Individual QI projects from single institutions

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Decreasing Unnecessary Resource Utilization for New-onset, Unprovoked, Afebrile Seizure in the Emergency Department

Laura A. Santry, MD; Kathryn Giordano, DO*; Andrew Mower, MD†; Jennifer Hubbard, APRN†; James Thomas, DNP, RN, CEN*; Rodney C. Scott, MD, PhD†; Karina Chara, MBA*; James Zent, BS*; Arezoo Zomorrodi, MD**

ABSTRACT

Introduction: Pediatric seizures account for approximately 1% of emergency department (ED) presentations. Laboratory evaluation and emergent electroencephalogram (EEG) are not indicated in patients with a new-onset, unprovoked, afebrile seizure with a normal physical examination. This study aimed to reduce unnecessary ED resource utilization. **Methods:** Through plan-do-study-act cycles from March 2021 to July 2023, a multidisciplinary team implemented change concepts, including creating a clinical pathway and supporting order sets, scheduling outpatient EEGs from the ED, and automating messages to the neurology team to ensure patient follow-up. The primary outcome measure was the percentage of qualified patients who received an EEG in the ED. Secondary outcome measures were the percentage of patients who had ED complete blood counts or neurology consults, the room-to-discharge time in minutes, and healthcare cost per patient. The balancing measure was the 30-day ED bounce-back rate. **Results:** Thirty-four and 99 patients met the inclusion criteria for the baseline and implementation phases, respectively. ED EEGs decreased from 59% to 1%. Complete blood counts and neurology consults decreased from 50% to 16% and 90% to 31%, respectively. Room-to-disposition time decreased from 308 to 203.5 minutes. Preliminary healthcare cost per patient decreased by $630. The 30-day bounce-back rate increased from 0% to 8%. **Conclusions:** Implementing a new-onset seizure pathway decreased ED resource utilization, shortened room-to-discharge time, and lowered healthcare costs. *(Pediatr Qual Saf 2025;10:e787; doi: 10.1097/pq9.0000000000000787; Published online January 10, 2025.)*

INTRODUCTION

Pediatric seizures account for ~1% of all emergency department (ED) visits, with 25,000–40,000 children presenting annually with a first afebrile seizure.[1–4] The immediate management of self-limited febrile seizures is well established.[5] However, the strategy for investigating children with afebrile seizures is more controversial, particularly concerning unnecessary testing.[2] Studies estimate that 40%–60% of medical tests performed are unnecessary.[6–8] In the United States, such tests account for 10% of healthcare costs, amounting to $210 billion annually.[9] Unnecessary testing can lead to patient discomfort, harm, and false-positive results.[10]

The American Academy of Neurology recommends an electroencephalogram (EEG) during the initial work-up for new-onset, unprovoked, afebrile seizures (NUAFS). However, there is no evidence that an EEG should be performed in the ED.[3] EEGs obtained within the first 48 hours may be challenging to interpret due to the poor predictive value of postictal abnormalities.[3] Data suggest that laboratory studies are not indicated for NUAFS in children over 6 months of age who have returned to baseline mental status and do not have other clinical indicators suggesting laboratory abnormalities.[3] At our institution, 59% of patients older than 6 months with NUAFS underwent EEG testing during their ED visit. A

*From the *Department of Pediatrics Division of Pediatric Emergency Medicine, Nemours Children's Health, Wilmington, Del.; and †Department of Pediatrics Divison of Neurology, Nemours Children's Health, Wilmington, Del.*

**Corresponding author. Address: Arezoo Zomorrodi, MD, Department of Pediatrics Division of Emergency Medicine, Nemours Children's Health, 1600 Rockland Road, Wilmington, DE 19803*
PH: 302-651-4296; Fax: 302-651-4227
Email: arezoo.zomorrodi@nemours.org

Supplemental digital content is available for this article. Clickable URL citations appear in the text.

Disclosure: The authors have no financial interest to declare in relation to the content of this article.

To cite: Santry LA, Giordano K, Mower A, Hubbard J, Thomas J, Scott RC, Chara K, Zent J, Zomorrodi A. Decreasing Unnecessary Resource Utilization for New-onset, Unprovoked, Afebrile Seizure in the Emergency Department. Pediatr Qual Saf 2025;10:e787.

Received for publication February 23, 2024; Accepted December 7, 2024.

Published online January 10, 2025

DOI: 10.1097/pq9.0000000000000787

total of 25% of NUAFS patients experienced ~2-hour waits from arrival to ED EEG. One hundred percent of these patients were discharged home and could have been scheduled for an outpatient EEG.

The primary aim of this project was to decrease the percentage of patients older than 6 months of age with NUAFS who received an EEG in the ED from 59% to <10% over 9 months. Secondary aims included decreasing the ED use of complete blood count (CBC) rate to <10%, neurology consults in children older than 3 years to <45%, and room-to-disposition time (RDT) by 50%.

