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FULL-LENGTH ORIGINAL RESEARCH

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Post-acute symptomatic seizure (PASS) clinic: A continuity of care model for patients impacted by continuous EEG monitoring

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Abstract

Objective: We present a model for the outpatient care of patients undergoing continuous electroencephalography (cEEG) monitoring during a hospitalization, named the post-acute symptomatic seizure (PASS) clinic. We investigated whether establishing this clinic led to improved access to epileptologist care.

Methods: As part of the PASS clinic initiative, electronic health record (EHR) provides an automated alert to the inpatient care team discharging adults on first time antiepileptic drug (AED) after undergoing cEEG monitoring. The alert explains the rationale and facilitates scheduling for a PASS clinic appointment, three-month after discharge, along with a same-day extended (75 minutes) EEG. We compared the initial epilepsy clinic visits by patients undergoing cEEG in 2017, before ("Pre-PASS" period and cohort) and after ("PASS" period and cohort) the alert went live in the EHR.

Results: Of the 170 patients included, 68 (40%) suffered a seizure during the mean follow-up of 20.9 ± 10 months. AEDs were stopped or reduced in 66 out of 148 (44.6%) patients discharged on AEDs. Pre-PASS cohort included 45 patients compared to 145 patients in the PASS cohort, accounting for 5.8% and 9.9% of patients, respectively, who underwent cEEG during the corresponding periods (odds ratio [OR] = 1.8, 95% CI = 1.26-2.54, $P = .001$). The two cohorts did not differ in terms of electrographic or clinical seizures. The PASS cohort was significantly more likely to be followed up within 1-6 months of discharge (OR = 4.6, 95% CI = 2.1-10.1, $P < .001$) and have a pre-clinic EEG (51.2% vs 11.1%; OR = 8.39, 95% CI = 3.1-22.67, $P < .001$).

Significance: PASS clinic, a unique outpatient transition of care model for managing patients at risk of acute symptomatic seizure led to an almost twofold increase in access to an epileptologist. Future research should address the wide knowledge gap about the best post-hospital discharge management practices for these patients.

KEYWORDS

acute seizures, antiepileptic drugs, continuous EEG, epilepsy clinic, model of care, PASS clinic

Statistical analysis was conducted by Vineet Punia, MD, MS.

1 | INTRODUCTION

Acute symptomatic seizures (ASyS), typically convulsive, account for 40% of all afebrile seizures with a 3.6% lifetime risk.[1,2] Over the past decade, there is a 10-fold increase in continuous electroencephalogram (cEEG) monitoring for the detection of ASyS in hospitalized patients.[3] Based on the cEEG studies, around 50%[4] to 90%[5] of the ASyS detected are exclusively non-convulsive seizures or status epilepticus (NCS/NCSE). Therefore, it can be safely assumed that the incidence of ASyS, in the age of cEEG, is much more than the literature suggests. In addition to NCS/NCSE (electrographic seizures), cEEG monitoring identifies other potentially epileptiform abnormalities like rhythmic or periodic patterns (RPP) in around 40% of the recordings.[4]

A recent study analyzing close to 5000 patients undergoing cEEG reported that close to two-thirds of patients receive antiepileptic drugs (AEDs) during the monitoring.[6] Apart from patients with ASyS, many patients with RPPs and close to 50% of patients without either of them on cEEG are treated with AEDs also.[6] In another study, 75% (225/300) of patients on cEEG were receiving AEDs by the end of monitoring and all but one were discharged on an AED.[7] No clear data on the appropriate duration of treatment of ASyS or RPPs exist. Experts recommend treating for a "short term"[8] or 1-12 months depending on acute cEEG findings.[9] We have previously shown that up to 50 to 90% of patients with ASyS or RPPs discharged on AEDs remain on them for 12-32 months.[10–12] Such prolonged treatment in patients with an overall low risk to develop epilepsy may be clinically inappropriate. We found that patients weaned off of AEDs were 12 times more likely to have been followed up outpatient by an epileptologist compared to patients who remained on the same AEDs 20 months after hospital discharge.[11]

Inspired by our research work and clinical experience, we started a dedicated outpatient post-acute symptomatic seizure (PASS) clinic. The sole impetus behind establishing this new clinical care track in epilepsy was to provide longitudinal follow-up for appropriate management of patients who were discharged on AEDs after cEEG monitoring. We put in place automated and streamlined processes to facilitate PASS clinic appointments and hypothesized that they would lead to a significantly improved access of eligible patients to outpatient expert (epileptologist) care. The goal of this paper is to describe our PASS clinic model and to analyze our hypothesis.

Key Points

- The increasing use of continuous EEG (cEEG) is leading to the diagnosis of acute symptomatic seizures and other epileptiform abnormalities in a large number of patients.
- A majority of them are treated with and discharged on antiepileptic drugs (AEDs), which continue for extended period of time in the absence of proper follow-up.
- We established a dedicated post-acute symptomatic seizure (PASS) clinic to provide standardized outpatient care to these patients.
- We describe our PASS clinic model and show that the clinic led to an almost twofold increase in the access to outpatient epileptologist care for eligible patients.

