Cardiology in the Young

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Sudden cardiac arrest response preparedness in Durham County schools

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Abstract

Sudden cardiac arrest is an uncommon event with high morbidity and mortality. There are improved outcomes with early access to an automated external defibrillator and cardiopulmonary resuscitation. We assessed the availability of automated external defibrillators and emergency cardiac arrest plans in schools. A cross-sectional electronic survey was conducted to determine the status of emergency cardiac arrest plans and automated external defibrillator presence. Most schools (88%) had access to an automated external defibrillator; however, trained staff and maintenance plans were highly variable. Automated external defibrillator availability did not differ by racial/ethnic or socio-economic composition; however, there was a relationship between number of automated external defibrillators and student population ($p = 0.0030$). The majority of schools either did not have (28%) or did not know if they had (36%) an emergency cardiac arrest plan. Even without state legislation, automated external defibrillators were largely available in schools. However, there remains a paucity of emergency cardiac arrest plans and automated external defibrillator maintenance plans.

Sudden cardiac arrest is a public health issue with high morbidity and mortality in children. These events are rare, with an incidence of <1–10 events per 100,000 population in children.[1] However, approximately 2.6% of public location cardiac arrests occur at schools.[2] Though rare, these events are associated with high mortality of up to 90%.[3] Early access to an automated external defibrillator and cardiopulmonary resuscitation improves survival in out-of-hospital cardiac arrest.[4,5] Access to both automated external defibrillators and cardiopulmonary resuscitation with an emergency cardiac arrest plan within schools is highly variable depending on school location and resources. Up to 20% of United States of America children and adults are in schools each day making access to these life saving devices in schools of the upmost importance.[6]

There are many barriers to a successful emergency cardiac response system and automated external defibrillator programme in schools including financial constraints, school and state policy, staff support/participation, and medicolegal concerns.[7,8] Currently, there are no federal laws regulating automated external defibrillator placement in schools and automated external defibrillator laws vary widely by state.[4] In North Carolina, there is no state law requiring automated external defibrillators in schools. Previous studies have attempted to quantify the distribution of automated external defibrillator/cardiac arrest plans within individual states[9–11] finding highly variable availability. This has not been attempted in North Carolina nor specifically, in Durham County in over a decade. Current Durham Public Schools policy manual states, "To provide opportunities for assistance to individuals who experience sudden cardiac arrest on school property, the board authorises the placement of automatic external defibrillators" but does not require their placement.[12] Given the lack of legal requirements for emergency cardiac arrest plans and automated external defibrillators, the objective of this study was to describe the distribution of automated external defibrillators and emergency cardiac arrest plans, automated external defibrillator and cardiopulmonary resuscitation trained individuals, and automated external defibrillator maintenance plans in both public and private schools in Durham County, North Carolina. Additionally, we sought to determine the association of automated external defibrillator and cardiac arrest plan presence with school size, type of school (public versus private), socio-economic status (as determined by percentage receiving free/reduced lunch), and non-white racial percentage. We hypothesised that the presence of automated external defibrillators and emergency cardiac arrest plans and related factors would be highly variable across the county.

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Methods

Participants

A cross-sectional survey was conducted in Durham County, North Carolina. Participants included staff members of Durham County public and private schools. Surveys were distributed to school principals or heads of school and completed by school administrators (principal, vice principal, or head of school), athletic trainers, and school nurses. Durham County Public school system is made up of 53 total schools serving approximately 32,000 students. There are also 36 private schools within Durham County. This led to a total of 89 schools surveyed. This study was determined to be exempt under the Duke University Institutional Review Board.

Procedure

This was a prospective, county-wide electronic survey of Durham County public and private schools conducted to determine the status of emergency cardiac arrest plans, cardiopulmonary resuscitation training of staff and students, and automated external defibrillator presence and characteristics. Electronic surveys were sent to schools via RedCap™ on a rolling basis. Survey data were collected from May 2, 2019 through December 5, 2019. Eighty-nine schools were contacted via the RedCap™ distribution tool a maximum of three times on a weekly basis to maximise response rate. The survey consisted of thirteen questions, with an additional three questions for high schools regarding cardiopulmonary resuscitation training for students. Survey questions were based on previously validated questionnaire used in other states.[9–11] Respondent and school demographics were collected. Public school demographic data were obtained from Durham Public Schools' official records. Private school demographic data were obtained directly from school representatives.