METHODS

Context

We conducted this prospective, single-center, interrupted time-series quality improvement (QI) project in an urban, academic pediatric ED with a yearly census of approximately 60,000 patients. The ED is a level 1 trauma center in a free-standing children's hospital with 208 inpatient beds. The provider composition included board-certified pediatric emergency medicine physicians, pediatric emergency medicine fellows, pediatric, emergency, and family medicine residents, and advanced practice providers.

Quality Intervention

Planning the Intervention

In March 2021, a multidisciplinary team of key stakeholders convened, including pediatric emergency medicine providers, pediatric neurologists, nursing leadership, advanced practitioners, nurses, and a process engineer. We utilized the Institute for Healthcare Improvement model for improvement to decrease unnecessary resource utilization.[11] The team reviewed the literature for management recommendations for first-time seizures, including published guidelines from the American Academy of Neurology and the American Academy of Pediatrics.[3,12] We interviewed ED and neurology staff to understand drivers for resource utilization (Fig. 1). We identified and implemented change concepts. The primary intervention was the development of a new-onset seizure pathway that identified inclusion criteria and a standardized set of recommendations for the work-up of qualified patients (Fig. 2). Implementation began in May 2021.

Patient Population

The population included patients 6 months to 18 years of age presenting to the ED with suspected NUAFS. We excluded patients who had a temperature greater than 38°C, status epilepticus, head trauma within the past 24 hours, or a known medical condition that increased their risk for epilepsy (Fig. 2). We stratified patients into 4 categories based on risk factors. No further diagnostics were indicated if patients met all the following additional criteria: age >3 years, generalized seizure, a normal neurologic examination, and normal mental status within two hours of the seizure (Fig. 2). We chose the age cutoff of 3 years for a neurology consult because more reliable neurologic examinations can be performed at this age.

Study of the Intervention

Plan-do-study-act Cycles

The plan-do-study-act cycles included a regular data review by the multidisciplinary QI team for patients who

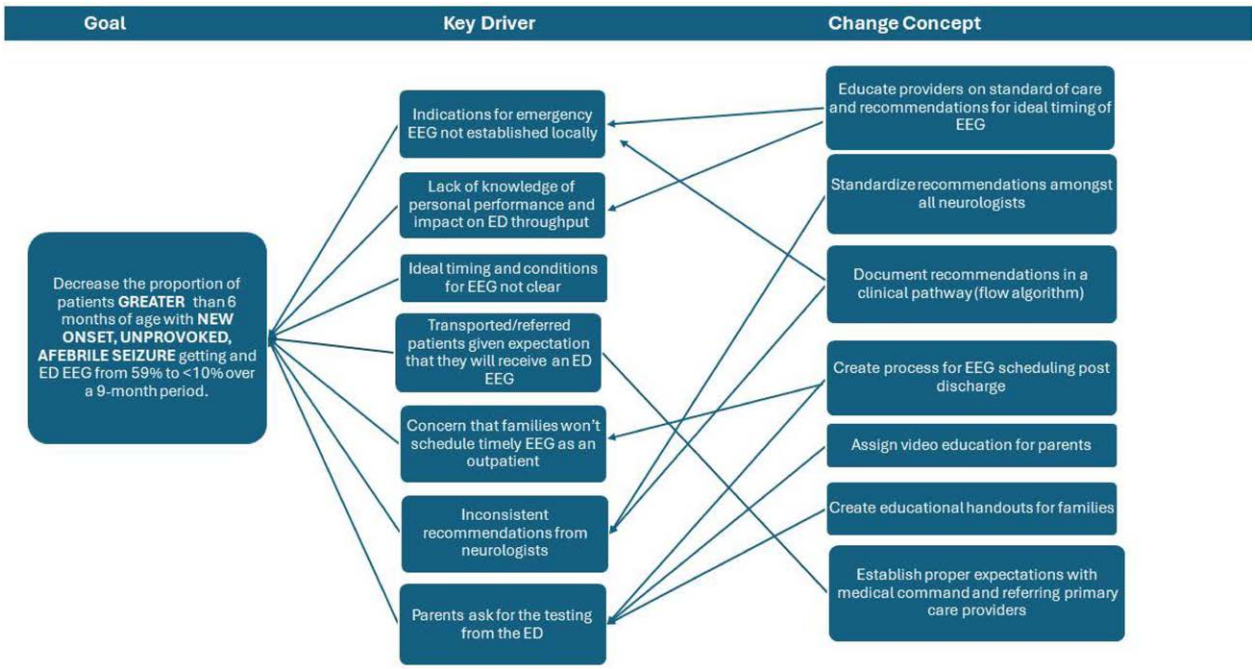

Fig. 1. Key driver diagram to reduce the number of electroencephalograms in the ED for patients with new-onset, unprovoked, afebrile seizures.