2 | METHODS

2.1 | Goal and scope of the PASS clinic

The primary goal of the PASS clinic is to individualize AED management after hospital discharge based on the patient's history of ASyS and the underlying etiology, cEEG findings, seizure recurrence risk, and a recent outpatient EEG. This goal is pursued by scheduling: (i) a post-discharge PASS clinic follow-up (ideally at 3 months) with a board-certified epileptologist, preferably with a major clinical interest and practice focus in cEEG monitoring and (ii) an outpatient EEG before the visit to facilitate an informed AED management.

The scope of the PASS clinic is to provide an outpatient specialized clinical care to adults (≥18 years), without pre-existing epilepsy, who undergo cEEG during hospitalization and are discharged on at least one AED.

2.2 | PASS clinic protocol

A best practice advisory (BPA) alert was created in our electronic health records (EHR) (Figures 1 and 2). This BPA notifies the discharging provider when a patient meets the criteria for a PASS clinic appointment. The criteria for the BPA alert to fire in the EHR are the following:

- Adult (≥18 years of age) patient not carrying epilepsy as a pre-admission diagnosis
- Underwent cEEG monitoring during current hospital admission
- Started and being discharged on an AED (except gabapentin)

The BPA fires when discharge orders for a qualifying patient are placed in the EHR. The BPA explains the rationale for the PASS clinic and enables a quick placement of an appointment order and for an extended (75 minute) EEG. Although the default PASS clinic appointment is 3 months after discharge, the inpatient care team is given an option to request a sooner

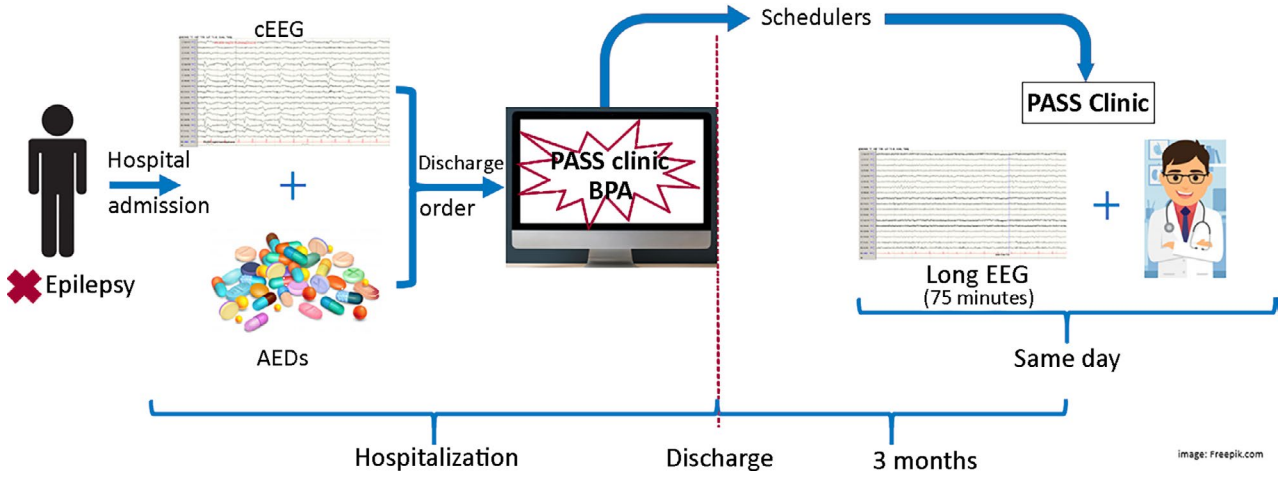

FIGURE 1 Pictorial representation of PASS clinic protocol for eligible patients from hospitalization to the outpatient visit

