Managing Acute Seizures

New Rescue Delivery Option and Resources to Assist School Nurses

Patricia Dean, MSN, ARNP, CNRN
Kathryn O'Hara, RN
Lai Brooks, DNP, FNP-BC
Ruth Shinnar, MSN, RN
Genei Bougher, MSN, APRN, CPNP, CCRC
Nancy Santilli, MN, PNP, FAAN

Approximately 470,000 children and adolescents in the United States have epilepsy, 30% of whom experience seizures despite antiseizure drug regimens. School nurses, teachers, caregivers, and parents play integral roles in implementing a care plan that avoids triggers, recognizes signs, and provides supportive care—ideally, guided by a patient-specific seizure action plan, which may include the use of rescue medication. Benzodiazepines are the mainstay of seizure rescue medication; for decades, rectally administered diazepam was the only approved rescue medication for seizure clusters outside the hospital setting. However, rectal administration has limitations that could delay treatment (e.g., social acceptability, removal of clothing, positioning). More recently, intranasal midazolam (for patients ≥12 years) and intranasal diazepam (for patients ≥6 years) were approved for this indication. Training and education regarding newer forms of rescue medication should improve confidence in the ability to treat seizures in school with the goal of increasing the safety of students with epilepsy.

Keywords: benzodiazepine; diazepam; epilepsy; intranasal; midazolam; nasal spray; rescue medication; seizure; seizure cluster

Approximately 3.5 million Americans were estimated to have epilepsy as of 2015; of these, 470,000 were younger than 18 years of age (Zack & Kobau, 2017). In an analysis of 67,733 children (0-18 years of age) from 2005 to 2012, the prevalence of epilepsy was higher than that of food allergies or diabetes (Miller et al., 2016). Among all patients with epilepsy, 30% continue to have seizures despite antiseizure drug regimens (Brodie, 2013). In particular, seizure clusters may result in emergency department visits and hospitalization, which negatively affect the quality of life of patients and caretakers (Penovich et al., 2017). Most seizures occur outside the hospital setting, and in school, treatment is dependent on the presence of the school nurse or persons delegated by the school nurse (Cross et al., 2013), such as assistants, aides, and any other unlicensed, nonmedical personnel identified by the school system. Given that a large proportion of a child's waking day is spent in school, and that many types of seizures are more common while a person is awake, school personnel are likely to encounter a student having a seizure during the school day (Gurkas et al., 2016; National Center for Education Statistics, 2021; Pavlova et al., 2012).

Some students with epilepsy will experience seizure clusters, also referred to as acute repetitive seizures. Although specific definitions vary (Haut, 2015; Haut et al., 2005), a general

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characterization is serial seizures within a specific time period that is distinguished from the patient's normal seizure pattern (Fisher et al., 2015; Jafarpour et al., 2019). Seizures that last longer than 5 minutes are substantially less likely than shorter seizures to stop on their own (Shinnar et al., 2001). Indeed, status epilepticus can be defined as 5 minutes of continuous clinical seizure activity or recurrent seizure activity without recovery between seizures (Brophy et al., 2012), and it may result in possible cognitive deficits and even death (Arzimanoglou, 2007; Sheppard & Lippé, 2012). Thus, guidelines from the American Epilepsy Society recommend that rescue medication be administered for any prolonged convulsive seizure lasting 5 minutes (Glauser et al., 2016).

Many school personnel might be frightened when a student has a convulsive seizure and want to call emergency medical services. However, when a child has a seizure in school, it does not mean he or she should be automatically taken to the emergency room. The student's seizure action plan (SAP) should outline the steps a healthcare provider recommends for the student regarding returning to the classroom, being sent home, calling emergency services, or being sent to the emergency room. School policies may require that a child be transported to the emergency department or that emergency medical services be called when students experience a convulsive seizure (Terry et al., 2016). Unfortunately, this is not always an optimal response because it can result in increased healthcare utilization, costs, and inconvenience and may not be beneficial for the child, thus emphasizing the importance of appropriate care for students in the school setting (Terry et al., 2016).