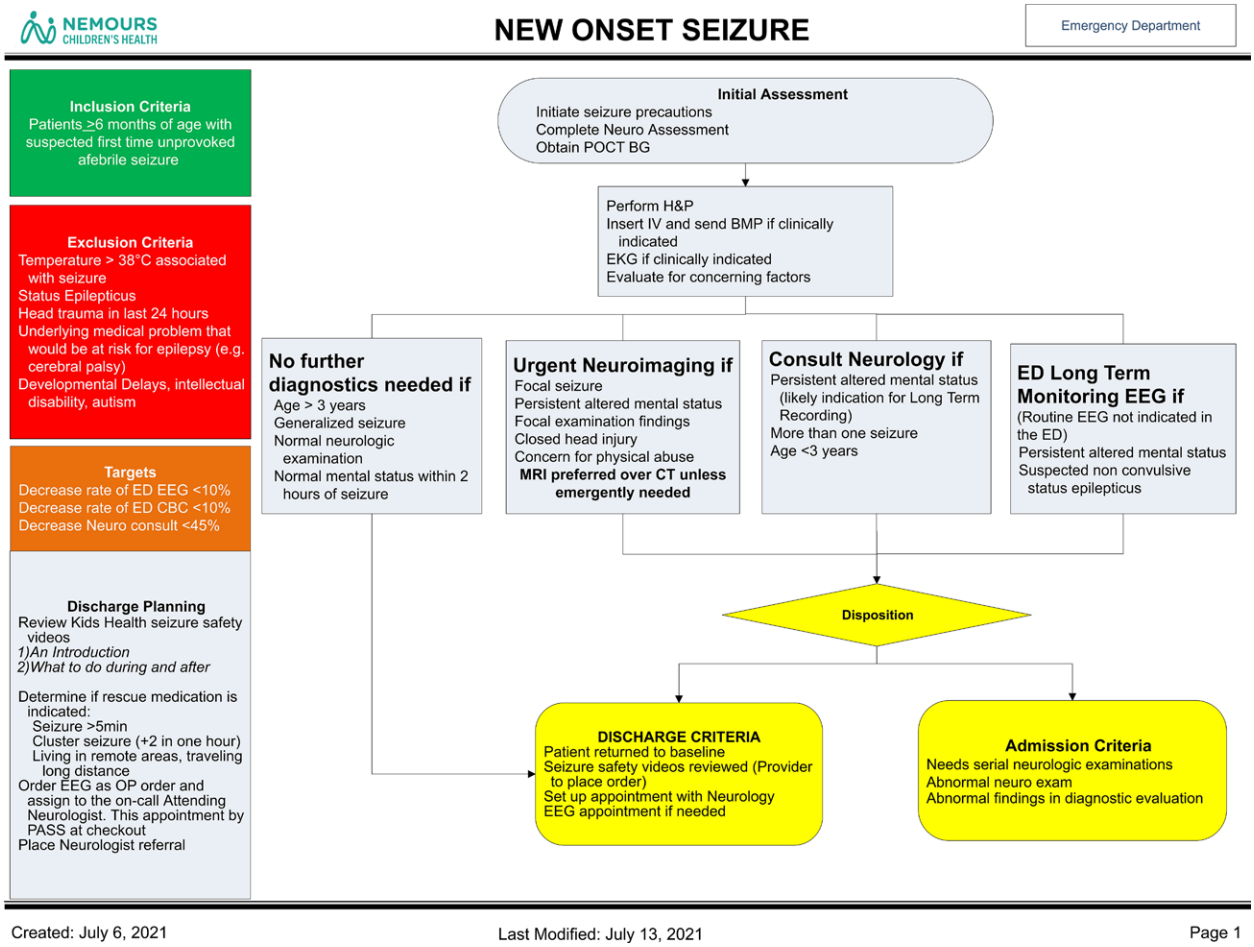

Fig. 2. Clinical pathway for patients with new-onset seizure.

met the criteria for the new-onset seizure pathway. We paid particular attention to assessing the EEG rate in the ED and 30-day bounce-back rates. The plan-do-study-act cycles led to the identification of new change strategies, including creating a clinical pathway, integrating with the electronic medical record (EMR), developing an outpatient EEG order, and establishing a mechanism to schedule outpatient EEG from the ED.

Clinical Pathway

The new-onset seizure clinical pathway was a reference tool to guide patient care. We made electronic and hard copies available for easy access. The pathway identified inclusion criteria, exclusion criteria, pathway targets, discharge planning considerations, a stepwise guide to recommended patient care, and instructions for ordering outpatient EEG and neurology consults (Fig. 2).

Integration with EMRs

We created an Epic (Epic Systems, Verona, Wis.) provider order set in November 2021 to guide the management of patients with NUAFS that included defaulted orders, clinical decision tools, and a link to the pathway algorithm. When an outpatient EEG was ordered, an automated Epic notification was sent to a designated neurology provider, who oversaw the monitoring of outpatient scheduling. This computerized message was designed as a surveillance mechanism to minimize the risk of patients lost to follow-up. We created permissions in EPIC, allowing the ED patient service representatives to schedule outpatient EEG appointments in real time for discharged patients.