Number and location of automated external defibrillators in the school, automated external defibrillator maintenance plan, staff training in cardiopulmonary resuscitation, and presence of emergency cardiac arrest plan were collected for each school. Number of automated external defibrillators was defined as the total number of automated external defibrillators available for use on a school campus. Number of trained individuals represents the number of staff trained in both cardiopulmonary resuscitation and automated external defibrillator use that are typical present in the school during a normal school day. This did not include students who might also be trained in cardiopulmonary resuscitation and automated external defibrillator use. Automated external defibrillator maintenance plan was defined as the time interval at which the automated external defibrillator was assessed for proper functioning.

Given North Carolina state requirement of cardiopulmonary resuscitation training for students, high schools were asked in which grades students receive cardiopulmonary resuscitation training, who was providing the training, and how training was tracked. These data are not presented but available from authors on request. Full survey can be seen in Figure 1.

Data analysis

Continuous variables are presented with mean ± standard deviation, median with 25th and 75th percentiles (Q1–Q3) and range. Normality was assessed using the Shapiro–Wilk test and QQ-plots. Categorical variables are summarised using frequency counts and percentages for non-missing data. Chi-square/Fisher's exact test or t-test/Wilcoxon rank sum test were used, as appropriate, to assess if differences in patient characteristics existed between groups. A generalised linear regression model with robust standard error and restricted cubic spline for population size was used to evaluate the correlation with the number of automated external defibrillators assuming an underlying Poisson distribution with results presented as the least squares mean estimate with 95% confidence interval at the overall 1st, 2nd, and 3rd quartiles of student population size. All data were extracted into SAS version 9.4 (SAS Institute, Inc., Cary, North Carolina) for analysis, and a p-value < 0.05 was considered statistically significant.

Results

Respondent school characteristics

There were 31 responses representing 25 schools of the total of 89 schools surveyed for a response rate of 28%. For schools with multiple responses from different representatives, we used the most recent response. Demographic characteristics of survey respondents are in Table 1. The majority of survey respondents were school administrators (60%). Most schools were elementary schools (40% of respondents) with high schools being the next most common type of respondents (28% of respondents). There were respondents from each category of grade level serviced. Respondents included two charter schools and six magnet schools. Most responses were from public schools (n = 20) compared to private schools (n = 5). School population sizes were variable with a median student population of 628 students (Q1–Q3: 188–908). Racial and ethnic make-up of the schools was diverse (Table 1). This racial and ethnic make-up of respondent schools is similar to the make-up of Durham County as a whole; however, there is a slight over-representation of students who identify as Non-Hispanic Black or African American and Hispanic, and an under-representation of students who identify as NH White. As per the United States of America Census Bureau, the racial and ethnic make-up of Durham County is NH White 54.0%, NH Black or African American alone 36.9%, American Indian and Alaska Native 0.9%, Asian 5.5%, Native Hawaiian and Other Pacific Islander 0.1%, two or more races 2.6%, Hispanic or Latino 13.7%.[13] More than half of students in the sample received free or reduced lunch (57.4% and 4.8%, respectively) which is similar to the Durham Country population (overall rate of free and reduced lunch of 64.5% in public schools county wide).[14] Private school students did not receive free or reduced lunch.

Survey responses

Automated external defibrillator availability

The majority of respondents had access to at least one automated external defibrillator (88%). More than half of schools had access to one automated external defibrillator (54.5%) with a minority of schools having more than one automated external defibrillator available (Table 2). A slim majority of schools (54.2%) had less than 10 staff members trained in automated external defibrillator operation. Two schools, both with an automated external defibrillators available, reported an unknown number of staff members trained in automated external defibrillator operation. Automated external defibrillator maintenance plans were highly variable with every one to three months being the most common response (47.8%). Four schools (21.7%) reported they did not know the automated external defibrillator maintenance plan, and one school reported having no scheduled automated external defibrillator maintenance. Automated external defibrillator were