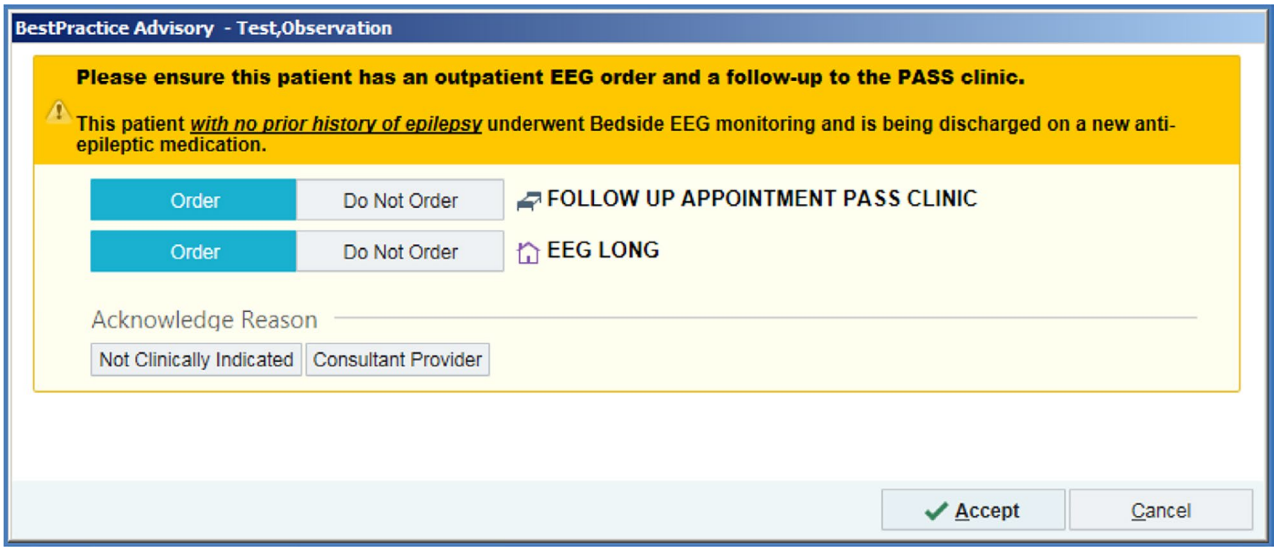

FIGURE 2 Sample best practice advisory (BPA) alert that fires after a hospital discharge order is placed for an eligible patient

appointment at the time of placing the order. Once the order is placed, a scheduling team in the epilepsy center is alerted and a scheduler contacts the patient to make the appointment.

2.3 | Research methodology

After IRB approval, we obtained information on all cEEGs performed from 01/01/2017 to 12/31/2017 (study period) at our hospital (target population) using our prospectively maintained EEG database. The BPA alert went live in the EHR on 05/17/2017. The target population was cross-matched with our epilepsy center outpatient clinic database to identify patients who presented for their initial clinic visit within 12 months after their cEEG monitoring. A generous 12-month follow-up period was used because prior to the PASS clinic, there was no clear protocol for the follow-up of these patients. For the purpose of this study, the patients who underwent cEEG monitoring prior to the BPA going live ("Pre-PASS period"—01/01/2017 to 05/16/2017) in the EHR were classified as "Pre-PASS" and the rest as the "PASS" cohort (underwent monitoring from 05/17/2017 to 12/31/2017).

The primary outcome measure was the likelihood of the target population in the "PASS period" to present for their initial clinic visit compared to the patients in the "Pre-PASS period". Secondary outcome measures included the odds of getting a pre-clinic routine EEG, a clinic visit within a 1- to 6-month period after hospital discharge and to be seen by an epileptologist with a major clinical interest and practice focus in cEEG monitoring (epileptologist of choice; VP or SH).

2.4 | Clinical and cEEG variables

EHR of the study population seen in the clinic for their initial visit was reviewed to extract demographical details, epilepsy

history, AED status at the time of discharge, the time period between discharge and clinic visit, pre-clinic outpatient EEG status, the epileptologist seen in the clinic (VP, SH versus others), duration of the last follow-up, any clinical seizure during the follow-up (Yes/No), and the AED status at the end of follow-up compared to hospital discharge (classified as discontinued, reduced, increased, unchanged). Primary etiology associated with cEEG findings was classified as acute brain insult (within preceding 7 days of cEEG monitoring; eg, stroke and hemorrhage), progressive brain insult (eg, tumors), anoxic brain insult, toxic/metabolic/infectious (T/M/I) encephalopathy (diagnosed when reversal of such etiology led to improvement in altered mental status), epilepsy (if breakthrough seizures led to the hospitalization of people with epilepsy), and miscellaneous (not classifiable in any of the above category including autoimmune/paraneoplastic encephalitis). Patients who had concomitant T/M/I encephalopathy along with acute brain insult were categorized in the latter category. The cEEG database was used to identify patients with electrographic seizures (classified based on Salzburg criteria[13]) and other epileptiform abnormalities (eg, sharp waves,[14] spikes,[14] lateralized periodic discharges (LPDs, formerly PLEDs),[11] lateralized rhythmic delta activity (LRDA)[15]).

2.5 | Statistical methods

Continuous measures were summarized with a median [IQR = inter-quartile range (Q1, Q3)] or mean [± standard deviation (SD)] based on their distribution. Categorical factors were summarized with frequencies and percentages. Comparisons between "Pre-PASS" and "PASS" subgroups for continuous measures (age, follow-up duration) were analyzed using the Student's *t* test (normally distributed). Pearson's chi-square test was used to analyze categorical data. *P*-values ≤ .05 were considered statistically significant. Analyses were done with SAS (version 9.4; Cary, NC).

