

# The Preparedness of Schools to Respond to Emergencies in Children: A National Survey of School Nurses

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**ABSTRACT.** *Objectives.* Because children spend a significant proportion of their day in school, pediatric emergencies such as the exacerbation of medical conditions, behavioral crises, and accidental/intentional injuries are likely to occur. Recently, both the American Academy of Pediatrics and the American Heart Association have published guidelines stressing the need for school leaders to establish emergency-response plans to deal with life-threatening medical emergencies in children. The goals include developing an efficient and effective campus-wide communication system for each school with local emergency medical services (EMS); establishing and practicing a medical emergency-response plan (MERP) involving school nurses, physicians, athletic trainers, and the EMS system; identifying students at risk for life-threatening emergencies and ensuring the presence of individual emergency care plans; training staff and students in first aid and cardiopulmonary resuscitation (CPR); equipping the school for potential life-threatening emergencies; and implementing lay rescuer automated external defibrillator (AED) programs. The objective of this study was to use published guidelines by the American Academy of Pediatrics and the American Heart Association to examine the preparedness of schools to respond to pediatric emergencies, including those involving children with special care needs, and potential mass disasters.

*Methods.* A 2-part questionnaire was mailed to 1000 randomly selected members of the National Association of School Nurses. The first part included 20 questions focusing on: (1) the clinical background of the school nurse (highest level of education, years practicing as a school health provider, CPR training); (2) demographic features of the school (student attendance, grades represented, inner-city or rural/suburban setting, private or public funding, presence of children with special needs); (3) self-reported frequency of medical and psychiatric emergencies (most common reported school emergencies encountered over the past school year, weekly number of visits to school nurses, annual number of "life-threatening" emergencies requiring activation of EMS); and (4) the preparedness of schools to manage life-threatening

emergencies (presence of an MERP, presence of emergency care plans for asthmatics, diabetics, and children with special needs, presence of a school nurse during all school hours, CPR training of staff and students, availability of athletic trainers during all athletic events, presence of an MERP for potential mass disasters). The second part included 10 clinical scenarios measuring the availability of emergency equipment and the confidence level of the school nurse to manage potential life-threatening emergencies.

*Results.* Of the 675 questionnaires returned, 573 were eligible for analysis. A majority of responses were from registered nurses who have been practicing for >5 years in a rural or suburban setting. The most common reported school emergencies were extremity sprains and shortness of breath.

Sixty-eight percent (391 of 573 [95% confidence interval (CI): 64–72%]) of school nurses have managed a life-threatening emergency requiring EMS activation during the past school year. Eighty-six percent (95% CI: 84–90%) of schools have an MERP, although 35% (95% CI: 31–39%) of schools do not practice the plan. Thirteen percent (95% CI: 10–16%) of schools do not identify authorized personnel to make emergency medical decisions. When stratified by mean student attendance, school setting, and funding classification, schools with and without an MERP did not differ significantly.

Of the 205 schools that do not have a school nurse present on campus during all school hours, 17% (95% CI: 12–23%) do not have an MERP, 17% (95% CI: 12–23%) do not identify an authorized person to make medical decisions when faced with a life-threatening emergency, and 72% (95% CI: 65–78%) do not have an effective campus-wide communication system. CPR training is offered to 76% (95% CI: 70–81%) of the teachers, 68% (95% CI: 61–74%) of the administrative staff, and 28% (95% CI: 22–35%) of the students.

School nurses reported the availability of a bronchodilator meter-dosed inhaler (78% [95% CI: 74–81%]), AED (32% [95% CI: 28–36%]), and epinephrine autoinjector (76% [95% CI: 68–79%]) in their school. When stratified by inner-city and rural/suburban school setting, the availability of emergency equipment did not differ significantly except for the availability of an oxygen source, which was higher in rural/suburban schools (15% vs 5%).

School-nurse responders self-reported more confidence in managing respiratory distress, airway obstruction, profuse bleeding/extremity fracture, anaphylaxis, and shock in a diabetic child and comparatively less confidence in managing cardiac arrest, overdose, seizure, heat illness, and head injury.

