

The 15-Year Evolution of an Epilepsy Monitoring Unit Program

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ABSTRACT

BACKGROUND: The establishment of epilepsy monitoring units (EMUs) has enhanced the diagnosis and treatment of people living with epilepsy. As demand for specialized care grows, more health care institutions are incorporating EMU programs, making the journey from initial concept to daily operations increasingly complex. **METHODS:** Best practices, successes, challenges, and quality initiatives can guide stakeholders in promoting positive patient outcomes. Sharing our experiences of health care professionals may provide valuable insights for other institutions starting their EMUs. The inclusion of an advanced practice nurse to coordinate and implement spheres of care, growth, and evolution of the EMU program can become an integral part of everyday operations. Quality data collected is vital for this ongoing process. Integrating modern science and technology is key to fiscal responsibility, educational advancement, evidence-based practices, and improved patient outcomes. The plan-do-study-act quality initiatives and qualitative data were incorporated into the action planning processes. **RESULTS:** Efforts over the past 15 years have provided the groundwork and growth of the EMU. One quality indicator was ≤ 60 seconds for a clinician should respond to an event. The average time remained over 94% with some variables. Two impactful variables were related to staffing ratios, or that the nurses were providing care to another patient. **CONCLUSIONS:** Through the efforts of a multidisciplinary team, the evolution of the journey from creation to an active EMU program remains progressive. A chronicle of that journey was documented to share various aspects over the years. Despite many challenges over the years, the EMU program has grown and continues to evolve.

The epilepsy monitoring unit (EMU) is a specialized 4-bed unit within a tertiary hospital neuroscience unit. Initially a 2-bed unit, it has expanded to meet the needs of patients living with epilepsy (PLWE), particularly those with difficult-to-diagnose epilepsy. The EMU is staffed by an interdisciplinary team that manages both epilepsy and comorbid neurological and medical conditions.¹⁻⁴ Patients admitted to the EMU often experience unpredictable seizures, intermittent seizures, or seizure-like episodes. Some patients often posed diagnostic challenges, which may or may not be of an epileptic origin.⁵⁻⁷ Others have confirmed epilepsy but require medication or evaluation for surgical intervention that is not adequately controlled by the current intervention.^{8,9} Surgical candidates may undergo extensive monitoring to localize seizure onset, including invasive intracranial electrode placement to assess lateralization of seizure activity.^{9,10}

Each EMU room is outfitted with continuous audio and video recording technology. Additional recording equipment and computer systems are housed in a separate, dedicated EMU technology room, strategically located near the patient rooms. The technical room is the workstation for neurodiagnostic technologists and the neuro-analyst to monitor patients in the EMU setting or occasionally, those in other locations throughout the hospital. Trained neurodiagnostic staff assist in providing 24-hour monitoring.^{11,12} A separate neurodiagnostic laboratory setting for outpatients and inpatients also operates during daytime hours and offers short-term testing and ambulatory electroencephalogram (EEG) services for the PLWE who require monitoring.^{13,14} Ongoing collaboration between nursing and neurodiagnostic teams is essential for providing safe, competent care for all PLWE.

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Training for the EMU Team

The EMU team consists of a diverse group including epileptologists, neurologists, an epilepsy program coordinator, a neurodiagnostic manager, EEG technologists and technicians, a neurodiagnostic analyst, specialized bedside registered nurses (RNs), clinical nurse specialist (CNS), advanced practice provider (APP), physician assistants (PAs), nurse practitioners (NPs), unit-based nursing leadership, and patient care technicians (PCTs). Training focuses on epilepsy diagnosis, critical thinking, safety,

TABLE 1
Response Rate—Time for a Provider to Enter the Room at the Time of an Event

Years	*EMU Response Rate (%)	Number of Times the Provider Entered the Room Within 60 s	Number of Events Recorded on the Tracking Tool as Documented by the Neurodiagnostic Team
2011	82%	119	145
2012	90%	114	127
2013	93%	108	118
2014	98%	189	194
2015	94%	174	186
2016	91%	143	166
2017	97%	216	220
2018	97%	237	244
2019	97%	245	253
2020	95%	82	86
2021	93%	132	146
2022	95%	102	106
2023	97%	101	105
2024	97%	71	73
Average	94%	2033	2169

*Percentage-# of times provider entered room within 60 seconds/total number of recorded events (target rate = 100%).

hands-on simulation learning, role-playing, and ongoing competency (Supplemental Digital Content 1, <http://links.lww.com/JNN/A655>).^{15–18} Supporting care for PLWE requires specialized in-depth instruction and training in areas such as seizure recognition, proper use of equipment, seizure precautions, sudden unexpected death in epilepsy precautions, and the procedures for continuous video-EEG monitoring. For instance, training emphasizes assessment practices that focus on evaluating memory, language, and motor functions with seizure assessment.^{19,20}

All staff members undergo comprehensive training. The training follows a multidisciplinary team approach, with ongoing competency efforts supported by the clinical education department to include practical demonstrations of evidence-based practices. Training for the Neurodiagnostic team is conducted by the neurodiagnostic manager and a designated group of mentors. The training is presented with classroom-style teaching to include neuroanatomy, physiology, electrode application, scalp preparation, seizure assessment, observation of hands-on clinical practices in various settings, initiating an EEG recording, and completion of a competency checklist.