3 | RESULTS

A total of 2042 unique patients underwent cEEG during the study period (target population). Of those, 170 (8.3%) patients (study population) were seen in the epilepsy center for their initial clinic visit within 12 months of the cEEG (Table 1). Within the study population, 148 (87.1%) were discharged on at least 1 AED (median = 1 [1-2]). During a mean follow-up duration of 20.9 ± 10 months, 68 (40%) patients suffered at least one seizure and 33 (19.4%) patients passed away after their initial clinic visit. AED status at the time of the last follow-up among patients discharged on them (n = 148) was as follows: discontinued in 33 (22.3%), reduced in 33 (22.3%), and increased in 27 (18.2%) patients. Four patients were started on AEDs during the follow-up, and the rest remained unchanged.

3.1 | Study sub-populations

Among the 170 study population, 45 (26.5% of the study population) belonged to the "pre-PASS" cohort and 125 (73.5%) to the "PASS" cohort. The "pre-PASS" cohort accounted for 5.8% (45/778) of the target population from the "Pre-PASS period" compared to the "PASS" cohort accounting for 9.9% (125/1264) of the target population from the "PASS" period (odds ratio [OR] = 1.8, 95% confidence interval [CI] = 1.26-2.54, $P = .001$).

3.2 | PASS clinic population

There were 125 patients (48% females; mean age 55.8 [±18.3] years) seen in the newly established PASS clinic (Table 1). One-third of these patients had cEEG after suffering an acute brain insult. Clinical seizures prior to cEEG were noted in 51.2% of the patients. Electrographic seizures were seen in 35 (28%) patients (including 16 with clinical seizures), and another 23 (18.4%) had epileptiform abnormalities. PASS clinic protocol violations included 11 (8.8%) patients with a history of epilepsy, and 15 (12%) patients not discharged on AEDs presenting to the PASS clinic. In terms of follow-up duration after discharge, 42 (33.6%) patients were seen within 1 month and 11 (8.8%) were seen 6 months after hospital discharge. A total of 64 (51.2%) patients underwent a pre-PASS clinic extended EEG, and 65 (52%) were seen by epileptologist of choice for the PASS clinic.

3.3 | Comparison of pre- and post-PASS cohorts

Patients in the pre-PASS and PASS cohort did not differ in terms of clinical seizures, electrographic seizures on the cEEG, epileptiform abnormalities, and AED status at discharge (Table 1). A significantly higher percentage of patients in the PASS cohort had diagnosis of T/M/I encephalopathy (16% vs 2.2%; OR = 8.38, 95% CI = 1.09-64.39, $P = .02$) compared to the pre-PASS cohort. The patients seen in the PASS clinic were significantly more likely to be followed up in the clinic within 1-6 months of discharge (OR = 4.6, 95% CI = 2.1-10.1, $P < .001$) and to undergo pre-clinic visit EEG (51.2% vs 11.1%; OR = 8.39, 95% CI = 3.1-22.67, $P < .001$). The proportion of patients seen by the epileptologist of choice

TABLE 1 Demographical, EEG, and clinical data of study population and comparison of Pre-PASS and PASS cohort

	Total Population (N = 170) (%)	Pre-PASS cohort (N = 45) (%)	PASS cohort (N = 125) (%)	Effect size	*P*-value
Age (y)	56.0 (±18.4)	56.5 (±18.5)	55.8 (±18.3)	0.22	.83[a]
Gender (F)	78 (45.9)	18 (40.0)	60 (48.0)	1.38 (0.69-2.77)	.39
Epilepsy history	24 (14.1)	13 (28.9)	11 (8.8)	0.24 (0.1-0.58)	**.002**
Etiology					
Acute brain insult	52 (30.6)	10 (22.2)	42 (33.6)	1.77 (0.8-3.9)	.19
Remote brain insult	25 (14.7)	6 (13.3)	19 (15.2)	1.17 (0.43-3.13)	.81
Progressive brain insult	26 (15.3)	5 (11.1)	21 (16.8)	1.62 (0.57-4.58)	.47
T/M/I encephalopathy	21 (12.4)	1 (2.2)	20 (16.0)	8.38 (1.09-64.39)	**.02**
Miscellaneous[b]	22 (12.9)	10 (22.2)	12 (9.6)	0.37 (0.15-0.93)	**.03**
Clinical seizures	94 (55.3)	30 (66.7)	64 (51.2)	1.9 (0.94-3.89	.08
cEEG findings					
Electrographic seizures	47 (27.6)	12 (26.7)	35 (28.0)	1.07 (0.5-2.3)	1
Additional epileptiform abnormalities[c]	32 (18.8)	9 (20.0)	23 (18.4)	0.9 (0.38-2.13)	.83
Discharged on AEDs	148[d] (87.1)	37 (82.2)	111 (88.8)	1.7 (0.67-4.4)	.3
Duration from discharge to clinic visit					
1-6 months	81 (47.6)	10 (22.2)	71 (56.8)	4.6 (2.1-10.1)	**<.001**
Others (0-1 month, >6 months)	89 (52.4)	35 (77.8)	54 (43.2)		
Pre-clinic EEG	69 (40.6)	5 (11.1)	64 (51.2)	8.39 (3.1-22.67)	**<.001**
Seen by staff	83 (48.8)	18 (40.0)	65 (52.0)	1.63 (0.8-3.2)	.22

Note: Bold *P*-value = statistically significant.