Education/Implementation Strategies

We educated ED and neurology staff on the goals and logistics of the new-onset seizure pathway via email and during department meetings. On July 5, 2021, the clinical pathway went live. In the month before the go-live date and the 4 weeks following, verbal reminders were discussed twice daily during the ED shift change huddle. New staff members and clinical rotators received orientation to the clinical pathway as part of the onboarding processes. Staff included weekly reminders in routine emails.

Data Collection

We queried a dashboard that extracted information from the EMR for patients presenting to the ED between January 1, 2020, and July 30, 2023, with one of the *International*

Classification of Diseases, Ninth Revision (ICD-9) and 10th *Revision* (ICD-10) codes containing the diagnosis term "seizure."[13] Data were collated in an Excel (Microsoft Corporation, Redmond, Va.) spreadsheet that was stored on an enterprise-encrypted, secure server. We retrospectively excluded patients from the analysis if they had a coexisting medical condition (identified from the ICD-10 codes) that deemed them medically complex or if they met exclusion criteria. (**See Table 1, Supplemental Digital Content 1,** which describes ICD-9 ICD-10 codes used as exclusion criteria during data extraction. http://links.lww.com/PQ9/A627.) Of the remaining encounters, the team performed a manual chart review, and patients who did not meet inclusion criteria or were transferred from an outside facility were excluded from the analysis. (**See Figure 1, Supplemental Digital Content 2**, which describes flow chart demonstrating causes for exclusion of patients in the baseline. http://links.lww.com/PQ9/A631.)

For patients who met inclusion criteria, a manual chart review identified if patients obtained a neurology consult, CBC or other blood work, head imaging, EEG, outpatient referral to neurology, or outpatient EEG order at discharge. Neurology consultations were stratified into phone or in-person consults. The team queried the EMR to determine if patients had an outpatient EEG scheduled at discharge. We presumed EEG appointments scheduled within 1 hour of the discharge order were made in the ED.

We performed a second chart review every ~90 days to determine the time between the initial ED visit and outpatient EEG, outpatient neurology appointment (if applicable), and 30-day ED bounce-back rates.

Measures

The primary outcome measure was the percentage of qualified patients older than 6 months with a NUAFS who received an EEG in the ED. Secondary outcome measures were the percentage of patients with CBC or ED neurology consults, RDT, and mean healthcare cost per patient. The RDT, as determined by the EMR time stamps between rooming and disposition orders (ie, discharge or admission order), was measured as this improvement project did not address ED capacity workflows surrounding processes before rooming or after disposition orders.

The process measure was the percentage of patients with an outpatient EEG scheduled in the ED. The balancing measure was the 30-day ED bounce-back rate for patients who did not receive definitive outpatient care, defined as a completed EEG and neurology follow-up if indicated.

Analysis

Baseline and intervention phase outcome differences were compared using statistical process control charts to determine special cause (SC) variation.[11] The baseline and intervention phases included patients presenting to the ED between January 2020 and April 2021 and May 2021 and July 2023, respectively. The team created statistical process control charts using QI-charts V.2.0.23 software (Scoville Associates, 2009) for Microsoft Excel (Microsoft, 2016).

The number of patients with an NUAFS between ED EEG, CBC, and neurology consults were analyzed using patients-between-events G (geometric) charts. The G chart was chosen as patients with NUAFS who met inclusion criteria were infrequent events in the department. The RDT was analyzed using an X-bar chart. The centerline and control limits were calculated using established formulas for G chart distributions. We applied standard rules to determine SC variation, including (1) 1 point outside the upper limit for the EEG G chart; (2) 2 of 3 consecutive points in the outer one-third of the control limits for the CBC and neurology G charts; and (3) 8 points above the previous center line for the RDT X-bar chart.

We utilized data from January 2020 to April 2021 and May 2021 to February 2022 to determine the healthcare costs for the baseline and implementation phases, respectively. The healthcare cost per patient included the combined costs associated with (1) the ED visit, such as imaging, laboratory studies, EEG, electrocardiogram, and consulting costs; (2) outpatient EEG and neurology appointments; and (3) overhead costs. Time-driven, activity-based costing methodology was applied to hospital expenses obtained from a payroll system, general ledger, and purchasing system. These expenses were broken down to the patient level, including personnel, equipment, building, and supply costs, to calculate a cost-per-minute (cost capacity rate) that was used to determine the cost of care.[14] A combination of Epic (patient-level) and hospital financial data were inputted into QLIK (Qlik Technologies, King of Prussia, Pa.) for analysis. The change in margin was determined by comparing revenue less expense. The total healthcare costs per patient within each cohort were added and averaged to determine the mean cost per patient. We defined the overall healthcare savings cost as the difference between the total mean cost per patient from the baseline and implementation phases.

Ethical Considerations

This initiative was not human subject research as determined by the institutional review board.