Neurodiagnostic technologists begin the continuous EEG setup by ensuring patient safety, which includes placing side-rail pads on the bed frame. Our neuro-analyst serves as a neurodiagnostic technologist and offers technical descriptions for a preliminary report. A witnessed seizure event may involve the neurodiagnostic staff member questioning the patient through the intercom into their room. In rare cases, as an adjunct for the nurse, the neurodiagnostic technologist may enter the room to assess the patient until a nurse arrives to complete the assessment (Table 1).²¹

Pathway of Evolution

The EMU evolved into a specialized area within the neuroscience unit as part of the neuroscience progressive care unit, since the PLWE meet specific admission criteria. Evolution can be defined in various ways. In health care, it can refer to changing and integrating evidence-based practices to ensure favorable outcomes and enhance the quality of patient care.^{22,23} While PLWE in the EMU are typically stable and undergo elective procedures, they may require emergent or critical care. Therefore, clinicians receive comprehensive training for the neuroscience progressive care unit. The unit’s policies cover general neurological disorders, including new-onset seizures, recovery from status epilepticus, and changes in seizure patterns. We consistently strive to evolve. The journey of the EMU program we are discussing is outlined in 5-year segments, highlighting key events and educational initiatives.

Between 2010 and 2014, the roles of coordinator, program manager, and clinical nurse specialist focused on streamlining clinical operations. Initial templates and an EMU Operations Manual were established to support staff training and reflect updated practices for all the EMU staff.^{24–26} Our team emphasized training and essential responsibilities that included examples of performing and documenting neurological exams at least once per shift and after seizures, connecting patients to EEG equipment and cardiac telemetry, anti-seizure medication management, infection prevention, electronic documentation in Seizure Assessment records, and using a foot pedal exercise bike with supervision for safety.

An operations manual that was developed included training, education, competency, being a mentor, and baseline teaching principles. Over the years, a plan was established and revised based on the guidance of competency frameworks influenced by nursing theorists who guide our nursing practices and daily organizational operations within the EMU setting. The development of our competency plan and educational guidance has been significantly shaped by theorists such as Patricia Benner, Kristen Swanson, and Everett Rogers.

Benner’s theory emphasizes achieving expertise through 5 stages of development, from novice to expert.¹⁸ Swanson’s caring theory outlines 5 caring processes: knowing, being with, doing for, enabling, and maintaining belief.^{25,26} For nurses, caring principles are the foundation for education and developing healthy relationships with patients.^{25,26} The Diffusion of Innovation theory applies to exploring how nurses can actively seek, adopt, and develop new methods to improve patient care.²⁷ The theory’s 5 categories of individuals—innovators, early adopters, early majority, late majority, and laggards—have been instrumental in the creation and revision of our educational plan over the years.^{27,28}

The EMU operations manual serves as a reference for care practices, educational topics, past presentations from the epilepsy coordinator/manager, and frequently asked questions (FAQs) related to the care of PLWE. From a holistic perspective, the manual content covers the entire timeframe from admission to discharge, including medical

TABLE 2
Video Consents Completed in the Medical Record

Years	EMU—Video Consent on Chart Target: 100% (%)	Video Consent on Chart Target: 100%	Video Consents Expected
2011	80	57	71
2012	95	70	74
2013	77	64	80
2014	95	65	69
2015	100	85	85
2016	96	75	78
2017	97	91	94
2018	97	119	123
2019	97	119	123
2020	97	83	86
2021	90	68	74
2022	97	74	77
2023	99	82	83
2024	99	79	80
Average	94	1131	1197

and surgical interventions and daily practices. For instance, topics covered include management of patients with intracranial electrodes, administration of IV medications, infection prevention and control, seizure and event assessment (electronic), and the EMU patient education checklist (electronic).

During this period, we created an educational class for the orientation of nurses, along with remediation and refresher classes. The “Neuroscience for the Novice” didactic classes were held regularly in collaboration with the Education Department and incorporated role-playing, video reviews, case studies, and pretest and posttest exams. The theories mentioned remain vital to modernization efforts for care delivery. This modernization also included electronic medical record physician orders, live video reviews, and a monthly teaching session known as “Epilepsy Talking Points.” This session featured a PowerPoint presentation and video review of seizure presentations, including nurse assessments.²⁹ Quality metrics were established, and seizure assessment testing was formalized.