[a]*t* test

[b]Including one anoxic brain insult.

[c]Excluding electrographic seizure.

[d]Of note, 31 (18.2%) patients discharged on AEDs did not suffer a clinic or electrographical seizure and lacked epileptiform abnormalities on cEEG.

for the PASS clinic was not different from the "Pre-PASS" cohort.

The mean duration of follow-up was 24.4 ± 11.3 months in the pre-PASS cohort and 19.6 ± 9.3 months in the PASS cohort ($P = .005$). At least one seizure during follow-up was noted in 18 (40%) patients from the pre-PASS cohort and 50 (40%) in the PASS cohort. Among patients discharged on AEDs, 18.9% (7/37) had been completely weaned off of AEDs compared to 23.4% (26/111) patients in the PASS cohort (OR = 0.76, 95% CI = 0.3-1.94, $P = .65$). AEDs were started in four patients in the PASS cohort during the follow-up.

4 | DISCUSSION

We present a unique model for the continuity of outpatient care of patients undergoing cEEG monitoring for concerns of ASyS, which impacts their medical management. The PASS clinic model utilizes the strength of EHR by automating the identification of eligible patients for the inpatient care team and facilitates the scheduling of the clinic visit along with ordering a pre-visit EEG. Our findings show that the streamlined clinical care path of the PASS clinic contributed to a nearly twofold increase in the access to an outpatient specialized clinic among patients undergoing cEEG.

The major impetus and the need for establishing the PASS clinic come from prior clinical and research observations. Epidemiological studies have shown that ASyS in the setting of insults like strokes and traumatic brain injuries significantly increase the risk of later epilepsy development, particularly within the first year,[16–19] which could be as early as 3-6 months.[12] Electrographic ASyS and acute findings like LPDs also significantly increase risk of epilepsy development.[10,12,20] Therefore, early identification and appropriate management of such an at-risk population are crucial. On the contrary, the overall risk for epilepsy development in this population is not high enough to warrant chronic AED therapy.[21] ASyS and epileptiform abnormalities, that may have been otherwise unrecognized, are becoming increasingly apparent with cEEG monitoring.[3,4] These findings may cause

treating providers to start and continue, at times reflexively, an AED.[6,7] As described above, we have previously shown that an AED started due to concerns for ASyS and continued at discharge is more likely to be weaned if patients are managed outpatient by an epileptologist.[11] These factors led us to believe that patients undergoing cEEG monitoring due to ASyS risk and discharged on AEDs require an assessment of their AED therapy needs while considering their seizure recurrence risk, by an epileptologist. The clinical follow-up findings of the study cohort highlight these challenges. During a mean follow-up duration of 21 months, while 40% of patients suffered a clinical seizure, the epileptologists were able to wean off (22.3%) or reduce (22.3%) AEDs in almost 45% of the patients. The percentage of AED discontinuation was slightly higher in the PASS cohort compared to pre-PASS patients (23.4% vs 18.9%). Although not statistically different, our early analysis shows that this was achieved in a significantly shorter follow-up period in the PASS cohort. The use of prophylactic AEDs to prevent acute seizures after brain injuries like intra-cerebral hemorrhages (ICH) is still a common practice, despite the lack of evidence supporting it.[22] This is the likely explanation for 18% of our study cohort lacking seizures (clinical or electrographic) or epileptiform abnormalities being discharged on AEDs. The use of AEDs after acute brain injury has also not shown antiepileptogenesis benefits.[23] These prophylactic AEDs affect cognitive function health-related quality of life.[24] Therefore, judicious use of AEDs in patients with acute brain injuries is highly recommended. In absence of that, having a second safety net like PASS clinic can serve a crucial role in the management of these patients.

