

OUTCOMES OF PATIENTS DIAGNOSED WITH PSYCHOGENIC NON-EPILEPTIC
SEIZURES

by

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DISSERTATION

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ABSTRACT
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SEIZURES

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Background: Psychogenic Non-Epileptic Seizures (PNES) is a complex neuropsychiatric illness that is very difficult to diagnose due to complex comorbidities and symptoms. There are also several risk factors associated with development of PNES that can contribute to the patient's presentation. However, there is very little literature on patient outcomes, management guidelines, and prognostic factors. Therefore, patients may not receive treatment according to a standard of care or in a streamlined manner which may worsen patient outcomes.

Objective: This study will examine 1) if patient outcomes improve with psychiatric or multidisciplinary management and 2) the influence of specific risk factors on patient outcomes.

Methods: This was a retrospective cohort study with data from chart review of the Parkland EMR. A total of 122 patients were examined who were diagnosed with PNES during an EMU admission in 2016. Demographic variables, risk factors for PNES, and treatment intervention information were extracted from each patient chart to be compared with the primary outcome variable. Patient outcomes were measured by recurrent symptoms leading to ED visits and/or

EMU admissions after the initial 2016 admission. Descriptive analysis was done using Excel while statistical analysis comparing independent variables to patient outcome variables was done using SPSS 25. If the independent variable was a categorical variable, chi-square tests were used, but for continuous variables, Kruskal-Wallis rank sum tests were used.

Results: Preliminary findings showed no significant associations between receiving any singular intervention and patient outcomes. Unexpectedly multidisciplinary management such as therapy and psychiatric follow-up had no significant relationship with patient outcomes. Risk factors that may be associated with increased recurrent PNES symptoms include prior psychiatric disorders, prior ED visits or EMU admissions, and socioeconomic factors such as type of insurance and homelessness.

Conclusion: Although multidisciplinary management did not show significant reduction in readmissions or ED visits for PNES symptoms, prior literature shows that psychiatric/psychological involvement can improve PNES outcomes. Treatment of PNES should be tailored for patients based on psychiatric/neurologic comorbidities and risk factors. Future research will need to explore the benefits of combinations of interventions and a multidisciplinary clinic such as a PNES clinic for these patients.

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CHAPTER 1

INTRODUCTION

Psychogenic non-epileptic seizure disorder (PNES) is a neuropsychiatric illness that is estimated to affect 2 to 33 per 100,000 persons.¹ Patients can present with episodic symptoms including convulsions of long or fluctuating duration specifically with varying limb involvement, asynchronous movements, pelvic thrusting, side-to-side movements, vocalizations, eye closure, and unresponsive behaviors.² Most episodes occur in front of witnesses, while awake, and/or after a stressful event. Epileptic activity is more likely than a diagnosis of PNES if there is postictal confusion, lack of memory recall, or an event during sleep.² The underlying etiology of PNES has been associated with dissociative and conversion disorders, where psychosocial disturbances manifest as physical symptoms that may be incongruent to known physiology per the DSM-5.³ The DSM-5 has also veered away from calling this group of disorders a diagnosis by exclusion and although is commonly triggered by a stressful event, does not require this psychological trigger for diagnosis. The most predominant demographic affected by functional neurological disorders is females in their 30's.³ Although there are no tangible changes in laboratory markers or EEG with functional neurologic disorders or PNES specifically, recent studies have shown alterations in neuronal networks involved in emotion, executive control, attention, default mode networks, and sensorimotor function. This pathology is similar to several psychiatric illnesses including Major Depressive Disorder and Post-Traumatic Stress Disorder.⁴ Diagnosis of PNES is primarily clinical; however, sensitivity or specificity of clinical features is not high enough to definitively rule out true epileptic events.³ Video EEG of the ictal and postictal state is

required for confirmatory testing. Differentiating between the diagnoses of PNES and true epileptic seizures can be extremely difficult, and patients are often mis-diagnosed. Of all patients in the Epilepsy Monitoring Unit (EMU) admitted for seizure symptoms, around 25-40% have a diagnosis of PNES. Of patients referred to outpatient epilepsy centers due to seizure activity, 5-25% have a diagnosis of PNES.¹ Overall, making the diagnosis of PNES can be challenging and take on average 7-10 years in some cases due to the diversity of presentations, lack of clear defining symptoms and reliance on observations, comorbid neurologic pathologies, and discomfort in making a psychiatric diagnosis.²