Acute seizures and seizure clusters are typically managed with benzodiazepines. Rectally administered diazepam was the first approved acute rescue treatment for seizure clusters for use outside a hospital setting (Bausch Health US, 2021). Although surveys have suggested that many school nurses feel confident administering it (Terry et al., 2016), the use of rectal diazepam is associated with issues of privacy and social acceptability, and the availability of school nurse and unlicensed personnel to administer medication also may be limited.

Safety of medication administration is one of the most important aspects of seizure management, and the National Association of School Nurses (NASN; 2017) guidelines emphasize that medication administration policies and procedures should focus on safety. Although it is important to be vigilant regarding dosing errors, safe medication administration, and side effects of benzodiazepines, it is also important to recognize the risks to the student associated with having a seizure (Szaflarski, 2016). Thus, utilizing rescue therapy is an important component of seizure management in schools. The objective of this review is to provide an up-to-date, evidence-based guide on the management of seizures in schools and the role school nurses play. The goals are safe and efficacious treatment for students with epilepsy and the potential for increased quality of life for the student and their family.

Being Prepared

For school nurses, ongoing education and training contribute to managing seizures appropriately (Toli et al., 2013). In a study conducted in conjunction with the Epilepsy Foundation of Minnesota, training of school nurses was shown to improve nurse confidence in managing students with seizures, following SAPs, and training other school personnel (Brook et al., 2015). Organizations including the Epilepsy Foundation, the Epilepsy Alliance, and local and state epilepsy groups provide online and in-person training resources (see Table 1); in addition, comprehensive epilepsy program nurses can provide seizure training resources for school nurses. Nurses are able to receive continuing education credits for successful completion of some of these training programs.

Another component of seizure management in schools is the education of the school community, including teachers, administrators, and coaches. A survey of elementary school teachers in Michigan indicated that although most respondents (68%) had obtained information about epilepsy from the internet, the majority would have preferred to receive information from either a school nurse (74%) or a physician (73%; Mott et al., 2013). These findings suggest that there is a need for further education and training of teachers in understanding epilepsy.

School nurses may be asked to educate the student population. Classmates may be unfamiliar with the disorder; introducing the basics of epilepsy and dispelling any erroneous preconceived notions will help the students be better informed and equipped in the event of witnessing a classmate's seizure. Follow-up support may also need to be provided to students who have witnessed a seizure to address questions about what they saw or concerns about their friend's safety. Thus, we suggest that, ideally, education should incorporate the entire school community. School nurses could provide a presentation on epilepsy basics and first aid to the school, including students, so that they are more confident and proactive with notifying school personnel if a student experiences a seizure. Education by school nurses will reduce the stigma of the condition.

The Epilepsy Foundation recommends Seizure Safe Schools legislation nationwide (Epilepsy Foundation, 2021). The model bill comprises requiring school personnel training, mandating for an SAP, ensuring that prescribed U.S. Food and Drug Administration (FDA)-approved medications are administered, educating and training students, and a Good Samaritan clause. Currently, eight states have passed this type of legislation (Epilepsy Foundation, 2021).

Developing a Care or Action Plan

A care or action plan is essential to seizure management. NASN recommends that every child with seizures should have an individualized healthcare plan (IHP), which includes the student's SAP

Table 1. Training Resources for School Nurses and Other Personnel

Training resources	URL
School nurses	
Epilepsy Foundation	https://www.epilepsy.com/living-epilepsy/our-training-and-education/managing-students-seizures-school-nurse-training-program
Epilepsy Alliance Ohio	http://www.epilepsy-ohio.org/programs-services/community-education/managing-students-with-seizures-school-nurse-training-program/
Epilepsy Alliance Louisiana	https://epilepsylouisiana.org/training-programs/
National Association of Epilepsy Centers (directory of local centers, which may provide local resources)	https://www.naec-epilepsy.org/about-epilepsy-centers/find-an-epilepsy-center/
School personnel	
Epilepsy Foundation	https://www.epilepsy.com/living-epilepsy/our-training-and-education/seizure-training-school-personnel
Epilepsy Alliance Louisiana	https://epilepsylouisiana.org/training-programs/
Epilepsy Florida	https://www.epilepsyfl.com/school-training/
Other students	
Epilepsy Foundation	https://www.epilepsy.com/about-us/our-programs/take-charge-classroom-epilepsy-education-programs
Centers for Disease Control and Prevention	https://www.cdc.gov/healthyschools/bam/diseases/epilepsy.html
Epilepsy Association of Western and Central Pennsylvania	https://www.eawcp.org/help/studentinclassroom/