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What is your role at your school?	○ School nurse ○ School administrator ○ Athletic trainer/ coach ○ Other
Is your school a charter school?	○ yes ○ no
Is your school a magnet school?	○ yes ○ no
How many staff are at your school?	○ Less than 25 ○ 25-50 ○ 50-100 ○ 100-250 ○ Greater than 250
What grades does your school serve?	○ Elementary ○ Middle ○ K-8 ○ Secondary ○ High
Do you have an automated external defibrillator (AED) in your school?	○ yes ○ no ○ unknown
How many automated external defibrillators (AEDs) do you have in your school?	○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ >5
Where is/are the AEDs in your school?	_____
What is your AED maintenance plan?	○ No scheduled maintenance ○ Every 1-3 mo ○ Every 4-6 mo ○ Annually ○ Less than once per year ○ Unknown
How many staff are trained to operate and AED at your school?	○ Less than 10 ○ 10-25 ○ 25-50 ○ greater than 50 ○ Unknown
Does your school have a cardiac arrest plan?	○ yes ○ no ○ unknown
Do you ask about CPR training/do you have a CPR requirement as a part of your staff hiring process?	○ Yes ○ No
How many of your staff members are CPR certified?	○ Less than 10 ○ 10-25 ○ 25-50 ○ greater than 50 ○ Unknown
In which grade do you students receive CPR training? (Check all that apply)	☐ 9 ☐ 10 ☐ 11 ☐ 12
Who provides CPR training to your students? (Check all that apply.)	☐ Physical education teacher ☐ Team coach ☐ Health teacher ☐ Other teacher ☐ Unpaid volunteer ☐ Paid instructor
How do you report successful CPR training of your students as a requirement for graduation?	☐ Report to the board of education ☐ Report to the superintendent ☐ Report to the legislature/state official ☐ There is no formal reporting procedure in place ☐ Other

Figure 1. Full list of survey questions and possible responses.

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Table 1. Overall characteristics of respondent schools

Characteristic	Response (n = 25)
Role At School	
School nurse	4 (16)
School administrator	15 (60)
Athletic trainer/coach	4 (16)
Other	2 (8)
Grades served	
Elementary	10 (40)
Middle	4 (16)
k-8	3 (12)
Secondary	1 (4)
High	7 (28)
Charter school	
Yes	2 (8)
No	23 (92)
Magnet school	
Yes	6 (24)
No	19 (76)
Public versus private	
Public	20 (80)
Private	5 (20)
Student population	n = 23 628 (188–908)
Race:	n = 19
Percentage American Indian	0.2 (0, 0.3)
Percentage Asian	2.7 (1.9, 4.6)
Percentage Hispanic	27.2 (23.5. 35.5)
Percentage black	42.3 (26.8, 47.8)
Percentage white	22.0 (4.2, 37.5)
Percentage 2 or more races	3.4 (2.0, 4.7)
Percentage Pacific islander	0 (0, 0.2)
Student Lunch:	n = 16
Percentage of free lunch	57.4 (49.6, 71.2)
Percentage of reduced lunch	4.8 (3.6, 5.2)

Note: Data presented as count (percentage) or median (Q1, Q3).

Table 2. Automated external defibrillators characteristics of respondent schools

Characteristic	Response (n = 25)
automated external defibrillators present	
Yes	22 (88)
No	3 (12)
Number of automated external defibrillators	n = 22
1	12 (54.5)
2	7 (31.8)
3	1 (4.5)
4	1 (4.5)
≥5	1 (4.5)
Number of staff trained to operate automated external defibrillators	n = 24
<10	13 (54.2)
10–25	5 (20.8)
26–50	3 (12.5)
>50	1 (4.2)
Unknown	2 (8.3)
AED maintenance plan	n = 23
No scheduled maintenance	1 (4.3)
Every 1–3 months	11 (47.8)
Every 4–6 months	1 (4.3)
Annually	4 (17.4)
Less than once per year	1 (4.3)
Unknown	5 (21.7)

Note: Data presented as count (percentage).

kept in a variety of locations within respondent schools including gym, main office, nurse's office, cafeteria, teachers' lounge, and athletic office.

Of the schools that did not have automated external defibrillators, 100% of these were elementary schools and 100% were private schools (Table 3). There were no differences in the racial/ethnic and socio-economic compositions of the schools that did or did not have an automated external defibrillator.

The size of the school as indicated by the number of staff (data not shown) has some association with automated external defibrillator presence (p = 0.032). Regression modelling of automated external defibrillator count and school student population size showed a significant non-linear association (Table 4) with larger population size schools being more likely to have a higher number of automated external defibrillators present (p = 0.0030). A sensitivity analysis removing the outlier (school with >5 automated external defibrillators) demonstrated similar significant findings
(p = 0.0034). Assuming school population sizes of 188 (Q1), 628 (median), and 908 (Q3), the least squares mean estimated number of automated external defibrillators was 0.68 (95% CI: 0.26–1.75), 0.96 (95% CI: 0.71–1.29), and 1.59 (1.10–2.02), respectively.