When analyzing schools with at least 1 child with special care needs, 90% (95% CI: 86–93%) have an MERP, 64% (95% CI: 58–69%) have a nurse available during all school hours, and 32% (95% CI: 27–38%) have an efficient and effective campus-wide communication system

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linked with EMS. There are no identified authorized personnel to make medical decisions when the school nurse is not present on campus in 12% (95% CI: 9–16%) of the schools with children with special care needs. When analyzing the confidence level of school nurses to respond to common potential life-threatening emergencies in children with special care needs, 67% (95% CI: 61–72%) of school nurses felt confident in managing seizures, 88% (95% CI: 84–91%) felt confident in managing respiratory distress, and 83% (95% CI: 78–87%) felt confident in managing airway obstruction. School nurses reported having the following emergency equipment available in the event of an emergency in a child with special care needs: glucose source (94% [95% CI: 91–96%]), bronchodilator (79% [95% CI: 74–83%]), suction (22% [95% CI: 18–27%]), bag-valve-mask device (16% [95% CI: 12–21%]), and oxygen (12% [95% CI: 9–16%]).

An MERP designed specifically for potential mass disasters was present in 418 (74%) of 573 schools (95% CI: 70–77%). When stratified by mean student attendance, school setting, and funding classification, schools with and without an MERP for mass disasters did not differ significantly.

**Conclusions.** Although schools are in compliance with many of the recommendations for emergency preparedness, specific areas for improvement include practicing the MERP several times per year, linking all areas of the school directly with EMS, identifying authorized personnel to make emergency medical decisions, and increasing the availability of AED in schools. Efforts should be made to increase the education of school nurses in the assessment and management of life-threatening emergencies for which they have less confidence, particularly cardiac arrest, overdose, seizures, heat illness, and head injury. *Pediatrics* 2005;116:e738–e745. URL: [www.pediatrics.org/cgi/doi/10.1542/peds.2005-1474](http://www.pediatrics.org/cgi/doi/10.1542/peds.2005-1474); *school emergencies, children with special health care needs, disaster preparedness.*

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ABBREVIATIONS. AAP, American Academy of Pediatrics; AHA, American Heart Association; EMS, emergency medical services; MERP, medical emergency-response plan; CPR, cardiopulmonary resuscitation; AED, automated external defibrillator; NASN, National Association of School Nurses; CI, confidence interval.

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Because children spend a significant proportion of their day in school, pediatric emergencies such as the exacerbation of medical conditions, behavioral crises, and accidental/intentional injuries are likely to occur. Recently, the American Academy of Pediatrics (AAP) Committee on School Health<sup>1</sup> and the American Heart Association (AHA)<sup>2</sup> published guidelines stressing the need for school leaders to establish emergency-response plans to deal with life-threatening medical emergencies in children. The goals include developing an efficient and effective campus-wide communication system for each school with local emergency medical services (EMS); establishing and practicing a medical emergency-response plan (MERP) involving school nurses, physicians, athletic trainers, and the EMS system; identifying students at risk for life-threatening emergencies and ensuring the presence of individual emergency care plans; training staff and students in first aid and cardiopulmonary resuscitation (CPR); equipping the school for potential life-threatening emergencies; and implementing lay rescuer

automated external defibrillator (AED) programs. Furthermore, recently published guidelines recommend improving the training of school nurses to determine rapidly and accurately the status of ill or injured children, provide life-saving interventions, and evaluate the effectiveness of treatment.<sup>3,4</sup> The only previously published study examining the preparedness of school nurses to respond to emergencies in children was conducted on a local level.<sup>5</sup>

The AAP has also recently published recommendations focusing on the preparedness of schools for emergencies in children with special health care needs<sup>6</sup> and disaster preparedness.<sup>7</sup> Because children with special health care needs frequently require emergency care for acute life-threatening complications and often lack concise summaries of their medical conditions and special management plans, the AAP has recommended that a brief, comprehensive, and frequently updated summary of their medical condition be rapidly accessible at home, school, during transportation, and the closest emergency department. In addition, disaster preparedness has been made a priority at a local and national level because of heightened awareness for the possibility of biological, chemical, and nuclear terrorism<sup>8,9</sup> as well as occurrences of mass disasters in schools. The AAP has recommended that pediatricians take a more active role in establishing disaster plans in the community, including schools, and in the training of first responders, including school nurses, administrative staff, and teachers. Because these recommendations are recent, published data examining the preparedness of schools to deal with emergencies in these 2 situations are lacking.