Once the diagnosis of PNES is made, the recommended management primarily consists of psychiatric interventions depending on underlying psychiatric conditions found on neuropsychological evaluation.⁵ Due to the variety of underlying conditions PNES patients may have, there have been a limited number of randomized trials to establish definitive treatment guidelines. Prior to diagnosis, PNES patients frequently take anti-epileptic medications to control their seizures as well, however there is no evidence to show these medications are beneficial.⁵ Anti-epileptics may still be used in situations where there is a prior history of true seizures with EEG changes and/or significant neurologic disease that increases risk for true seizures.⁶ There have been some studies that have shown Cognitive Behavioral Therapy (CBT) to reduce PNES episodes. Use of SSRIs alone did not have this effect, but if given in addition to CBT, episodes were reduced.⁷ Additionally, after the diagnosis of PNES, long-term follow-up is typically done by psychiatry only since most underlying causes of PNES are psychiatric in nature. Neurology may discharge the patient early on in care which may have been shown to exacerbate episodes and slow patient

understanding/acceptance of their diagnosis.⁵ There are some institutions, including UT Southwestern, that refer patients newly diagnosed with PNES to a specific PNES clinic where a neuropsychiatrist or psychiatrist will follow-up with the patient depending on their prior history and needs. Patients are additionally offered group and individual psychotherapy for PNES, which allows for a centralized and multidisciplinary management of PNES.

There are several risk factors that have been associated with developing non-epileptic seizures. This disorder is more prevalent among females with onset usually in 20-30's.¹ Prior brain injury also seems to be a significant risk factor since 75% of PNES patients report a history of sustained brain injury prior to seizure onset.⁸ Around 70% of patients also report at least one significant past traumatic experience – physical, emotional, or sexual, with nearly half of these experiences being sexual trauma.⁹ Trauma seems to be the most studied risk factor for PNES which has led to the development of two models of how trauma might manifest as seizure-like symptoms. The first model is the Post-traumatic model in which one event causes the patient significant distress leading to intrusive memories, one of the criteria for Post-Traumatic Stress Disorder (PTSD). To avoid the negative emotions associated with that traumatic event, the patient immediately blocks the memory (cut-off phenomenon) which then manifests as a physical symptom. The second model is the Developmental model in which there are repeated events or exposures to an adverse environment. These repeated traumas cause changes in multiple brain circuits that lead to differences in thought processing and coping skills. Seizure-like episodes become a coping mechanism during stressful situations.¹⁰ The etiology of PNES seems to be primarily psychological as well, and patients may therefore have several comorbid psychiatric illnesses, most commonly depression,

anxiety, post-traumatic stress disorder (PTSD), or somatic disorders. Many PNES patients have pre-existing psychiatric disorders that continue to be difficult to manage after seizure onset.¹¹ Many patients also have a co-existing seizure disorder or neurologic illness requiring anti-epileptic medications, which may be associated with increased risk for developing PNES.⁶

There is a small amount of literature that explore the factors that affect prognosis of PNES patients, which is overall poor as less than 40% of patients become seizure free. Most studies demonstrate no conclusive results that show one treatment to be associated with better outcomes. In general, patients require a combination of psychiatric and neurologic management that is tailored to the patient's history.¹²⁻¹⁴ Those with more psychiatric comorbidities may have worse outcomes with continued seizures and mental health issues. These studies suggest that depression, anxiety, and somatizations disorders are associated with worse prognosis.^{11, 13} Additionally, some studies have shown that history of sexual trauma may lead to poor outcomes, however other studies demonstrate no significance between the two.¹⁵ However, studies also show that those with underlying psychiatric disorders that are resolved with therapy or medication may have improved quality of life and better outcomes. Overall, there is not enough evidence to support or deny a relationship between psychiatric comorbidities and PNES outcomes.⁹ However, most studies agree that co-existing epilepsy or seizure disorder is associated with worse outcomes as seizure frequency continues to remain high.¹²⁻¹⁴ In fact, one study showed that 30-day readmission risk for epilepsy patients was increased with a concurrent PNES diagnosis or psychiatric comorbidity.¹⁶ The primary objective of this study is to evaluate the clinical outcomes of