Cardiac arrest plan availability

Less than half of schools (36%) had an emergency cardiac arrest plan (Table 5). Most schools reported either not having an emergency cardiac arrest plan (28%) or not knowing if their school had an emergency cardiac arrest plan in place (36%). The number of staff trained in cardiopulmonary resuscitation was highly variable though most schools reported less than 10 staff members trained in cardiopulmonary resuscitation (48%). Two schools (8%) had an unknown number of staff that were cardiopulmonary resuscitation certified.

Of the schools that did not have an emergency cardiac arrest plan, five (71.4%) of these were elementary schools and two

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Table 3. School characteristics by automated external defibrillators presence

Characteristic	No automated external defibrillators present (n = 3)	Automated external defibrillators present (n = 22)
Role at school		
School nurse	0	4 (18.2)
School administrator	3 (100)	12 (54.5)
Athletic trainer/ coach	0	4 (18.2)
Other	0	2 (9.1)
Grades served		
Elementary	3 (100)	7 (31.8)
Middle	0	4 (18.2)
k-8	0	3 (13.6)
Secondary	0	1 (4.5)
High	0	7 (31.8)
Public versus private		
Public	0	20 (90.9)
Private	3 (100)	2 (9.1)
Number of students	n = 3 108 (47, 110)	n = 20 701 (431, 908)
Race:	n = 1	n = 22
Percentage American Indian	1.0 (–,–)	0.2 (0, 0.2)
Percentage Asian	13.0 (–,–)	2.6 (1.9, 4.0)
Percentage Hispanic	6.0 (–,–)	27.6 (23.7, 35.5)
Percentage black	7.0 (–,–)	42.3 (33.0, 47.8)
Percentage white	46.0 (–,–)	22.0 (4.2, 29.9)
Percentage 2 or more races	2.0 (–,–)	3.5 (2.3, 4.7)
Percentage Pacific islander	0 (–,–)	0.05 (0, 0.2)
Student Lunch	n = 0	n = 16
Percentage of free lunch	———	57.4 (49.6, 71.2)
Percentage of reduced lunch	———	4.8 (3.6, 5.2)

Note: Data presented as count (percentage) or median (Q1, Q3).

(28.6%) of these were high schools (Table 6). Six of the schools without emergency cardiac arrest plans were public schools and one was a private school. Hispanic ethnicity ($p = 0.012$) had some association with increased likelihood of having an emergency cardiac arrest plan and percentage; White ($p = 0.051$) had some association with decreased likelihood of having an emergency cardiac arrest plan, though these associations may be more due to school size (Table 6). There was no difference in the median number of student or socio-economic composition of the schools that had a cardiac arrest plan compared to those that did not.

Table 4. Poisson regression model results: expected automated external defibrillators count by student population size

	Population size	Expected automated external defibrillators count (95% CI)
Estimated automated external defibrillators count	Q1: 188	1.36 (0.51, 3.65)
	Median: 628	0.88 (0.61, 1.27)
	Q3: 908	1.49 (1.11, 2.02)
Estimated automated external defibrillators count (without outlier)	Q1: 188	0.68 (0.26, 1.75)
	Median: 628	0.96 (0.71, 1.29)
	Q3: 908	1.49 (1.10, 2.02)

Table 5. Cardiac arrest plan characteristics overall and by automated external defibrillators presence

Characteristic	No automated external defibrillators present (n = 3)	automated external defibrillators present (n = 22)	Overall (n = 25)
Cardiac arrest plan			
Yes	1 (33.3)	8 (36.4)	9 (36.0)
No	1 (33.3)	6 (27.3)	7 (28.0)
Unknown	1 (33.3)	8 (36.4)	9 (36.0)
Number of CPR certified staff			
<10	1 (33.3)	11 (50.0)	12 (48.0)
10–25	1 (33.3)	5 (22.7)	6 (24.0)
26–50	1 (33.3)	1 (4.5)	2 (8.0)
>50	0	3 (13.6)	3 (12.0)
Unknown	0	2 (9.1)	2 (8.0)

Note: Data presented as count (percentage).