The use of cEEG is more common in larger hospital systems.[3] In most centers, the team reading cEEG may not be involved in direct patient care. The likelihood of a post-discharge follow-up of patients with ASyS on AEDs in an epilepsy clinic usually depends on the awareness and biases of the inpatient care team. To overcome this limitation, an EHR-based alerting system was created. It identifies and assists the inpatient care team in scheduling patients eligible for follow-up in the PASS clinic. We found that this alerting system increases the awareness among the inpatient care teams for the need for an appropriate follow-up for patients on AEDs due to acute symptomatic seizure concerns. Ultimately, the system-wide BPA implementation was a critical step in the near doubling of the percentage of cEEG patients attending the PASS clinic. A piece of evidence that supports this assertion is the significant increase in the patients with T/M/I encephalopathy attending PASS clinic. These patients are typically managed by non-neurological services such as internal medicine. These patients are likely to have AMS, epileptiform abnormalities such as generalized periodic patterns,[25,26] and an increased long-term risk of seizures in large population-based study.[27]

The PASS clinic was designed to follow-up patients 3 months after hospital discharge with an option for a sooner visit if requested by the inpatient care team. While a 3-month time period for follow-up is somewhat arbitrary, it has been recommended to be an optimum time period for AED management changes in patients suffering ASyS.[9,28] Many of these patients have altered level of consciousness during cEEG monitoring and do not have a good understanding of their acute seizures. By the time of the PASS clinic, a majority of them can be expected to have completed their rehab course and have a stable, possibly improved, cognitive functioning. Therefore, PASS clinic provides an ideal opportunity to discuss their cEEG findings, the reason and rationale for them being on AEDs, discuss and appraise them of their future seizure recurrence/epilepsy risk, and discuss plans for AED management, including the safe weaning off of AEDs. We consider a follow-up within a month of hospital discharge as too short of a time period to make any significant changes to AED or to assess their future seizure recurrence risk. Nonetheless, one-third of times, the inpatient care teams requested PASS follow-up within this time period (35.2% vs 60% in the pre-PASS cohort; Figure 3). Another one-third of patients in

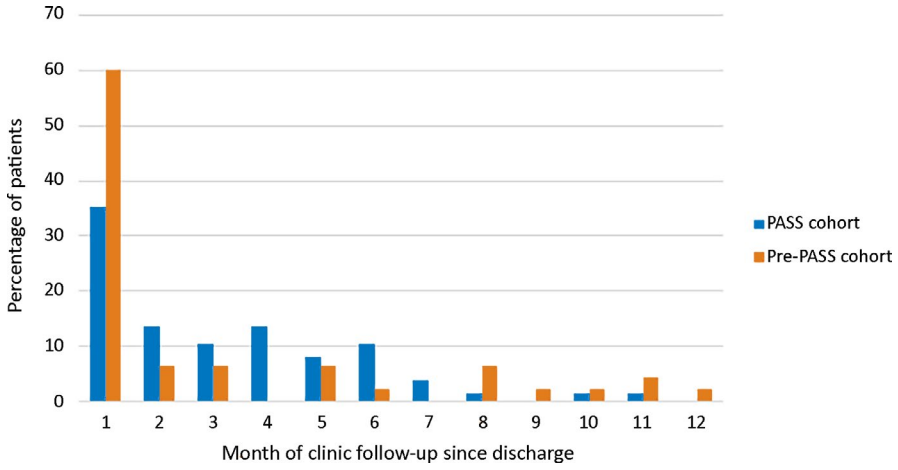

FIGURE 3 Distribution of Pre-PASS and PASS cohort based on the time from hospital discharge to the initial clinic visit

the PASS cohort were seen around 3 (±1) months post-discharge (Figure 3). We found that the PASS cohort was 4 times more likely to follow-up between a time period of meaningful decision-making (1-6 months) compared to the pre-PASS cohort.

Although the percentage of patients seen by epileptologists of choice for PASS clinic went up by more than 10%, it was not statistically significant compared to the pre-PASS cohort. This suggests scope for improvement in the scheduling of PASS clinic. We also plan to utilize tele-neurology services for those patients unable to return to the clinic for a variety of reasons (such as distance to the clinic and reduced mobility). The decision to have specific "epileptologists of choice" manage the PASS clinic is motivated by two primary factors. cEEG monitoring is a relatively new and rapidly evolving electrodiagnostic field. The long-term epileptogenic potential of many of the cEEG findings is unclear at this point. Therefore, the epileptologists with major clinical interest and practice focus in cEEG monitoring, who are most likely to be involved in the acute management of many of these patients, were considered as most suitable to serve the PASS clinic. Secondly, limiting the number of epileptologist in the PASS clinic is likely to accelerate their experience and expertise in treating this unique patient population.

We included an extended EEG, performed on the day of the visit, prior to the appointment as part of the PASS clinic protocol to inform the decision-making process. Studies analyzing the significance of epileptiform abnormality on EEG prior to AED withdrawal in well-controlled epilepsy patients have noted their presence to be associated with a 1.5 times higher likelihood of seizure recurrence.[29,30] Therefore, the presence of epileptiform abnormality on the EEGs in the PASS clinic could suggest an ongoing risk for seizures and guide the treating physician to defer immediate discontinuation of AEDs. Our PASS clinic protocol of performing an extended EEG instead of a routine EEG (20-minutes)[31] is supported by a close to 20% increase in the yield of epileptiform abnormality during a 60-minute EEG.[32] While performing an extended EEG on the day of clinic visit is our PASS clinic protocol, we can imagine each center tailoring the requirement and duration of this EEG based on their resources and preferences. Other deviations from PASS clinic protocol include a small percentage of patients seen in the clinic who had epilepsy on admission, which was an exclusion criterion and a similar percentage not discharged on AEDs, a requirement for PASS clinic patients. The reason for the former is likely the absence of epilepsy in the pre-admission problem list in the EHR. The latter was likely due to discontinuation of AED after placing the discharge orders (and requesting PASS clinic appointment) but prior to the actual discharge from the hospital.