PNES patients based on management – pharmacological vs nonpharmacological treatment. The secondary objective is to evaluate risk factors such as history of trauma as possible prognostic factors for PNES patients. It is expected that multidisciplinary treatment with therapy and psychiatric follow-up will be associated with improved outcomes. There is not enough evidence or uniformity in the disease to create specific treatment guidelines that can be easily followed for all PNES patients. Therefore, treatment options and evaluation of factors that may affect outcomes should be explored further to reduce seizure recurrence and improve quality of life for PNES patients.

CHAPTER 2

EXPERIMENTAL PROCEDURES

For this retrospective cohort study, data was extracted from an MS access clinical database of electronic medical records of patients at Parkland Hospital and UT Southwestern in Dallas, Texas. Patient MRNs were extracted if they had an established diagnosis of PNES in their Epic medical charts from at least one stay in the Epilepsy Monitoring Unit (EMU) during the year of 2016, resulting in a total sample of 122 patients. During literature review, several variables were selected that were shown to have possible association with or contribution to PNES outcomes which were refined during chart review. All patient charts were reviewed for information on the patient's demographics, medical/psychiatric history, social chaos variables, PNES management, and outcomes. This study was IRB approved.

Demographic variables included age, gender, and ethnicity. Medical history that was found to be relevant to PNES were history of seizure disorder, anti-epileptic use, chronic pain syndromes, history of traumatic brain injury. Psychiatric history included psychiatric disorders, psychiatric medication use, and history of physical, emotional, or sexual abuse/trauma. Due to the psychological etiology of PNES, social chaos variables were explored for the influence of the social systems around the patients on PNES outcomes.¹⁷ Social chaos variables included presence of insurance on first EMU admission, history of substance use, history of sexually transmitted disease in the year prior to EMU admission, living arrangements (alone or with a support system) and the variables included for psychiatry history to measure mental health.¹⁷ Variables for treatment interventions were separated into therapy, psychotropic medication, and anti-epileptic medication. Additional

variables for management focused on follow-up with neurology, psychiatry and/or the PNES clinic located at UTSW. If patients did follow-up with the PNES clinic, this was considered as neurology and psychiatry follow-up. To determine the extent of follow-up patients were receiving, we recorded the number of follow-up visits in the year after the initial EMU admission in 2016 as length of follow-up. This allowed differentiation between patients who never received a referral to certain clinics and patients who were referred but were lost to follow-up for a few patients, however this information was unavailable for a large percentage of patients. Patient notes were reviewed to determine if patients participated in group or individual therapy. PNES outcomes were measured by number of EMU admissions and ED visits within 30 days of the initial 2016 admission and those admissions and ED visits 30 days after the initial admission. These visits were counted if the chief complaint was related to PNES symptoms. The chart review included number of admissions within the following year and all admissions between 2016 and 2020.

Statistical Analyses

Statistical analyses were completed with the assistance of Parkland statisticians. Excel 2005 was used to record data from chart review, calculate descriptive statistics for patient demographics, and cross-tabulate variables for risk factors and outcome. SPSS 25 was used to summarize descriptive data with proportions, median, 25th percentiles, and 75th percentiles. Demographic, social chaos, and treatment variables were compared among three groups related to patient outcomes: 1) number of patients with ED visits and/or EMU readmissions within 30 days of admission, 2) number of patients with ED visits and/or EMU readmissions after 30 days after the initial admission, and 3) number of patients with no ED visits and

EMU readmissions after the initial admission. Continuous data such as age and prior ED/EMU visits were compared among the three groups using a Kruskal-Wallis rank sum test and categorical data such as trauma history were compared among the three groups using Chi-square test. All statistical tests used 0.05 as the statistical significance level.