Discussion

This study examined the availability of automated external defibrillators and emergency cardiac arrest plans in one county of a state that does not have legislation requiring automated external defibrillators in schools. There have been other state-wide studies assessing automated external defibrillator availability within North Carolina, however not in the recent past. Monroe et al (2009) assessed the availability of automated external defibrillators in the entire state of North Carolina and found a lower rate of automated external defibrillators availability state wide (72.5% versus 88%) compared to Durham County.[15] Fields and Bright (2011) assessed automated external defibrillator availability in middle schools across the state and found only 61.1% of middle schools had automated external defibrillators available. All middle schools (100%) in our study had an automated external defibrillator available. Compared to these state-wide studies, it appears that Durham County has increased access to automated external defibrillators. Additionally, these studies were conducted over ten year ago, and while we do not know what availability in our county was like at the time of these surveys, the increased availability we found suggests that automated external defibrillators availability has improved over time, which may be due to decreased cost.[16]

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Table 6. School characteristics by cardiac arrest plan presence

Characteristic	No cardiac arrest plan (n = 7)	Cardiac arrest plan present (n = 9)
Role at school		
School nurse	1 (14.3)	3 (33.3)
School administrater	6 (85.7)	4 (44.4)
Athletic trainer/ coach	0	1 (11.1)
Other	0	1 (11.1)
Grades served		
Elementary	5 (71.4)	3 (33.3)
Middle	0	2 (22.2)
k-8	0	2 (22.2)
High	2 (28.6)	2 (22.2)
Public vs private		
Public	6 (85.7)	7 (77.8)
Private	1 (14.3)	2 (22.2)
Number of students	557 (188, 796)	520 (269, 763)
Race:	n = 5	n = 7
Percentage American Indian	0.2 (0.1, 0.5)	0.1 (0, 0.1)
Percentage Asian	4.0 (4.0, 4.6)	2.2 (0.9, 2.7)
Percentage Hispanic	23.5 (10.0, 23.7)	35.5 (24.9, 50.1)
Percentage black	37.7 (26.8, 50.1)	46.5 (35.8, 57.3)
Percentage white	37.5 (18.4, 40.2)	4.0 (2.7, 22.1)
Percentage 2 or more races	3.6 (3.4, 7.9)	2.3 (1.0, 4.3)
Percentage Pacific islander	0.2 (0.1, 0.3)	0 (0,0.3)
Student Lunch:	n = 4	n = 7
Percentage of free lunch	42.4 (29.3, 73.1)	67.5 (57.0, 98.7)
Percentage of reduced lunch	4.4 (1.9, 5.0)	4.0 (0, 6.6)

Note: Data presented as count (percentage) or median (Q1, Q3).

Early access to an automated external defibrillator and cardiopulmonary resuscitation has been shown to improve survival for out-of-hospital cardiac arrest for both children and adults that learn, work, and visit schools.[4,5] A survey of schools with at least one automated external defibrillator on-site had high rates of cardiopulmonary resuscitation (94%), automated external defibrillator shocks delivered (83%), and survival to hospital discharge (64%) showing that having an automated external defibrillator in schools improves outcomes.[17] We found that most schools in our cohort did have access to at least one automated external defibrillator. However, all of the schools that did not have access to an automated external defibrillator were private schools. Though this is small sample of the private schools within the county, there may be variable access to automated external defibrillators in these locations due to differences in funding and regulations. Other states have shown that funding automated external defibrillators in both public and private schools is effective for increased availability and enhanced school safety suggesting that this may be an option to pursue to increase availability in private schools where automated external defibrillators may be less available.[18]

About half of schools had access to only one automated external defibrillator (54.5%). While the likelihood of two cardiac emergencies happening simultaneously is exceedingly low, schools with larger student population or campus sizes may benefit from additional automated external defibrillators to optimise availability. Delay of minutes in getting an automated external defibrillator to a victim is crucial as time to defibrillation has been shown to be associated with favourable neurologic outcomes.[4] Using regression modelling, we found a non-linear relationship between number of automated external defibrillators and school population. Exclusion of one outlier school showed similar results with estimated average automated external defibrillator counts of 0.68, 0.96, and 1.49 for the 1st, 2nd, and 3rd quartiles of overall student population size, respectively (Table 6). The outlier school is believed to be different than the other schools in the survey in that it is co-located within a college campus which may affect the number of automated external defibrillators present. Though not assessed in this study, having more than one automated external defibrillator available would allow for schools to have a "travel" automated external defibrillator for off-site events, such as athletic events or class trips, where automated external defibrillator access might vary.