RESULTS

Outcome Measures

We identified 1303 patients 6 months to 18 years of age with ICD-9 and ICD-10 codes containing "seizure." After exclusion based on nonqualifying terms within the ICD-9 and ICD-10 codes and manual chart review, 34 and 99 patients met the criteria for the baseline and implementation phases, respectively (**Supplemental Digital Content 2**, http://links.lww.com/PQ9/A631). In the baseline phase, 20 EEGs (59%) were obtained in the ED compared with 1 EEG (1%) in the implementation phase (Table 1). The

Table 1. Number and Percent of Baseline and Implementation Phase Patients with ED EEGs, CBCs, and Neurology Consults

	Baseline	Implementation
ED EEG*	20/34 (59%)	1/99 (1%)
ED CBC*	17/34 (50%)	16/99 (16%)
ED total neurology consults (total)†	26/29 (90%)	24/77 (31%)
ED in-person consults†	11/26 (42%)	2/24 (8%)
ED telephone consults†	15/26 (58%)	22/24 (92%)

Neurology consults are subdivided into telephone consults and in-person consults.
*Ages 6 mo–18 y.
†Ages 3 y–18 y.

median number of patients between ED EEG increased from 0.5 to 39 (Fig. 3). SC was met on January 30, 2022, with a point outside the upper control limit (UCL). As of January 30, 2022, no further EEGs were obtained in the ED, signifying sustained improvement, and the G chart was not re-phased.

Seventeen CBCs (50% of patients) were obtained during the baseline phase compared with 16 of 99 (16%) patients who had CBCs in the implementation phase (Table 1). The median number of patients with an NUAFS between CBC in the ED increased from 0.7 to 4.2 (Fig. 4A). The centerline was rephased once the SC was achieved on August 1, 2021, with one point above the UCL and 2 of the subsequent 3 points greater than the outer one-third. On May 2, 2023, 12 points were obtained in the new phase, and a new centerline of 4.2 was calculated.

There were 29 patients older than 3 years in the baseline phase and 77 patients in the implementation phase for whom the pathway recommended not obtaining a neurology consult. In the baseline phase, 26 (90%) of 29 patients received unnecessary neurology consultations compared with 24 (31%) of 77 patients in the implementation phase (Table 1). The median number of patients between ED neurology consults increased from 0.1 to 2 patients (Fig. 4B). Once an SC was achieved on November 15, 2021, the centerline was re-phased, with 1 point above the UCL and 2 of the 3 subsequent points greater than the outer one-third. On November 25, 2022, 12 points were obtained in this new phase, and a new centerline of 2 was calculated.

In the baseline and implementation phases, 11 of the 26 (42%) and 2 (8%) of the 24 ED neurology consults were in-person, respectively (Table 1). In the baseline phase, 15 (58%) of the 26 neurology consults were via phone, compared with 22 (92%) of the 24 in the implementation phase (Table 1).

The RDT time decreased from a mean of 308 minutes in the baseline phase to 203.5 minutes in the implementation phase (Fig. 4C). Healthcare cost savings were $630 per patient. (**See Table 2, supplemental Digital Content 3**, which describes mean cost per patient in the baseline and implementation cohorts as determined by time-driven activity-based costing analysis. http://links.lww.com/PQ9/A628).

In the implementation phase, 61 of 99 patients had outpatient EEG orders at discharge (62%), with 13 of 61 (21%) scheduled in the ED. Outpatient EEGs were completed in 71 of 99 patients (72%). The average time from ED visit to outpatient EEG was 10.4 days. A total of eight patients (8%) who did not receive outpatient neurology treatment returned to the ED within 30 days of the initial visit in the implementation phase compared with none (0%) in the baseline phase. (**See Table 3, Supplemental Digital Content 4**, which describes implementation cohort metrics for electroencephalogram orders, scheduling, completion and return rates. **http://links.lww.com/PQ9/A629**.)