and follows the student's healthcare provider's orders for the school setting (Lepkowski & Maughan, 2018a, 2018b). The development of the SAP should involve collaboration with the student as appropriate to their age and abilities, to increase self-advocacy and self-management of seizures (Lepkowski & Maughan, 2018a, 2018b) to ensure that they can fully participate in their academic and extracurricular activities (Keehner Engelke et al., 2008). Case management, including SAP development, must also involve collaboration with the student's family, the school nurse, and relevant healthcare providers, such as the treating clinician and the hospital or office nurse (Keehner Engelke et al., 2008). The IHP/SAP should address a student's individual needs related to seizures (Lepkowski & Maughan, 2018a, 2018b). Key items in an IHP/SAP include student information; a list of current medications, including doses, route of administration, and student's reaction to the medication if available; type of seizure; signs and length of a typical seizure and potential triggers; detailed course of action in the event of a seizure; when and how to intervene; and course of action after a seizure (Epilepsy Foundation, 2020b). Template SAPs are provided by organizations such as the Epilepsy Foundation (see Table 2). Individual school districts may also have preferred SAP templates.

When to Use Rescue Medications

A detailed history of rescue medication use, obtained from the students' parents, caregivers, and medical providers, is invaluable in planning for a seizure emergency in the school setting. In the school-age population, intranasal and rectal treatments are currently approved for seizure clusters. Initiation of assessment and treatment for recognizable seizure clusters is dictated by both the provider and state orders and should begin when the stereotypic seizure profile is recognized; directions for use for approved medications do not include a time frame (Bausch Health US, 2021; Neurelis, Inc., 2021; UCB, Inc., 2021). Currently, rectal diazepam, diazepam nasal spray, and midazolam nasal spray are approved as rescue therapies for seizure clusters (see Table 3). The choice of rescue medication outside of the hospital setting depends on a variety of factors, including the route of administration and efficacy (Galemore, 2016). Rectal diazepam gel was historically the only approved seizure rescue medication and was commonly prescribed for administration in the school setting (O'Dell & O'Hara, 2007). However, this route necessitates the student to be partially undressed, which may delay administration and be

Table 2. Tools for School Nurses

Templates	URL
Seizure action plans	
Epilepsy Foundation	https://www.epilepsy.com/sites/core/files/atoms/files/SCHOOL%20Seizure%20Action%20Plan%202020-April7_FILLABLE.pdf
Child Neurology Foundation	https://www.childneurologyfoundation.org/wp-content/uploads/2018/04/CNF_Seizure_Action_Plan_v3.pdf
American Academy of Pediatrics	https://www.aap.org/en-us/Documents/Seizure_Action_Plan_for School.pdf
Delegation resources and checklists	
Recommended Qualifications	https://higherlogicdownload.s3.amazonaws.com/NASN/3870c72d-fff9-4ed7-833f-215de278d256/UploadedImages/PDFs/Professional%20Topic%20Resources/delegation_UAP_qualifications.pdf
Skills checklist for training	https://higherlogicdownload.s3.amazonaws.com/NASN/3870c72d-fff9-4ed7-833f-215de278d256/UploadedImages/PDFs/Professional%20Topic%20Resources/delegation_UAP_skills.pdf
S081—Principles for Practice: Nursing Delegation to Unlicensed Assistive Personnel in the School Setting (2nd ed.)	https://my.nasn.org/online-store/publications
NASN course on delegation	https://www.pathlms.com/nasn/courses/25478
NASN Emergency Medications Toolkit[a]	https://www.pathlms.com/nasn/courses/25694

[a]This toolkit may be a valuable resource for school nurses; however, content regarding when it is appropriate to call 911 is not aligned with the NASN Seizures and Epilepsy Clinical Practice Guideline for School Nurses or with the best practices/literature included here.

viewed as problematic for the student, school staff, and other students (O'Dell & O'Hara, 2007). One study examining school nurses' knowledge of state and school district policies and their own experiences with the administration of rectal diazepam reported privacy, availability of a nurse, legal/delegation issues, staff anxiety/fear, and lack of training as the most common barriers to diazepam rectal gel administration in a school setting (O'Dell & O'Hara, 2007).