The objective of this study is to use published guidelines by the AAP and AHA to examine the preparedness of schools in the United States to respond to pediatric life-threatening emergencies, including those emergencies involving children with special care needs, as well as the preparedness of schools to respond to potential mass disasters.

## MATERIALS AND METHODS

A 2-part questionnaire was developed to determine the preparedness of schools in the United States to respond to life-threatening emergencies in children. The first part included 20 questions focusing on (1) the clinical background of the school nurse (highest level of education, years practicing as a school health provider, CPR training), (2) demographic features of the school (student attendance, grades represented, inner-city or rural/suburban setting, private or public funding, presence of children with special needs), (3) self-reported frequency of medical and psychiatric emergencies (most common reported school emergencies encountered over the past school year, weekly number of visits to school nurses, annual number of “life-threatening” emergencies requiring activation of EMS), and (4) the preparedness of schools to manage life-threatening emergencies (presence of an MERP, presence of emergency care plans for asthmatics, diabetics, and children with special needs, presence of a school nurse during all school hours, CPR training of staff and students, availability of athletic trainers during all athletic events, presence of an MERP for potential mass disasters). The second part included 10 clinical scenarios (Appendix) measuring the availability of emergency equipment and the confidence level of the school nurse to manage potential life-threatening emergencies. Confidence was defined as a response of 4 (“confident”) or 5 (“very confident”) on a Likert scale ranging from 1 (“very uncomfortable”) to 5 (“very confident”). These cases were adapted from a previously published

study that examined the confidence of schoolteachers to respond to 14 clinical scenarios reflecting potential pediatric emergencies in schools.<sup>10</sup>

In December 2004, the questionnaire was mailed to 1000 randomly selected members of the National Association of School Nurses (NASN). A second mailing was sent to nonresponders in January 2005. Data analysis was performed on responses from practicing full-time or part-time school nurses who work exclusively in a single school setting. Responses from nurses who were retired, no longer work in a school setting, work at >1 school, or work primarily as a nurse administrator of a school district at the time of the study were excluded.

Data organization and analysis were performed by using the Epi Info system developed by the Centers for Disease Control and Prevention.<sup>11</sup> Descriptive statistics were calculated for all response variables. Analysis of variance was used to compare continuous data, and the  $\chi^2$  test was used to compare categorical data. 95% confidence intervals (CIs) were calculated by standard methods. Significance was indicated by a *P* value of <.05. Significance of differences between 2 stratified groups was determined by non-overlapping 95% CIs. The institutional review board at Newark Beth Israel Medical Center approved the study. A letter of informed consent was mailed with the questionnaire.

## RESULTS

Of the 1000 questionnaires sent, 21 were returned as “undeliverable.” Of the remaining 979 questionnaires, 675 (69%) were returned. One hundred two returned questionnaires were excluded (37 respondents were retired, 19 respondents no longer worked in a school setting, 20 respondents worked in >1 school, and 26 respondents worked in a school district as an administrator), which left 573 questionnaires available for analysis.

A majority of responses were from registered

nurses practicing for >5 years in a rural or suburban setting (Table 1). Responding school nurses represented 49 states (except Alaska) and the District of Columbia. The most common reported school emergencies were extremity sprains and shortness of breath (Table 2). The school nurse’s ranking of the most common school-related emergencies did not differ significantly at the 95% confidence level between inner-city and rural/suburban school settings.

Of 573 school nurses, 391 (68% [95% CI: 64–72%]) had managed a life-threatening emergency requiring EMS activation during the past school year. Table 3 evaluates the preparedness of schools to respond to pediatric life-threatening emergencies as delineated by the AAP<sup>1</sup> and AHA.<sup>2</sup> The only statistically significant difference in the emergency preparedness of inner-city versus rural/suburban schools was in the identification of authorized personnel to make medical decisions when faced with a life-threatening emergency. More school nurses who worked in an inner-city setting reported lacking “identification of authorized personnel to make medical decisions” compared with nurses who work in a rural/suburban setting (21% vs 11%; *P* = .02). When stratified by mean student attendance, school setting, and funding classification, schools with and without an MERP did not differ significantly (Table 4).