CHAPTER 3

RESULTS

Descriptive analysis of patient demographic data shows that the PNES population is predominantly Caucasian females. The age group that PNES affects seems to be on the younger side as majority of the patients were under 60 years of age. Majority of patients had a history of a seizure disorder and history of a psychiatric disorder (Table 1, Figure 1). 57.38% of patients had a history some type of chronic pain syndrome, such as fibromyalgia, migraines, arthritis, or back pain. In terms of the social chaos variables, patients were mostly distributed evenly with no insurance, Medicare/Medicaid, or commercial insurance. 56.56% of patients had a history of trauma, including traumatic brain injury, abuse, or both. The frequency of STDs was low among patients as was homelessness (only three patients had a history of homelessness). 31% of PNES patients had a current or recent history of substance use (within last 5 years).

Management of PNES once diagnosed at the first EMU admission in 2016 was by therapy and/or medication. 42.62% of patients participated in at least one therapy session per chart notes. Psychotropic medications, most commonly SSRIs, were prescribed to 53.28% of patients while antiepileptic medications were either continued or prescribed for 41.8% of patients. In terms of follow-up, all patients except for 3 were referred for neurology follow-up with 30% of those referred with no follow-up visits noted in the Parkland EMR. However, 31.97% of patients were not given psychiatry or psychology referrals. Of those who were given this referral, 38.1% of patients had no follow-up visits with either department per the Parkland EMR. Overall, only 42.28% of patients met with psychology or psychiatry at least

once after a PNES diagnosis. The UTSW PNES clinic referral which was considered neurology and psychiatry follow up was provided to 46.72% of patients. Of all patients diagnosed with PNES in 2016 at Parkland, only 20.49% of patients had at least one visit with the PNES clinic.

There was a total of 22 EMU admissions subsequent to the initial 2016 admission among 13 of the patients with an established PNES diagnosis. A total of 31 patients had ED visits or EMU admissions for recurrent PNES symptoms after diagnosis. Of those 31 patients, 29 patients had a history of psychiatric illness prior to the EMU admission. About half of the patients (N=15) were patients who had undergone some trauma, either head injury, physical/emotion/sexual abuse, or both. There was not a large difference between admissions based on history of substance use, in fact only 9 of the 31 patients had a history of substance use. However, only 3 of the 31 patients with ED/EMU visits were patients with commercial/private insurance. Regarding treatment, 21 of the 31 patients with recurrent PNES symptoms were prescribed an anti-epileptic medication after their initial EMU stay. 13 patients with recurrent symptoms were referred to psychotherapy usually cognitive-behavioral therapy, and 19 patients received psychiatric medication after their initial EMU admission. Almost all patients were referred to a neurologist for follow-up, and this includes all patients who had recurrent PNES symptoms. For psychiatric follow-up, 8 of the patients with recurrent symptoms did not receive a referral for psychiatry. Only 8 of the 31 total patients with subsequent ED visits or EMU admissions for PNES were patients who followed up in the PNES clinic at UTSW at least once after the initial admission.

Statistical analysis was done by comparing the three groups of outcomes to various

demographic and treatment variables (Table 2). When comparing the three groups of outcomes based on intervention, there were no significant results. Patients on anti-epileptic medication, psychiatric medication, or psychotherapy had no significant differences in whether they had recurrent ED visits or EMU admissions after initial admission ($p > 0.05$). Additionally, multidisciplinary follow-up did not have significant association with the three outcomes either. Almost all patients received neurology follow-up referrals; however, psychiatry follow-up referrals also did not have any significant difference in recurrent visits for PNES symptoms.

There were some risk factors that showed significant association with recurrent PNES symptoms. Those with prior history of psychiatric illness were significantly associated with patient outcomes, as almost all patients with recurrent symptoms did have psychiatric illness ($p < 0.05$). Insurance or method of pay was also significantly associated with the three patient outcome groups ($p < 0.05$). Homelessness was significantly associated with patient outcomes ($p < 0.05$), as all three homeless patients had recurrent ED/EMU visits. Prior ED/EMU visits in the 12 months before initial 2016 EMU admission was also significantly associated with patient outcomes as the median number of prior visits was higher for the outcome group with recurrent symptoms 30 days after the initial admission. History of trauma, substance use, and living alone did not have any significant association with patient outcomes.