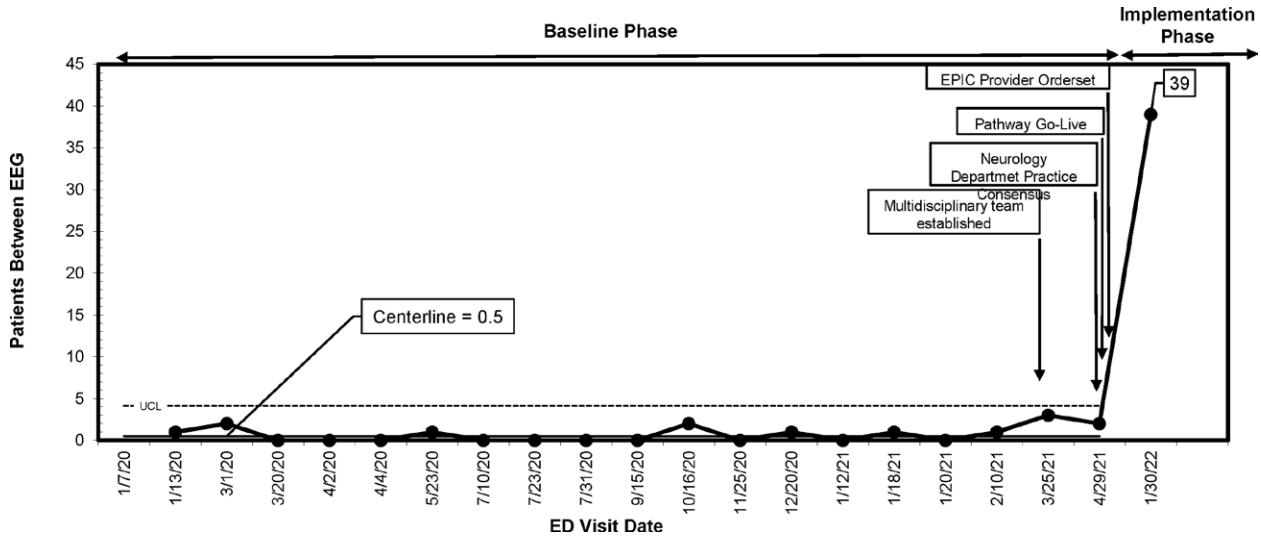

Fig. 3. G chart demonstrating the number of patients with new-onset, unprovoked, afebrile seizures between electroencephalograms obtained in the ED during the baseline and implementation phase over the study period. There was SC on January 30, 2022, with a point outside the UCL. LCL, lower control limit.