Of the 205 schools that do not have a school nurse present on campus during all school hours, 17% (95% CI: 12–23%) do not have an MERP, 17% (95% CI:

**TABLE 1.** Demographics of School Nurse Responders and Their Schools

	All Responses ( <i>N</i> = 573)	Inner City ( <i>N</i> = 108)	Rural/Suburban ( <i>N</i> = 465)
School–nurse demographics			
Highest educational level			
Licensed practical nurse	12 (2 [1–4])	1 (1 [0–5])	11 (2 [1–4])
Registered nurse	394 (69 [65–73])	70 (65 [56–73])	324 (70 [66–74])
Masters degree	139 (24 [21–28])	30 (28 [20–37])	109 (23 [19–27])
Nurse practitioner	25 (4 [3–6])	6 (6 [3–12])	19 (4 [3–6])
Doctorate in nursing	3 (1 [0–2])	1 (1 [0–5])	2 (0.4 [0–0.5])
Experience as school nurse			
≤5 y	115 (20 [17–23])	13 (12 [7–19])	102 (22 [18–26])
>5 y	458 (80 [77–83])	95 (88 [81–93])	363 (78 [74–82])
Certification in CPR†	478 (83 [80–86])	88 (82 [74–88])	390 (84 [80–87])
School demographics			
Student attendance*			
Grades represented	962 (849 [892–1032])	755 (511 [659–851])	1010 (903 [928–1092])
Kindergarten through 8th grade	241 (42 [38–46])	54 (50 [41–59])	187 (40 [36–45])
High school	92 (16 [13–19])	21 (19 [13–27])	71 (15 [12–19])
Kindergarten through high school	240 (42 [38–46])	33 (31 [23–40])	207 (45 [41–50])
Funding classification			
Public	519 (91 [88–93])	95 (88 [81–93])	424 (91 [88–93])
Private	54 (9 [7–12])	13 (12 [7–19])	41 (9 [7–12])
Weekly number of visits to school nurses for “medical or psychiatric” emergencies			
<10 visits	193 (33 [30–38])	29 (27 [20–36])	164 (35 [31–39])
10–25 visits	90 (16 [13–19])	19 (18 [12–26])	71 (15 [12–19])
>25 visits	290 (51 [47–55])	60 (56 [47–65])	230 (50 [45–55])
Life-threatening emergencies over the past school year requiring activation of EMS*	2.2 (3.6 [1.9–2.5])	2.8 (5.6 [1.7–3.9])	2.1 (2.9 [1.8–2.4])
Children with special needs			
Tracheostomy	96 (17 [14–20])	18 (17 [11–25])	78 (17 [14–21])
Gastric feeding tube	220 (38 [34–42])	38 (35 [27–44])	182 (39 [35–44])
Ventriculoperitoneal shunt	210 (37 [33–41])	36 (33 [25–42])	174 (37 [33–42])

All values are expressed as no. (% [95% CI]) except where noted.

\* Values are expressed as mean (SD [95% CI]).

† Cardiopulmonary resuscitation.

**TABLE 2.** Most Common Reported School Emergencies

	All Responses (N = 573)
Extremity sprain	339 (59 [55–63])
Shortness of breath	336 (59 [55–63])
Seizure	89 (16 [13–19])
Extremity fracture	81 (14 [11–17])
Head/neck injury	61 (11 [9–14])
Laceration	60 (11 [9–14])
Psychiatric emergency	44 (8 [6–11])
Abdominal pain	27 (5 [3–7])
Syncope	19 (3 [2–5])
Anaphylaxis	18 (3 [2–5])
Chest pain/palpitations	17 (3 [2–5])
Dehydration	17 (3 [2–5])
Poisoning/overdose	8 (1 [0–2])
Airway obstruction	8 (1 [0–2])
Loss of consciousness	6 (1 [0–2])
Cardiac arrest	1 (0.2 [0–1])

All values are expressed as no. (% [95% CI]). Number of respondents who ranked potential school emergency as “first most frequent” or “second most frequent” when asked to rank the top 5 most frequent school emergencies encountered over the past school year.