Oral and buccal formulations of benzodiazepines, such as clonazepam, might be used off-label as rescue therapies for seizure clusters. However, these formulations may be associated with drawbacks (Gidal et al., 2020), and none are yet approved for use in the United States. There is a potential risk of injury to both the student and the nurse when administering oral treatment (Hartman et al., 2016), and universal precautions, such as the use of gloves, must be taken. Nurses may be unable to administer oral or buccal therapy during a seizure owing to the risk of aspiration or accessibility (Gidal et al., 2020; Seinfeld et al., 2020). Furthermore, the bioavailability and absorption of the rescue drug may vary because of factors such as excessive secretions and possible postictal emesis (Gidal et al., 2020; Hartman et al., 2016).

Alternative routes of administration have been investigated that may address an unmet need, and NASN recommends that nurses advocate for the least restrictive/invasive medication route (i.e., nasal or buccal rather than rectal; Lepkowski & Maughan, 2018a, 2018b). There are now two FDA-approved intranasal treatments: a diazepam formulation for patients ≥6 years of age (Neurelis, Inc., 2021) and a midazolam formulation for patients ≥12 years of age (UCB, Inc., 2021). Administration details for the FDA-approved rescue therapies are provided in Table 3. Demonstration videos and downloadable instructions are available through the medication websites (links provided in Table 3). Additionally, there are a number of rescue medications and routes of administration currently under investigation (Epilepsy Foundation, 2020a, 2020c; Seinfeld et al., 2020).

Students should be monitored closely after the administration of rescue medication for medication response or side effects and may recover relatively quickly. A recent patient survey suggested that approximately 37% of patients who received intranasal diazepam administered at the first sign of a seizure felt like their usual selves within 30 minutes, and approximately 60% felt like their usual selves after 1 hour (Penovich et al., 2021). In clinical trials, benzodiazepines have demonstrated effectiveness with generally mild side effects (most