There was significant variability in location of the automated external defibrillators within schools. This is likely due to school layout and planning to have automated external defibrillators in easily accessible and central locations. The American Heart Association recommends that a successful automated external defibrillator programme should be able to deliver a shock within three to five minutes of a sudden cardiac arrest.[19] When assessing automated external defibrillator use in a school, one study found that most events (80%) occurred near an athletic facility, making this an important consideration in automated external defibrillators placement.[18] Local clinicians, along with school personnel, can play a key role in planning for automated external defibrillator location, as well as staff education on how to activate the emergency response system and obtain automated external defibrillator at a time of need. Additionally, a clear cardiac arrest plan that is reviewed with staff on a regular basis can provide continued reminders of where automated external defibrillators are located. Education on how to activate the emergency response system for all individuals, irregardless of cardiopulmonary resuscitation and automated external defibrillator training, who witness an unresponsive individual is critical in saving lives.[22] Of respondents, only about half (47.8%) reported they had automated external defibrillators serviced every 1-3 months. According to AHA guidelines, automated external defibrillators should have a "weekly or monthly visual inspection to ensure they are in working order" making this another area of possible intervention.[19]

While having access to a well placed and functioning automated external defibrillator is the first step, it is crucial to have a plan of what to do in the event of a cardiac arrest. The most striking finding was the paucity of emergency cardiac arrest plans within respondent schools. In 2004, a statement released in Circulation and endorsed by a variety of professional organisations, including the AHA, American Academy of Pediatrics, Center for Disease Control, and others put forth a statement detailing the creation, training, and implementation of an emergency response plan for schools[20] with additional guidelines updated in 2016.[21] Despite this

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statement and guidelines, the majority of schools did not have (28%) or did not know if they had (36%) an emergency response plan. Previous studies have shown a number of barriers to implementing an emergency response plan including knowledge of how to implement a plan,[22,23] lack of funding,[22–25] lack of medical personnel.[24,25] One potential way to ameliorate the lack of medical personnel is the use of athletic trainers. Schools with access to an athletic trainer have been shown to be more likely to have an emergency cardiac arrest plan.[26]

It is likely that if the school administrators or school nurses completing this survey are unaware of the plan that the remainder of a schools' staff are unlikely to know how to react in the event of a cardiac arrest. Even in states with high availability of emergency cardiac arrest plans, they are unlikely to have practice what to do in the event of an emergency.[17] This is especially concerning as one prior survey of teachers reported that about one-fifth (18%) had reported having to respond to one or more life threatening emergencies during their teaching career making knowledge of what to do in emergency even more necessary.[27] This gap provides an opportune area for intervention for healthcare providers to work with their communities to help design and rehearse emergency cardiac arrest plans. With thoughtful design and implementation of emergency response plans, school staff can respond in a timely and effective manner if a student, staff, or visitor, whether child or adult, were to have a sudden cardiac arrest while in school.

There are some limitations to this study. This survey represents just one county in a state in the southeastern United States. Given that legislation and school district guidelines vary widely across the country, each school district likely has a unique environment of automated external defibrillator and cardiac arrest plan availability. As there is no legislation requiring automated external defibrillators and cardiac arrest plans in North Carolina schools, our survey may represent what might be found in other similar states without legislation. Response rates for electronically based surveys can be highly variable. Our response rate was approximately one quarter of the schools surveyed. While this number is low making it subject to some non-response bias,[28] based on demographics of respondent schools that were similar the overall district and city demographics, we feel this is a representative sample of our surveyed cohort. When receiving multiple responses from a single school, we choose to use this most recent response with the assumption this provided the most recent state of automated external defibrillators in the school. This may introduce some bias as some individual may have more knowledge than others filling out the survey; however, this is difficult to tell on survey, and we thus chose the most recent for consistency.

We found that most schools in a county without legislation requiring their presence do have access to automated external defibrillators but lack automated external defibrillator maintenance and emergency cardiac arrest plans. Every school should have as many automated external defibrillators as needed to meet the AHA recommendation of three to five minutes for a shock to be delivered in the event of an sudden cardiac arrest and a plan to implement their use. With increased awareness of this gap, communities can work to increase funding and knowledge to makes our schools safers. Healthcare providers who care for children experiencing cardiac arrest are ideal advocates for these efforts in their communities.

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