**TABLE 3.** Emergency Preparedness of Schools Based on AAP and AHA Guidelines

	All Responses N = 573
Presence of an MERP	498 (86 [84–90])
MERP practiced (N = 498)	
Beginning of school year only	154 (31 [27–35])
End of school year only	7 (1 [0–2])
Periodically during year	162 (33 [29–37])
Never practiced	176 (35 [31–39])
Presence of communication with local EMS integrating all parts of school campus*	185 (32 [28–36])
Identification of authorized personnel to make medical decisions	
No	75 (13 [10–16])
Yes: school nurse	365 (64 [60–68])
Yes: administrative staff	125 (22 [19–26])
Yes: teacher	7 (1 [0–2])
School nurse educated in basic life support	478 (83 [80–86])
Presence of asthma emergency care plan for asthmatics	462 (81 [78–84])
Presence of diabetic emergency care plan for diabetics	514 (90 [87–92%])
Presence of emergency care plan for students with special care needs†	454 of 526 (86 [83–89])
School health provider present during all school hours	368 (64 [60–68])
CPR training available in school	
For administrative staff	368 (64 [60–68])
For teachers	434 (76 [72–79])
For students	166 (29 [25–33])
Athletic trainer present during all athletic events‡	191 (36 [32–40])

All values are expressed as no. (% [95% CI]).

\* Cellular phones, walkie-talkies, alarms, intercom systems, etc.  
† Five hundred twenty-six nurses reported at least 1 child with special needs in their school.

‡ Five hundred thirty-four nurses responded; athletic events included practices and competition.

12–23%) do not identify an authorized person to make medical decisions when faced with a life-threatening emergency, and 72% (95% CI: 65–78%) do not have an effective campus-wide communication system. CPR training is offered to 76% (95% CI:

**TABLE 4.** Comparisons With the Presence and Absence of an MERP

	Presence of MERP (N = 498)	Absence of MERP (N = 75)
Student attendance*	940 (804 [869–1011])	1108 (1096 [860–1356])
Setting		
Inner city	95 (88 [81–93])	13 (12 [7–19])
Rural/suburban	403 (87 [84–90])	62 (13 [10–16])
Funding classification		
Public	446 (86 [83–89])	73 (14 [11–17])
Private	52 (96 [87–99])	2 (4 [1–13])

All values are expressed as no. (% [95% CI]) except where noted.

\* Values are expressed as mean (SD [95% CI]).

70–81%) of the teachers, 68% (95% CI: 61–74%) of the administrative staff, and 28% (95% CI: 22–35%) of the students.

Table 5 describes the availability of selected emergency equipment recommended by the AAP,<sup>1</sup> AHA,<sup>2</sup> and NASN<sup>12</sup> as reported by school-nurse responders. When stratified by inner-city and rural/suburban school settings, the availability of emergency equipment did not differ significantly except for the availability of an oxygen source, which was higher in rural/suburban schools (15% vs 5%; *P* = .001).

School-nurse responders self-reported more confidence in managing respiratory distress, airway obstruction, profuse bleeding/extremity fracture, anaphylaxis, and shock in a diabetic child and comparatively less confidence in managing cardiac arrest, overdose, seizure, heat illness, and head injury (Table 6). When stratified by inner-city and rural/suburban settings, the reported confidence of school nurses did not differ significantly. When comparing levels of experience, school nurses with ≤5 years of experience and those with >5 years of experience reported similar levels of confidence in all scenarios except in the management of a diabetic child in shock, in which more experienced nurses reported greater confidence (82% vs 70%; *P* = .005).

When analyzing the schools with at least 1 child with special care needs, 254 (90% [95% CI: 86–93%])

**TABLE 5.** Availability of Emergency Equipment at Each School as Recommended by the AAP, AHA, and NASN

	All Responses (N = 573)
Suction device	84 (15 [12–18])
Oxygen	75 (13 [10–16])
Albuterol meter dosed inhaler	446 (78 [74–81])
Mouth-to-mouth mask	526 (92 [89–94])
Bag-valve-mask device	109 (19 [16–22])
AED	184 (32 [28–36])
Epinephrine autoinjector	437 (76 [68–79])
Emergency care manual	469 (82 [79–85])
Gloves	562 (98 [96–99])
Face mask/shield	355 (62 [58–66])
Portable first aid kit	497 (87 [84–90])
Glucose source for hypoglycemia*	529 (92 [89–94])
Cervical spine collar	77 (13 [10–16])
Backboard with restraints	65 (11 [9–14])
Extremity splints	435 (76 [72–79])
Sterile dressings	477 (83 [80–86])

All values are expressed as no. (% [95% CI]).

\* Sugar packet, glucagon, etc.