Table 3. Approved Treatments for Seizure Clusters and Instructions for Use

Treatment	Indication	Age- and Weight-Based Dosing	Administration Instructions
Diazepam rectal gel (Bausch Health US, 2021) FDA approval July 29, 1997 Link to Instructions for Use 	Selected refractory patients with epilepsy, on stable regimens of antiepileptic drugs, who require intermittent use of diazepam to control bouts of increased seizure activity. Approved for use at home	Age 2-5 years (0.5 mg/kg) • 6-10 kg, 5 mg • 11-15 kg, 7.5 mg • 16-20 kg, 10 mg • 21-25 kg, 12.5 mg • 26-30 kg, 15 mg • 31-35 kg, 17.5 mg • 36-44 kg, 20 mg Age 6-11 years (0.3 mg/kg) • 10-16 kg, 5 mg • 17-25 kg, 7.5 mg • 26-33 kg, 10 mg • 34-41 kg, 12.5 mg • 42-50 kg, 15 mg • 51-58 kg, 17.5 mg • 59-74 kg, 20 mg Age 12+ years (0.2 mg/kg) • 14-25 kg, 5 mg • 26-37 kg, 7.5 mg • 38-50 kg, 10 mg • 51-62 kg, 12.5 mg • 63-75 kg, 15 mg • 76-87 kg, 17.5 mg • 88-111 kg, 20 mg	1. Put person on their side where they cannot fall 2. Get medicine 3. Get syringe 4. Push up with thumb and pull to remove cap from syringe. Be sure seal pin is removed with the cap 5. Lubricate rectal tip with lubricating jelly 6. Turn person on side facing you 7. Bend upper leg forward to expose rectum 8. Separate buttocks to expose rectum 9. Gently insert syringe tip into rectum 10. Slowly count to 3 while gently pushing plunger until it stops 11. Slowly count to 3 before removing syringe from rectum 12. Slowly count to 3 while holding buttocks together to prevent leakage 13. Keep person on side facing you, note time given and continue to observe 14. If the second dose is needed, administer 4 to 12 hours after the first dose
Diazepam nasal spray (Neurelis, Inc., 2020, 2021) FDA approved January 10, 2020 Link to Instructions for Use Video Instructions 	Acute treatment of intermittent, stereotypic episodes of frequent seizure activity that are distinct from a patient's usual seizure pattern in patients with epilepsy 6 years of age and older. Approved for use at home	Age 6-11 years (0.3 mg/kg) • 10-18 kg, 5 mg • 19-37 kg, 10 mg • 38-55 kg, 15 mg[b] • 56-74 kg, 20 mg[b] Age 12+ years (0.2 mg/kg) • 14-27 kg, 5 mg • 28-50 kg, 10 mg • 51-75 kg, 15 mg[b] • 76+ kg, 20 mg[b]	1. Remove one blister pack from the box. Depending on the dose, each blister pack contains one or two nasal spray devices. One blister pack contains one dose 2. Peel back the tab with the arrow on the corner of the pack. Remove spray device from the pack 3. Hold the sprayer with your thumb on the bottom of the plunger and your first and middle fingers on either side of the nozzle. Do not test or prime; each device sprays only one time 4. Gently insert the tip of the nozzle into one nostril until your fingers, on either side of the nozzle, are against the bottom of the person's nose 5. Press the bottom of the plunger firmly with your thumb to give the medicine 6. Remove sprayer from the nose after giving the dose 7. If dose requires two devices, give second spray for full dose in the other nostril 8. If needed, a second dose may be given 4 or more hours after the first dose, using a new blister pack
Midazolam nasal[a] (UCB, Inc., 2019, 2021) FDA approved May 17, 2019 Link to Instructions for Use Video Instructions 	Acute treatment of intermittent, stereotypic episodes of frequent seizure activity that are distinct from a patient's usual seizure pattern in patients with epilepsy 12 years of age and older. Approved for home use	Age 12+ years • All weights, 5 mg	1. Peel open the blister packaging. When ready to use, open the blister packaging. Hold blister packaging in the palm of your hand. On the foil backing find the "Peel Here" tab and pull down. Remove the nasal spray unit carefully 2. Hold the nasal spray unit with your thumb on the plunger and your middle and index fingers on each side of the nozzle. Do not press the plunger yet. If you press the plunger now, you will lose the dose 3. Place the tip of the nozzle into one nostril until your fingers on either side of the nozzle touches the bottom of the nose 4. Press the plunger firmly to deliver the dose of medicine. Make sure to firmly press the plunger using 1 motion 5. If the second dose is needed, administer second spray into the opposite nostril after 10 minutes

Note. FDA = Food and Drug Administration.
[a]Note that school nurses may see generic midazolam in a multidose vial prescribed with an atomization device. [b]Two devices required for one full dose.

common typically include somnolence, dysgeusia, headache, nasal discomfort, nasopharyngitis, diarrhea; Detyniecki et al., 2019; Hogan et al., 2020; Neurelis, Inc., 2021; UCB, Inc., 2021), which contrasts with the risks of not administering rescue medications, which may include prolonged seizures and status epilepticus, which increases the risk of irreversible neurologic injury and death (Sheppard & Lippé, 2012; Szaflarski, 2016).

Delegation

Although nurses are generally confident and comfortable with appropriately managing seizures in the school setting, many nurses have responsibility for multiple sites (Ohio Department of Health, 2017; Terry et al., 2016), which necessitates delegation of some nursing tasks and procedures. The NASN notes that "school nurses [are] at the forefront of ensuring that students with healthcare needs are identified and accommodated," and delegation is an important aspect of supporting students' right to high-quality school health services (NASN, 2019). When considering tasks to be delegated (e.g., tasks that do not involve nursing assessment or judgment), school nurses should take into account the complexity of the task, predictability of the outcome, and potential for harm (NASN, 2019).

Nonmedical personnel, such as educational support staff, must be trained prior to administration of any of the FDA-approved rescue medications. Laws and regulations regarding who is legally permitted to administer medication such as epilepsy rescue in schools vary among states and school districts. School nurses are responsible for understanding and relaying this information to the school.