In the current study, we did not investigate the AED management decision-making in the PASS clinic visit, the pre-clinic EEG findings, the latter's impact on AED management, and correlation with epilepsy development. These are highly relevant and critical questions that we hope the establishment of dedicated outpatient care models like PASS clinic will help address. The primary goal of the current study was to investigate the real-world improvement in access to outpatient epilepsy care by the establishment of the PASS clinic. This is the reason for considering all patients undergoing cEEG as the target population for the primary endpoint in the study. Therefore, another limitation of our study is that we did not investigate whether there were eligible patients for whom the inpatient care team chose not to place a PASS clinic order at the time of discharge or whether the patients failed to follow-up after a PASS clinic appointment was scheduled.

In conclusion, we present a unique model for outpatient management of patients with ASyS or RPPs in the times when cEEG affects the management of a large majority of monitored patients. We show that establishing the PASS clinic almost doubled the access to an epileptologist for the eligible population. PASS clinic is a new step in improving the transition of care, considered a "hot topic in health care" by the Joint Commission,[33] for patients impacted by cEEG monitoring. It is our sincere hope that the PASS clinic model is emulated and enhanced in other centers. Future multi-center research in optimizing appropriate care for patients suffering from acute symptomatic seizures from various etiologies is warranted.

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CONFLICT OF INTEREST

None of the authors has any conflict of interest to disclose. We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

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REFERENCES

1. Hauser WA, Annegers JF, Rocca WA. Descriptive epidemiology of epilepsy: contributions of population-based studies from Rochester, Minnesota. Mayo Clin Proc. 1996;71:576–86.
2. Annegers JF, Hauser WA, Lee JR, Rocca WA. Incidence of acute symptomatic seizures in Rochester, Minnesota, 1935–1984. Epilepsia. 1995;36:327–33.
3. Hill CE, Blank LJ, Thibault D, Davis KA, Dahodwala N, Litt B, et al. Continuous EEG is associated with favorable hospitalization outcomes for critically ill patients. Neurology. 2019;92:e9–18.