CHAPTER 4

CONCLUSION

The prevalence of PNES in this sample was highest in the younger female patients which reflects the predominant demographic in the general population with functional neurologic disorders.¹ The majority of patients had a history of psychiatric illness and/or a prior seizure history per chart review, which substantiates prior studies of common comorbidities of PNES.^{6, 10} Only a little over half of the sample had a history of trauma which was interesting as trauma is one of the most studied risk factors to be significantly associated with development of PNES.⁹ However, the percentage of patients who experienced abuse in this sample was about 44% which is much higher than the general population, supporting prior findings that trauma is a major risk factor for PNES.¹⁸

The primary objective was to determine associations between PNES treatment and outcomes. We expected that patients who underwent multidisciplinary treatment – those who participated in therapy and followed up with psychiatry/psychology along with neurology would have reduced seizure recurrence. However, statistical analysis showed no significant association between reduced EMU or ED visits and prescription of therapy or psychiatry follow-up. However, literature review has shown that PNES patients and patients without PNES have similar amounts of stressors but differences in coping skills.⁷ There may be increased benefit for Cognitive Behavioral therapy as patients are able to learn coping skills for long-term management of stress.⁷ This is especially true for PNES patients with psychiatric comorbidities as therapy, specifically CBT, has been proven to be effective for treating these comorbidities.⁷ Although almost all patients in this sample had neurology

follow-up, psychiatry follow-up was expected to play a larger role in patient outcomes, but was also found to have no significant association.¹³ Patients who took anti-epileptic medications did not have significantly higher subsequent EMU admissions or ED visits than those who did not, which does not support the understanding that anticonvulsants are not optimal treatments to improve PNES outcomes. This may be due to the large percentage of patients who had true concurrent seizure disorders requiring anti-epileptic management. This study surprisingly did not show any statistically significant relationship between any one of these interventions, non- pharmacological and pharmacological.

The study's hypothesis was that multidisciplinary management would be associated with better outcomes as there have been studies that show this in many fields of medicine.¹⁹ One factor that might have resulted in these unexpected findings was limited access to only Parkland's electronic medical record. Many patients in the sample were referred to therapists or psychiatrists outside the hospital system, which made it difficult to record if and how much they were able to follow-up with the other disciplines. Additionally, the primary outcome measure of recurrent PNES symptoms did not have as much statistical power which may have also impacted outcomes. This study also examined each intervention separately and found no significant relationship with patient outcomes; however, literature review has shown that patients typically receive a combination of interventions based on their needs.⁵⁻⁷ The data from this study can be used to explore the effect of various combination interventions on patient outcomes in future studies.

The secondary objective of this study was to examine risk factors for PNES that may be effective prognostic factors that may be associated with patient outcomes. The risk factors

that seem to be associated with higher number of EMU admissions are ED visits or EMU admissions in the 12 months prior to PNES diagnosis and the social chaos variables of history of psychiatric disorder, lack of private insurance, and homelessness. The impact of psychiatric comorbidities on patient outcomes was expected as there have been some studies that associated a separate psychiatric diagnosis with worse PNES symptoms.¹⁰ The psychologic etiology of PNES suggests that with unmanaged psychiatric symptoms, functional disorders may worsen.¹⁰ Insurance was also significantly associated with outcomes which has been described in one study.²⁰ Since this is an illness that requires the involvement of multiple specialties, having commercial insurance would allow for much more access to multiple specialties and supplemental therapies that patients with Medicaid/Medicare/no insurance would not be able to receive. This not only supports the finding that insurance impacts outcomes, but also supports the idea that combination interventions may be related to outcomes more than any one intervention. Similarly, homelessness would also be expected to impact outcomes due to lack of access to care, although there were only three homeless patients in the sample to analyze. Prior ED visits and EMU admissions for symptoms demonstrate severity of illness which would be expected to impact outcomes as well. There have been studies in the literature that have shown comorbid epilepsy or seizure disorders to be associated with worse prognosis for PNES patients, so this could be corroborated in future studies.⁶ Trauma was expected to have a significant impact on patient outcomes; however, patients who underwent some type of trauma did not have statistically significantly increased risk for developing PNES. This may be due to targeted resolution of any psychiatric sequelae from these traumatic events, reducing subsequent number of PNES episodes. Substance use