**TABLE 6.** Reported Confidence of School Nurses in the Management of Potential Pediatric Emergencies

	All Responses (N = 573)
Respiratory distress	505 (88 [85–90])
Airway obstruction	481 (84 [81–87])
Profuse bleed/fracture	475 (83 [80–86])
Anaphylaxis	468 (82 [79–85])
Diabetic in shock	457 (80 [77–83])
Cardiac arrest	426 (74 [70–77])
Overdose	373 (65 [61–69])
Seizure	346 (60 [56–64])
Heat illness	287 (50 [46–54])
Head injury	287 (50 [46–54])

Confidence was determined by a response of 4 (“confident”) or 5 (“very confident”) on a Likert scale ranging from 1 (“very uncomfortable”) to 5 (“very confident”). Values are expressed as no. (% [95% CI]).

of 282 schools have an MERP, 64% (95% CI: 58–69%) have a nurse available during all school hours, and 32% (95% CI: 27–38%) have an efficient and effective campus-wide communication system linked with EMS. There are no identified authorized personnel to make medical decisions when the school nurse is not present on campus in 12% (95% CI: 9–16%) of the schools with children with special care needs. When analyzing the confidence level of school nurses to respond to common potential life-threatening emergencies in children with special care needs, 67% (95% CI: 61–72%) of the school nurses felt confident in managing seizures, 88% (95% CI: 84–91%) felt confident in managing respiratory distress, and 83% (95% CI: 78–87%) felt confident in managing airway obstruction. School nurses reported having the following emergency equipment available in the event of an emergency in a child with special care needs: glucose source (94% [95% CI: 91–96%]), bronchodilator (79% [95% CI: 74–83%]), suction (22% [95% CI: 18–27%]), bag-valve-mask device (16% [95% CI: 12–21%]), and oxygen (12% [95% CI: 9–16%]).

An MERP designed specifically for potential mass disasters was present in 418 (74% [95% CI: 70–77%]) of 573 schools. When stratified by mean student attendance, school setting, and funding classification, schools with and without an MERP for mass disasters did not differ significantly (Table 7).

## DISCUSSION

Several recently published studies have reported the prevalence of life-threatening emergencies occur-

**TABLE 7.** Comparisons With the Presence and Absence of an MERP for Mass Disasters

	Presence of MERP for Mass Disasters (N = 418)	Absence of MERP for Mass Disasters (N = 150)
Student attendance*	961 (857 [879–1043])	939 (795 [812–1066])
Setting		
Inner city	79 (74 [65–81])	28 (26 [19–35])
Rural/suburban	339 (74 [70–78])	122 (26 [22–30])
Funding classification		
Public	379 (74 [70–78])	136 (26 [22–30])
Private	39 (74 [61–84])	14 (26 [16–39])

All values are expressed as no. (% [95% CI]) except where noted. \* Values are expressed as mean (SD [95% CI]).

ring in children while they attend school. Seventeen percent of surveyed teachers from the Midwest have responded to at least 1 life-threatening student emergency during their teaching career.<sup>10</sup> A survey of school nurses in New Mexico reported that 67% of schools have activated EMS over the past year for a life-threatening emergency in a student, with an average of 4 transports per year.<sup>5</sup> In a recently published study, Miller and Spicer<sup>13</sup> reported that each year, 3.7 million children suffer a significant injury while at school, resulting in an estimated \$3.2 billion in medical spending. These studies stress the importance of establishing an MERP in schools throughout the United States. An efficient and effective MERP would improve the assessment, triage, and management of injured and ill children at school by well-trained and confident school staff members and facilitate transfer of these children to an acute care facility by EMS.

We attempted to determine the preparedness of schools in the United States to deal with life-threatening emergencies by determining if they had an MERP as recommended by the AAP and AHA, determining the availability of emergency equipment at each school, and reporting the confidence level of school nurses to deal with potential pediatric life-threatening emergencies. Our data demonstrate that although school nurses reported that their schools, for the most part, were in compliance with these recommendations, there are areas for improvement. Although a majority of schools have an MERP (including emergency plans specific to children with asthma, diabetes, and special care needs), the plan was practiced periodically during the year in only 33% of the schools and never practiced in 35% of the schools. Furthermore, an efficient and effective campus-wide communication system, which would facilitate the transfer of an injured or ill child by EMS from the school to an acute care facility, was lacking in 68% of the schools. No authorized personnel were designated to make medical decisions when faced with a life-threatening emergency in 13% of the schools. Therefore, improvement in the preparedness of schools to deal with life-threatening emergencies should include increasing the frequency of practice of the MERP (to identify potential barriers and areas for improvement), linking all areas of the campus directly with EMS through various means of communication (cellular phones, walkie-talkies, alarms, intercom systems), and designating roles among school staff a priori for potential life-threatening emergencies (administer medication, communicate with EMS and local emergency departments, contact family members).

