparedness of Schools to Respond to Emergencies in Children: A National Survey of School Nurses. *Pediatrics* 116(6), e738-e745. doi:10.1542/peds.2005-1474

Project Adam Tennessee. (2012). Retrieved from:

http://projectadamtennessee.org/about_us/mission.aspx

Rothmier, J. D., Drezner, J. A., and Harmon, K. G. (2007). Automated external defibrillators in washington state high schools. *The British Journal of Sports Medicine*, 41, 301-305. doi: 10.1136/bjism.2006.032979

Swor, R., Grace, H., McGovern, H., Weiner, M. and Walton, E. (2012). Cardiac arrest in schools: Assessing use of automated external defibrillators (AED) on school campuses. *Resuscitation*. <http://dx.doi.org/10.1016/j.resuscitation.2012.09.014>