4. Rodriguez Ruiz A, Vlachy J, Lee JW, Gilmore EJ, Ayer T, Haider HA, et al. Association of periodic and rhythmic electroencephalographic patterns with seizures in critically ill patients. JAMA Neurol. 2017;74:181–8.
5. Claassen J, Mayer SA, Kowalski RG, Emerson RG, Hirsch LJ. Detection of electrographic seizures with continuous EEG monitoring in critically ill patients. Neurology. 2004;62:1743–8.
6. Alvarez V, Rodriguez Ruiz AA, LaRoche S, Hirsch LJ, Parres C, Voinescu PE, et al. The use and yield of continuous EEG in critically ill patients: a comparative study of three centers. Clin Neurophysiol. 2017;128:570–8.
7. Kilbride RD, Costello DJ, Chiappa KH. How seizure detection by continuous electroencephalographic monitoring affects the prescribing of antiepileptic medications. Arch Neurol. 2009;66:723–8.
8. Beghi E, Carpio A, Forsgren L, Hesdorffer DC, Malmgren K, Sander JW, et al. Recommendation for a definition of acute symptomatic seizure. Epilepsia. 2010;51:671–5.
9. Chong DJ, Hirsch LJ. Which EEG patterns warrant treatment in the critically ill? Reviewing the evidence for treatment of periodic epileptiform discharges and related patterns. J Clin Neurophysiol. 2005;22:79–91.
10. Punia V, Garcia CG, Hantus S. Incidence of recurrent seizures following hospital discharge in patients with LPDs (PLEDs) and nonconvulsive seizures recorded on continuous EEG in the critical care setting. Epilepsy Behav. 2015;49:250–4.
11. Punia V, Vakani R, Burgess R, Hantus S. Electrographic and clinical natural history of lateralized periodic discharges. J Clin Neurophysiol. 2018;35:71–6.
12. Punia V, Bena J, Krishnan B, Newey C, Hantus S. New onset epilepsy among patients with periodic discharges on continuous electroencephalographic monitoring. Epilepsia. 2018;59:1612–20.
13. Beniczky S, Hirsch LJ, Kaplan PW, Pressler R, Bauer G, Aurlien H, et al. Unified EEG terminology and criteria for nonconvulsive status epilepticus. Epilepsia. 2013;54(Suppl 6):28–9.
14. Noachtar S, Binnie C, Ebersole J, Mauguière F, Sakamoto A, Westmoreland B. A glossary of terms most commonly used by clinical electroencephalographers and proposal for the report form for the EEG findings. The International Federation of Clinical Neurophysiology. Electroencephalogr Clin Neurophysiol Suppl. 1999;52:21–41.
15. Gaspard N, Manganas L, Rampal N, Petroff OA, Hirsch LJ. Similarity of lateralized rhythmic delta activity to periodic lateralized epileptiform discharges in critically ill patients. JAMA Neurol. 2013;70:1288–95.
16. Temkin NR. Risk factors for posttraumatic seizures in adults. Epilepsia. 2003;44:18–20.
17. So EL, Annegers JF, Hauser WA, O'Brien PC, Whisnant JP. Population-based study of seizure disorders after cerebral infarction. Neurology. 1996;46:350–5.
18. Lahti A-M, Saloheimo P, Huhtakangas J, Salminen H, Juvela S, Bode MK, et al. Poststroke epilepsy in long-term survivors of primary intracerebral hemorrhage. Neurology. 2017;88:2169–75.
19. Galovic M, Döhler N, Erdélyi-Canavese B, Felbecker A, Siebel P, Conrad J, et al. Prediction of late seizures after ischaemic stroke with a novel prognostic model (the SeLECT score): a multivariable prediction model development and validation study. Lancet Neurol. 2018;17:143–52.
20. Punia V, Fitzgerald Z, Zhang X, Huynh H, Bena J, et al. Electroencephalographic biomarkers of epilepsy development in patients with acute brain injury: a matched, parallel cohort study. Ann Clin Transl Neurol. 2019;6:2230–9.
21. Punia V, Fitzgerald Z, Zhang X, Huynh H, Bena J, et al. Is a first acute symptomatic seizure epilepsy? Mortality and risk for recurrent seizure. Epilepsia. 2009;50:1102–8.
22. Pinto D, Prabhakaran S, Tipton E, Naidech AM. Why physicians prescribe prophylactic seizure medications after intracerebral hemorrhage: an adaptive conjoint analysis. J Stroke Cerebrovasc Dis. 2020;4:104628.
23. Brigo F, Lattanzi S, Zelano J, Bragazzi NL, Belcastro V, Nardone R, et al. Randomized controlled trials of antiepileptic drugs for the treatment of post-stroke seizures: a systematic review with network meta-analysis. Seizure. 2018;61:57–62.
24. Naidech AM, Beaumont J, Muldoon K, Liotta EM, Maas MB, Potts MB et al Prophylactic seizure medication and health-related quality of life after intracerebral hemorrhage. Crit Care Med. 2018;46(9):1480–5.
25. Foreman B, Claassen J, Abou Khaled K, Jirsch J, Alschuler DM, Wittman J, et al. Generalized periodic discharges in the critically ill: a case-control study of 200 patients. . Neurology. 2012;79:1951–60.
26. Foreman B, Mahulikar A, Tadi P, Claassen J, Szaflarski J, Halford JJ, et al. Generalized periodic discharges and "triphasic waves": A blinded evaluation of inter-rater agreement and clinical significance. Clin Neurophysiol. 2016;127:1073–80.
27. Reznik ME, Merkler AE, Mahta A, Murthy SB, Claassen J, Kamel H, et al. Long-term risk of seizures in adult survivors of sepsis. Neurology. 2017;89:1476–82.
28. Gunawardane N, Fields M. Acute symptomatic seizures and provoked seizures: to treat or not to treat? Curr Treat Options Neurol. 2018;20:41.
29. Lamberink HJ, Otte WM, Geerts AT, Pavlovic M, Ramos-Lizana J, Marson AG, et al. Individualised prediction model of seizure recurrence and long-term outcomes after withdrawal of antiepileptic drugs in seizure-free patients: a systematic review and individual participant data meta-analysis. Lancet Neurol. 2017;16:523–31.
30. Berg AT, Shinnar S. Relapse following discontinuation of antiepileptic drugs: a meta-analysis. Neurology. 1994;44:601–8.
31. Sinha SR, Sullivan L, Sabau D, San-Juan D, Dombrowski KE, et al. American Clinical Neurophysiology Society Guideline 1: minimum technical requirements for performing clinical electroencephalography. J Clin Neurophysiol. 2016;33:303–7.
32. Burkholder DB, Britton JW, Rajasekaran V, Fabris RR, Cherian PJ, Kelly-Williams KM, et al. Routine vs extended outpatient EEG for the detection of interictal epileptiform discharges. Neurology. 2016;86:1524–30.
33. The Joint Commision. Transitions of Care (ToC) Portal, 2016. https://www.jointcommission.org/toc.aspx. Accessed on 09/16/2019.

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