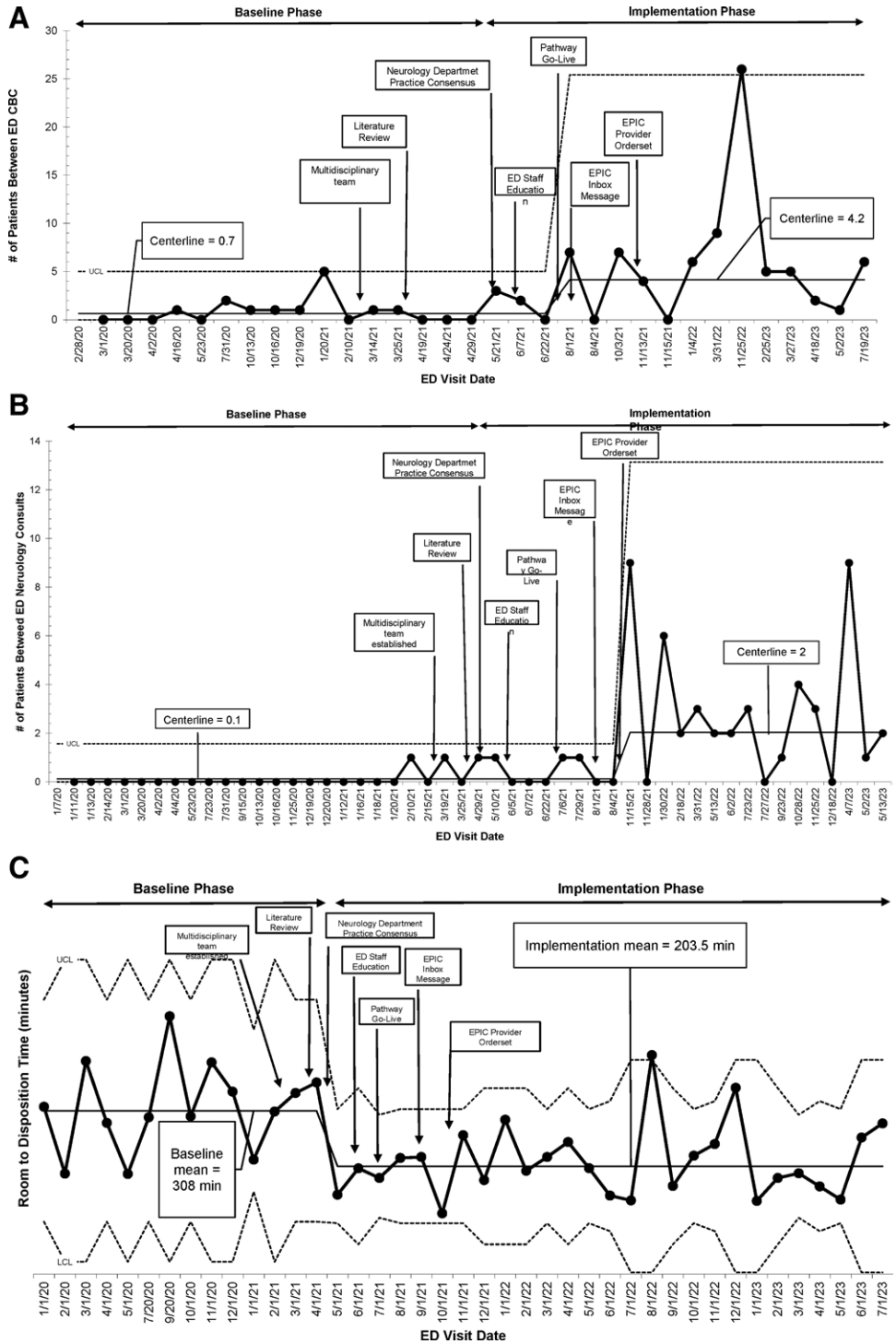

Fig. 4. Secondary outcome measure results. A, G chart demonstrating the number of patients with NUAFS between CBCs obtained in the ED during the baseline and implementation phases. The center line was shifted once an SC was achieved on August 1, 2021, with 2 of 3 points in the outer one-third of the control limit. B, G chart demonstrating the number of patients with NUAFS between neurology consults obtained in the ED during the baseline and implementation phases. The center line was shifted on November 15, 2021, when SC was first achieved with two out of three points in the outer third of the control limits. C, X-bar chart demonstrating the change in room-to-discharge time for patients with NUAFS during the baseline and implementation phases of the study. SC was achieved on May 1, 2021, with 8 points above the center line.

DISCUSSION

This QI initiative was associated with a sustained decrease in ED resource utilization, including improved RDT per patient and healthcare cost savings. In an era when pediatric EDs have experienced record-setting censuses, it is important to provide effective and efficient care, as defined by the Institute of Medicine.[15] Treatment should optimize patient safety while minimizing unnecessary

resources that lead to preventable prolonged ED stays and health care costs. In December 2022, the American Academy Of Pediatrics Section of Emergency Medicine released the Choosing Wisely campaign, identifying 5 common pediatric conditions where families and providers could partner to avoid unnecessary testing.[16] The campaign recommended that providers should not order laboratory testing or a head computed tomography scan for pediatric patients with an unprovoked, generalized seizure or a simple febrile seizure who returned to baseline mental status.[16] This statement highlights the growing national awareness regarding minimizing inappropriate testing for children with NUAFS who have returned to baseline mental status.

There was a modest increase in bounce-back rates, accounting for eight patients, none of whom returned in status epilepticus. (**See Table 4, Supplemental Digital Content 5**, which describes 30-day bounce-back encounters for NUAFS. **http://links.lww.com/PQ9/A630**.) Outpatient EEG for NUAFS is the standard of care in many institutions nationwide.[17,18] However, the literature lacks data establishing the percentage of patients in this population who obtain an EEG in the outpatient setting after initial ED care. Thus, it is not easy to benchmark results.

This study describes one institution's experience creating a system to provide timely, patient-centered, cost-efficient care for children with NUAFS. Current literature includes research on the benefits and challenges of new-onset seizure outpatient clinics.[19,20] However, these studies do not discuss ED management and referral. Unique aspects of this QI study are (1) scheduling outpatient EEG appointments from the ED and (2) developing an automated EPIC in-basket notification from the ED to neurology. Many patients cite unclear follow-up as a frustration with ED care.[21] We hypothesized that the ability to schedule an outpatient EEG, whereas the patient was in the ED would decrease family frustrations and ED return rates. Unfortunately, only 20% of patients had an EEG scheduled from the ED. We believe barriers to successful outpatient EEG scheduling included forgetting to remind parents to secure an appointment before ED discharge and insurance barriers. We created an automated EPIC in-basket notification to neurology to mitigate the low rate of EEG appointments scheduled in the ED. Many pediatric ED providers defer ordering outpatient studies to the primary care provider or specialist, which may result in a delay or absence of care. The automated EPIC in-basket message solved this challenge by establishing a mechanism for pediatric ED providers to order an outpatient study while routing follow-up responsibilities to the appropriate party. In summary, this study achieved the desired outcomes despite low compliance with the process metric.

During this study, the neurologists noted challenges in scheduling clinic visits with patients with abnormal EEG. Therefore, we created a new-onset seizure clinic in May 2023. Patients could be scheduled for an EEG and neurology appointment at the same visit within 14 days of the ED encounter. To mitigate the low percentage of patients with an EEG scheduled in the ED, the clinic staff reached out to ED patients to schedule appointments, and the ED no longer scheduled the EEG. The next steps include patient satisfaction surveys, troubleshooting follow-up care for patients with out-of-network insurance, and educating community providers on the appropriate work-up for NUAFS, including referral avenues for prompt outpatient workups.

Limitations of our QI initiative included the low prevalence of patients with NUAFS and reliance on appropriate ICD coding to allow for accurate data collection. Provider and parent/guardian comfort levels affected the adherence to pathway recommendations. As a single-center study, the generalizability represents another limitation. Some patients may have sought care in other institutions, which we could not identify on chart review. A limitation of our healthcare cost analysis was that some patients' expenses decreased because they failed to obtain the recommended outpatient EEG. Thus, these expenses were not included, falsely lowering the overall healthcare cost. Finally, the changing insurance landscape can result in the inability to arrange in-network outpatient evaluations for specific populations. In these instances, establishing a safe follow-up plan from the ED can be challenging.

CONCLUSIONS

This QI initiative, which developed and implemented an evidence-based clinical pathway to risk stratify patients presenting with NUAFS, decreased unnecessary ED resources, including EEG, CBC, and neurology consults, improved patient throughput, and reduced healthcare costs.