The improvement in the preparedness of schools to deal with life-threatening emergencies requires the commitment of the entire community. The AAP has suggested that school nurses take a leadership role in the preparation of schools for life-threatening emergencies by developing a strong partnership with local EMS, school personnel, and local primary care physicians.<sup>14</sup> Pediatricians should take an active role in local community response planning, assist in the development of prehospital pediatric protocols,

train first responders in pediatric assessment and CPR, and, in the event of a disaster, participate in the community or hospital disaster plan.<sup>7</sup> Emergency physicians should also be involved in the development and organization of systems for the prevention of life-threatening emergencies in schools and advocate through local legislation for the implementation of school health emergency systems, school-nurse staffing ratios, and administrator and teacher training.<sup>15</sup> EMS workers should identify the barriers to the care of injured or sick children in schools in their community and develop policies in schools to deal with disasters such as extreme weather conditions, fires, explosions, hazardous materials, mass casualties, and bomb scares.<sup>3</sup>

In general, the availability of emergency equipment at each school to treat potential life-threatening emergencies requires improvement. One piece of equipment recommended strongly by the AHA<sup>2,16</sup> and NASN<sup>12</sup> for schools is the AED. Our data show that only 32% of the schools have an AED present on campus. Although the risk of sudden cardiac arrest has been estimated at 0.5 to 1.0 per 100 000 children and young adults who participate in school athletics,<sup>17,18</sup> the use of an AED may be life saving. Furthermore, the AHA has stressed the importance of availability of an AED for potential sudden cardiac arrest in adults who work or visit the school.<sup>2</sup> Therefore, improvements must be made in schools to increase the availability of AEDs and ensure the certification of all school nurses, as well as administrative staff, teachers, and students, in basic life support.

Another area of improvement is the education and training of school nurses as well as administrative staff, teachers, and students. Our data show that 83% of school nurses were certified in CPR. Furthermore, school nurses reported less confidence when faced with scenarios dealing with cardiac arrest, overdose, seizures, heat illness, and head injury when compared with the confidence in dealing with respiratory distress, airway obstruction, profuse bleeding/fracture, anaphylaxis, and a diabetic in shock. Only 50% of the school nurses reported confidence in managing head injuries and 60% in managing seizures, which is of concern because these scenarios were reported as 2 of the 5 most common reported school emergencies. Efforts should be made to increase the education of school nurses in the assessment and management of life-threatening emergencies, particularly in topics for which they reported less confidence. This education could be provided on the school campus or in a conference format taught by local pediatricians, emergency physicians, EMS staff, or other school nurses. For example, education of school nurses on CPR could include not only basic life support certification but also frequent mock-emergency-scenario training sessions. Furthermore, considering the fact that school nurses may not be present on campus during all school hours, efforts should be made to increase the education of administrative staff, teachers, and students in CPR.

One important barrier to the preparedness of schools to respond to life-threatening emergencies in children occurs when there is a school nurse present

during only a portion of the school day.<sup>3</sup> The US Department of Health and Human Services, in its *Healthy People 2010* objectives, recommends at least 1 nurse per 750 students, depending on the community and student population.<sup>19</sup> Our data demonstrate that a significant proportion of surveyed schools that have a school nurse present during only a portion of the school day do not have an MERP and do not identify an authorized person to make medical decisions when faced with a life-threatening emergency. Furthermore, only 75% of teachers and administrative staff are trained in CPR. Therefore, efforts should be made to improve the presence of an MERP in schools that have a school nurse present during only a portion of the school day and increase the training of teachers and administrative staff to perform CPR in the event of a pediatric cardiorespiratory arrest. Although studies have demonstrated schoolteachers' overall lack of knowledge of CPR and lack of confidence to manage asthma and epilepsy, Barrett<sup>20</sup> has illustrated the value of school nurses educating schoolteachers about emergencies in children. Sapien et al<sup>21</sup> demonstrated that schoolteachers' confidence level in recognizing respiratory distress in asthmatic children and knowledge of asthma medications improved after attending an education session consisting of video footage and didactic teaching.