A multidisciplinary group of participants—including neurodiagnostic technologists, RNs, PAs, CNSs, NPs, and PCAs/PCTs—typically attended these meetings, alongside other clinical providers such as epileptologists/neurologists, medical students, nursing students, and pharmacists. The EMU Multi-Disciplinary Committee (MDC) was formed to collaborate, report data, share successes and challenges, and coordinate opportunities for improvement. During this time, learning sessions were expanded to inpatient, outpatient, and community settings. Participation in health fairs, community meetings, support groups, and both internal and external meetings helped raise awareness about our epilepsy program. We developed an outpatient series of FAQs, an EMU admission booklet, bulletin board displays, educational leaflets, and triaging phone calls to enhance education, customer service, and coordination efforts for all stakeholders. We also presented information at local, regional, and national conferences through poster presentations, didactic sessions, and other forms of communication.¹⁵

For our quality improvement study using plan-do-study-act criteria, we focused on the time for a provider to enter a room after seizure onset to initiate the assessment process, with a target timeframe of ≤ 60 seconds. We conducted retrospective reviews of EMU video monitoring samples and created a quality monitoring tool used in collaboration with the neurodiagnostic team. In addition, we also reviewed whether the video consent was present on the chart (Table 2). This sampling of the data collected for these 2 indicators, along with others, monitored our overall favorable outcomes or opportunities for improvement based on the care rendered by our clinical staff.

Between the years 2015 and 2019, we made significant revisions to our epilepsy program, focusing on evidence-based education for inpatients, outpatients, and community members. We collaborated with organizations such as the NAEC (National Association of Epilepsy Centers), AANN (American Association of Neuroscience Nurses), AES (American Epilepsy Society), EFA (Epilepsy Foundation of America), AAN (American Academy of Neurology), and ILAE (International League Against Epilepsy), among others, to ensure high-quality care. These organizations created opportunities to update evidence-based practices and policies, revise competency requirements, develop innovations, and update public health initiatives.

The EMU program achieved NAEC Level 4 status, validating our diagnostic and interventional skills. Ongoing community engagement and weekly interdisciplinary EEG Case Review meetings enhanced programmatic initiatives. Our program aimed to improve the quality of life for PLWE and address social determinants of health. Between 2020 and 2025, the pandemic dramatically affected health care operations, including nursing staffing. Despite the challenges, we continued caring for PLWE, despite limitations with scheduling and surgical services. Changes that occurred hindered our ability, at times, to admit EMU patients, perform some surgical procedures, or even maintain our NAEC Level 4 status. Multiple changes and disruptions were known to affect other organizations throughout the health care arena for many of the same reasons. Collaborative initiatives, including action planning, revised workflows to enhance staff satisfaction, and debriefing sessions, were implemented to address these challenges.³⁰

While continuing to evolve, a designated EMU policy was established to guide daily operations effectively. As a team, efforts continue to improve the quality and efficiency of the EMU program while integrating innovative technologies and strengthening data collection techniques.²⁹ Evolution is a constant force that maintains ongoing quality initiatives in focused operations within the EMU setting. Evolutionary changes will reflect the needs of patients, staff development, technological advancements, and the continued application of evidence-based practices. Collaboration will hopefully continue as a solid foundation for this process.

Discussion

In the process of building an EMU program, several operational practices, nursing theories, evidence-based guidelines, and innovative strategies were offered and utilized during the

journey. Several opportunities for growth and ongoing education were constantly occurring. The roles of each team member were crucial to its successes and highlighted many opportunities for improvement along the way. The role(s) of the APP/CNS team members were also integral to the everyday evidence-based practices, development of new initiatives, and action planning processes. Perhaps these combined efforts will one day result in achieving Level 4 NAEC status once again. Sharing these stories, developments, practices, and action plans is part of the driving forces to improve overall patient, family, and other stakeholder outcomes.

Conclusions

Our EMU's evolution is reflected in the ongoing commitment to providing quality care for PLWE. Hiring new graduates and specialty nurses is supported by the principles of nursing theorists. Neurodiagnostic collaboration and maintaining consistent competency training for all clinicians are essential to our daily EMU operations. Despite interruptions during the pandemic, we maintained our NAEC certification as a Level 3 center, which continues to demonstrate high-quality care. The role and duties of the CNS and APP are crucial to the EMU program. It adds spheres of care that involve the patient and family care, evidence-based nursing practice, and organizational collaboration to improve outcomes.

With the inclusion of a CNS and APP to lead clinical guidance, coordinate the program, and implement the spheres of care, the growth and evolution of the program can become an integral part of everyday EMU operations. Constant processes for maintaining quality initiatives, utilizing innovations, updating evidence-based practices, and fostering interdisciplinary teamwork are crucial to effective EMU operations. These efforts will continue toward the attainment of the favorable outcomes for our PWLE, clinicians, community, and other stakeholders as the EMU journey continues.

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