and living alone have been shown to be associated with other mental illness and cognitive issues but were unrelated to PNES outcomes in this study.²¹ Due to the impact of social variables, management of PNES should take social disparities into account to reduce the risk of future EMU admissions or ER visits for PNES symptoms.²² Future studies using this data could explore risk factors in further detail, for example, the impact of different types of trauma on outcomes and other adverse childhood experiences as these are known to increase risk for psychogenic disorders.²³

There were several limitations to this study, first and foremost that PNES is a complex illness with several confounding and overlapping factors. Prior seizure history, psychiatric comorbidities, and prior trauma may be of different severities for each patient which might affect severity of PNES episodes that require EMU admissions. Furthermore, we did not have data for these patients prior to 2016; therefore, onset of seizures was not specifically recorded in the charts, nor was prior therapy or treatment for any of the comorbidities or risk factors the patient may have had in the past. In terms of management, the length of medication use and compliance was not specifically recorded in the medical charts. As mentioned, the charts were also unclear on follow-up if patients saw providers outside the UTSW/Parkland system, especially regarding therapy. If patients were admitted outside the UTSW/Parkland system or did not see a physician after having an episode, this would not be included in the chart review unless the note specifically mentioned that the patient did follow-up with the specific specialist. Additionally, even if the referral was made within the UTSW/Parkland system, many patients had no further hospital visits recorded in their chart. Several patients were lost to follow-up in this way due to reasons unspecified which may have impacted the analysis.

Future studies should attempt to identify how long patients underwent the intervention of therapy, medication use, or follow-up. The study also measured outcomes solely based on number of EMU admissions and ED visits which were few among the total sample causing the outcome measure to have lower power. Outcomes and quality of life is also dependent on ability to continue functioning in society especially with psychiatric illness, which should be measured in future studies as a supplemental outcome measure.

Conclusion

Psychogenic non-epileptic seizure disorder is a complex illness that is difficult to diagnose and manage by both physicians and patients. Due to the various neurological and psychiatric comorbidities as well as confounding factors, clinicians and researchers have not been able to establish specific treatment guidelines for patients. There is also little literature on what risk factors may have the greatest influence on patient outcomes. This retrospective cohort study examined PNES patients from Parkland Hospital to find that reduced risk of recurrent seizures was not associated with any specific intervention, pharmacological or non-pharmacological. However, patient outcomes were associated with prior PNES symptoms requiring ED or EMU and social chaos variables such as type of insurance, homelessness, and history of mental illness. Therefore, treating mental illness and providing social work to PNES patients may be important to improving symptoms and outcomes. Studies have shown diligent psychiatric follow-up and therapy along with occasional neurology follow-up may help with symptom reduction and management of comorbidities but should be prescribed based on clinical judgement. Future studies should examine the impact of combinations of the different interventions analyzed in this study on

patient outcomes and further stratify the various risk factors to help determine any prognostic factors for PNES. Psychogenic Non-Epileptic seizure disorder is a difficult illness to manage, requiring continued research to create improved guidelines for physicians to be able to provide high quality patient care.