Our demographic data pertaining to the number and type of life-threatening emergencies is similar to previously published data. Sapien and Allen<sup>5</sup> reported that 67% of the schools in New Mexico activate the EMS system yearly, which is similar to our data (68%). Knight et al<sup>22</sup> reported that injuries account for a majority of school-based EMS calls and that the 2 most documented medical complaints requiring EMS activation were breathing difficulty and seizures. Similarly, our data demonstrate that 4 of the 6 most common reported school emergencies were related to trauma (extremity sprain, extremity fracture, head/neck injury, laceration), whereas shortness of breath and seizures were the most common medical complaints.

Our study has several limitations. Although only 69% of the questionnaires were returned completed, we feel that the data obtained represent both a diverse group of school nurses in their experience and schools in their population, grades represented, setting, and funding classification. Although ~81% of the surveyed school nurses work in a school described as rural or suburban, this corresponds with national data collected by the National Center for Educational Statistics (74% of 95 920 schools nationally).<sup>23</sup> Our survey was sent only to school nurses; therefore, these data do not include schools without a designated school nurse. In particular, schools with small enrollment that either do not have the need or the financial resources to employ a full-time or part-time school nurse were not surveyed.

As with most surveys, responding to clinical scenarios in a questionnaire format may not reflect the true practice in real time of a school nurse responding to a life-threatening emergency. Although the questionnaire has not been validated to measure the

preparedness of schools or its effect on the morbidity or mortality of children who experience life-threatening emergencies, it does reflect how compliant schools in the United States are with nationally recommended guidelines at the time of the survey and identifies areas of improvement. Although we surveyed school nurses on the presence of an MERP for children with special needs, we did not ask whether they specifically used the universally accepted "Emergency Information Form for Children With Special Needs" standardized form as recommended by the American College of Emergency Physicians and the AAP.<sup>6</sup> Last, although we inquired about the presence of an MERP specifically for mass casualty, we did not ask specific questions concerning the handling, identification, response, and decontamination for acts of chemical, biological, and radiologic terrorism as recommended by the National Advisory Committee on Children and Terrorism<sup>24</sup> or measure the confidence of school nurses to assess and manage potential life-threatening emergencies specific to terrorism.

### CONCLUSIONS

Our data demonstrate that although school nurses reported that their schools, for the most part, were in compliance with recommendations by the APA and AHA, several areas for improvement exist. Practicing the MERP several times a year, linking all areas of the campus directly with EMS, and assigning roles among school staff when faced with a life-threatening emergency would improve the preparedness of schools. Only one third of schools have AEDs. Efforts are needed to increase AED availability in schools and the confidence of school nurses to deal with cardiopulmonary arrest. Efforts also should increase the education of school nurses in the assessment and management of other life-threatening emergencies for which they have less confidence, particularly overdose, seizures, heat illness, and head injury. We recommend that communities, including physicians, EMS staff, and school staff members, assess their current state of school preparedness several times during the school year and ensure compliance with these published guidelines to improve the care of children while in school.

### APPENDIX

#### Potential Pediatric School Emergencies

- A 7-year-old with history of asthma who is complaining of chest tightness, is tachypneic, and is in moderate respiratory distress.
- An 8-year-old found unconscious after choking on a hot dog.
- A 6-year-old with a large scalp laceration and open fracture of the left ankle after a fall in a stairwell.
- An 18-year-old with difficulty breathing and swallowing and moderate facial swelling after being stung by a bee.
- A 9-year-old with diabetes found unconscious, pale, and sweaty with fine shaking of the extremities and weak pulse.
- A 12-year-old who collapsed suddenly on the playground and is unconscious, pale, pulseless, and apneic.
- A 14-year-old who is conscious but vomiting after swallowing an unknown number of pills.
- A 5-year-old with a ventriculoperitoneal shunt and tracheostomy who is having a prolonged seizure and vomiting.
- A 16-year-old football player who is complaining of headache and muscle cramps after practice, who appears weak with red, hot, dry skin and cool, clammy hands and who subsequently loses consciousness on the playing field.
- A 10-year-old who is unconscious but breathing after falling off of the monkey bars and landing on his head.

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