Delegate selection is a complex process, requiring the professional judgment of the school nurse along with communication among the school nurse, the treating clinician, the clinic nurse, the parents, the school administrators, and the selected delegate (NASN, 2019). According to the NASN guidelines, when selecting a delegate, school nurses must take into account the needs of the individual student and the school population, the stability and predictability of the student's condition, school nurse workloads, documented training and competence of the delegate, and the ability of the school nurse to supervise the delegate (NASN, 2019). Of note, the licensed school nurse retains accountability for the outcome of an action taken by the delegate, provided such action was performed as instructed, and must therefore periodically assess the delegate's competence (NASN, 2019). Although delegate selection places a significant responsibility on the school nurse, there are guidelines and tools to support the process. This guidance is summed up by five rights of delegation (Barrow & Sharma, 2020): (1) the right task, (2) the right circumstance, (3) the right person, (4) the right directions and communication, and (5) the right supervision and evaluation. Online resources to help in the selection and training of delegates are available, and those from the NASN are included in Table 2. If school nurses do not already have the skills required for delegation, they should ideally be provided with educational opportunities so that they feel confident selecting and training a delegate (NASN, 2019).

Conclusions

Children and adolescents with epilepsy may experience seizures in a school setting. School nurses play an integral role in the management of such students by engaging with the student, their families, teachers, and other support staff to devise and implement a plan of care. This care plan should identify known seizure triggers; describe stereotypical seizure activity, frequency, and duration; and support any learning or other nonmedical special needs. Education and training of teachers and school staff to help them understand the signs of seizure clusters and prolonged seizures/status epilepticus, to support a student during a seizure, and to provide necessary rescue medication or first aid, is key to optimize the safety of students with epilepsy. School personnel should be aware of newly approved intranasal rescue therapies, which represent a new delivery option for seizure clusters. There are many avenues for the education of teachers and staff, depending on locality and state. Education and training should be individualized, school specific, and creative to be useful to the learners. ■

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Patricia Dean, MSN, ARNP, CNRN
Epilepsy Program Specialist
Comprehensive Epilepsy Center, Nicklaus Children's Hospital
Miami, FL

Ms. Dean is president of Epilepsy FL and has been involved in epilepsy consumer groups locally and nationally. She has worked for more than 30 years in a Level 4 Epilepsy Center. She is known for her work with children and families.

Kathryn O'Hara, RN
Clinical Research Nurse
Department of Neurology, Virginia Commonwealth University
Richmond, VA

Kathryn O'Hara has been a clinical research nurse at Virginia Commonwealth University Medical Center for 30 years. She educates and trains nurses, families, and the community on seizures and first aid for seizures. She has published articles on this topic and is a nationally known speaker on epilepsy.

Lai Brooks, DNP, FNP-BC
Senior Director of the Neuroscience Institute
Le Bonheur Children's Hospital
Memphis, TN

Dr. Brooks served as program director of Epilepsy Patient Services, managed patients in Level 4 Epilepsy Monitoring Unit, and is assistant professor, University of Tennessee. Dr. Brooks served on advisory boards, contributed to book chapters and articles, and presented articles on neurological disorders in pediatrics.

Ruth Shinnar, MSN, RN
Consultant
New Rochelle, NY

Ruth Shinnar is a clinical nurse specialist in neurology; past president, Association of Child Neurology Nurses; past Chair, American Epilepsy Society Practice Committee; past president of Board of Directors, Epilepsy Foundation of Southern New York, and Professional Advisory Board of New York City.

Genei Bougher, MSN, APRN, CPNP, CCRC
Vice President/Subinvestigator
Northwest Florida Clinical Research Group, LLC
Gulf Breeze, FL

Genei Bougher specializes in child neurology and is a nurse practitioner. She is affiliated with Sacred Heart Hospital.

Nancy Santilli, MN, PNP, FAAN
Global Managing Director
Human Care Systems
Boston, MA

Nancy Santilli is past president of the Epilepsy Foundation and past treasurer of the American Epilepsy Society. She secured and led multiple clinical trials evaluating new therapies for epilepsy and has authored 37 articles and chapters, 50 abstracts, and two books.