LIST OF TABLES

Table 1: Descriptive Statistics

	N (%)
<i>Demographics/Risk Factors</i>	
<i>Gender</i>	
<i>Female</i>	87 (71.31)
<i>Male</i>	35 (28.69)
<i>Ethnicity</i>	
<i>Caucasian</i>	62 (50.82)
<i>African American</i>	33 (27.05)
<i>Hispanic</i>	25 (20.49)
<i>Other</i>	2 (1.64)
<i>Age</i>	
< 35	36 (29.51)
35-59	69 (56.56)
60+	17 (13.93)
<i>Prior seizure disorder</i>	
No	25 (20.49)
Yes	97 (79.51)
<i>Prior psychiatric disorder</i>	
No	26 (21.31)
Yes	96 (78.69)
<i>Insurance</i>	
None	36 (29.51)
Medicaid/Medicare	42 (34.43)
Commercial/private	44 (36.07)
<i>Trauma history*</i>	
None	53 (43.44)
Head injury	45 (36.89)
Physical, emotional, sexual abuse	41 (33.61)
<i>Homelessness</i>	
No	119 (97.54)
Yes	3 (2.46)
<i>Prior ED/EMU visit in last 12 months</i>	
No	85 (69.67)
Yes	37 (30.33)

Management after PNES diagnosis

Anti-epileptic medication

No	71 (58.20)
Yes	51 (41.80)

Psychiatric medication

No	57 (46.72)
Yes	65 (53.28)

Psychotherapy

No	70 (57.38)
Yes	52 (42.62)

Neurology referral

No	3 (2.46)
Yes	119 (97.54)

Psychiatry referral

No	39 (31.97)
Yes	83 (68.03)

PNES Clinic referral

No	65 (53.28)
Yes	57 (46.72)

PNES Clinic follow-up

No	97 (79.51)
Yes	25 (20.49)

Patient Outcomes

ED visits or EMU readmissions

Within 30 days

No	115 (94.26)
Yes	7 (5.73)

After 30 days

No	94 (77.05)
Yes	28 (22.95)

*Several patients reported both head injury and history of abuse

Table 2: Analysis

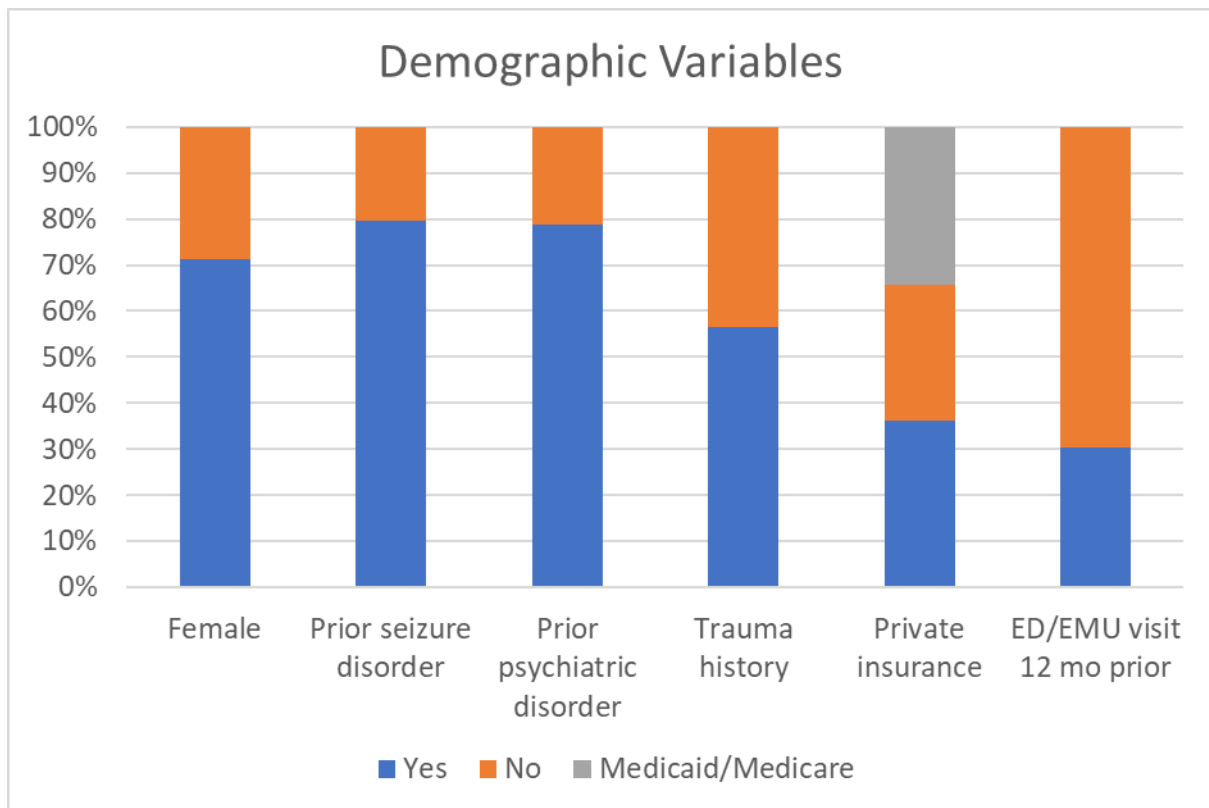
Characteristic	30-day ED visits and readmissions (N=7)	ED visits and readmissions after 30 days (N=24)	Patients with no further ED visits and readmissions (N=91)	P-value*
Age (median)	42 (19, 49)	37 (30, 48)	42 (34, 53)	0.12
Female (%)	5 (71)	18 (75)	64 (70)	0.90
Ethnicity				
-White	4 (57)	7 (29)	51 (56)	0.06
-African American	2 (29)	13 (54)	18 (20)	
-Hispanic	1 (14)	4 (17)	20 (22)	
-Other	0 (0)	0 (0)	2 (2)	
Insurance				
-Charity/Self-pay	4 (57)	12 (52)	19 (21)	<0.01
-Medicare/Medicaid	13 (43)	8 (35)	31 (34)	
-Commercial	0 (0)	3 (13)	41 (45)	
Trauma history (yes/no)	6 (86)	10 (42)	55 (60)	0.08
History of chronic pain (yes/no)	2 (29)	16 (67)	52 (57)	0.20
Psychiatric diagnosis (yes/no)	7 (100)	23 (96)	66 (73)	0.02
Active psychiatric symptoms (yes/no)	5 (71)	7 (29)	30 (33)	0.10
Psychiatric Medications (yes/no)	5 (71)	14 (58)	46 (51)	0.49
Substance use (yes/no)	1 (14)	8 (33)	22 (24)	0.52
Homeless (yes/no)	2 (29)	1 (4)	2 (2)	<0.01
Lives alone (yes/no)	0 (0)	1 (5)	16 (18)	0.17