REFERENCES

1. Pallin DJ, Goldstein JN, Moussally JS, et al. Seizure visits in US emergency departments: epidemiology and potential disparities in care. *Int J Emerg Med*. 2008;1:97–105. 10.1007/s12245-008-0024-4.
2. Santillanes G, Luq Q. Emergency department management of seizures in pediatric patients. *Pediatr Emerg Med Pract*. 2015;12:1–27.
3. Hirtz D, Ashwal S, Berg A, et al. Practice parameter: evaluating a first nonfebrile seizure in children: report of the quality standards subcommittee of the American Academy of Neurology, the Child Neurology Society, and the American Epilepsy Society. *Neurology*. 2000;55:616–623.
4. Hauser WA, Annegers JF, Kurland LT. Incidence of epilepsy and unprovoked seizures in Rochester, Minnesota: 1935–1984. *Epilepsia*. 1993;34:453–468. 10.1111/j.1528-1157.1993.tb02586.x.
5. Mastrangelo M, Midulla F, Moretti C. Actual insights into the clinical management of febrile seizures. *Eur J Pediatr*. 2014;173:977–982. 10.1007/s00431-014-2269-7.
6. Zhi M, Ding EL, Theisen-Toupal J, et al. The landscape of inappropriate laboratory testing: a 15-year meta-analysis. *PLoS One*. 2013;8:e78962. 10.1371/journal.pone.0078962.
7. Miyakis S, Karamanof G, Liontos M, et al. Factors contributing to inappropriate ordering of tests in an academic medical

department and the effect of an educational feedback strategy. *Postgrad Med J*. 2006;82:823–829. 10.1136/pgmj.2006.049551.
8. Rehmani R, Amanullah S. Analysis of blood tests in the emergency department of a tertiary care hospital. *Postgrad Med J*. 1999;75:662–666. 10.1136/pgmj.75.889.662.
9. Clarke JL, Laskowski RJ, Coons C, et al. Proceedings of the Christiana Care Health System Value Institute Value Symposium. *Am J Med Qual*. 2012;27:3S–20S. 10.1177/1062860612459480.
10. Koch C, Roberts K, Petruccelli C, et al. The frequency of unnecessary testing in hospitalized patients. *Am J Med*. 2018;131:500–503. 10.1016/j.amjmed.2017.11.025.
11. Langley GL, Moen R, Nolan KM, Nolan TW, Norman CL, Provost LP. *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance*. 2nd ed. Jossey-Bass Publishers; 2009.
12. Fine A, Wirrell EC. Seizures in children. *Pediatr Rev*. 2020;41:321–347. 10.1542/pir.2019-0134.
13. World Health Organization. International statistical classification of disease and related health problems, 11th ed. 2019. Available at: https://icd.who.int/. Accessed February 6, 2024.
14. Kaplan RS, Anderson SR. *Time-driven Activity-based Costing: A Simpler and More Powerful Path to Higher Profits*. Harvard Business School Press; 2007.
15. Institute of Medicine (US) Committee on Quality of Health Care in America. *Crossing the Quality Chasm: A New Health System for the 21st Century*. National Academies Press (US); 2001.
16. American Academy of Pediatrics. Choosing wisely: five things physicians and patients should question in the practice of pediatric emergency medicine. 2022. Available at: https://www.aap.org/en/news-room/news-releases/aap/2022/choosing-wisely-five-things-physicians-and-patients-should-question-in-the-practice-of-pediatric-emergency-medicine/. Accessed February 6, 2024.
17. Buchhalter L, Blackstone M, Abend N, et al. Emergency department clinical pathway for management of new unprovoked seizure(s). Children's Hospital of Philadelphia. 2021. Available at: https://www.chop.edu/clinical-pathway/unprovoked-seizure-clinical-pathway. Accessed November 22, 2023.
18. Eschbach K, Walleigh D, Jacobson M, et al. Clinical pathway: new onset seizure. Children's Hospital Colorado. 2015. Available at: https://www.childrenscolorado.org/globalassets/healthcare-professionals/clinical-pathways/seizure-new-onset-clinical-pathway.pdf. Accessed November 22, 2023.
19. Shah S, Nagarajan L, Palumbo L, et al. Paediatric new-onset seizure clinic in Australia: experience and lessons learnt. *J Paediatr Child Health*. 2019;55:789–794. 10.1111/jpc.14290.
20. Kim S, DeGrauw T, Berg AT, et al. Evaluation of pediatric patients in new-onset seizure clinic (NOSc). *Epilepsy Behav*. 2020;112:107428. 10.1016/j.yebeh.2020.107428
21. Engel KG, Heisler M, Smith DM, et al. Patient comprehension of emergency department care and instructions: are patients aware of when they do not understand? *Ann Emerg Med*. 2009;53:454–461.e15. 10.1016/j.annemergmed.2008.05.016.