Psychotherapy (yes/no)	3 (43)	10 (42)	39 (43)	0.99
Neurological follow up (yes/no)	7 (100)	24 (100)	88 (97)	0.59
Psychiatric follow up (yes/no)	6 (86)	17 (71)	60 (66)	0.53
PNES clinic follow up (yes/no)	3 (43)	5 (21)	17 (19)	0.31
ED encounters 12 months prior to admission (median)	0 (0, 1)	1 (0, 2)	0 (0, 0)	<0.01
Average number of admissions 12 months prior to admission (median)	0 (0, 1)	0 (0, 0)	0 (0, 0)	0.07

*Median compared with Kruskal-Wallis test and percentage compared by Chi-square test.

LIST OF FIGURES

Figure 1



REFERENCES

1. Benbadis SR, Allen Hauser W. An estimate of the prevalence of psychogenic non-epileptic seizures. *Seizure*. 2000;9(4):280-281.
2. Cragar DE, Berry DT, Fakhoury TA, Cibula JE, Schmitt FA. A review of diagnostic techniques in the differential diagnosis of epileptic and nonepileptic seizures. *Neuropsychol Rev*. 2002;12(1):31-64.
3. Duncan R, Razvi S, Mulhern S. Newly presenting psychogenic nonepileptic seizures: incidence, population characteristics, and early outcome from a prospective audit of a first seizure clinic. *Epilepsy Behav*. 2011;20(2):308-311.
4. Gedzelman ER, LaRoche SM. Long-term video EEG monitoring for diagnosis of psychogenic nonepileptic seizures. *Neuropsychiatr Dis Treat*. 2014;10:1979-1986.
5. Lesser RP. Treatment and Outcome of Psychogenic Nonepileptic Seizures. *Epilepsy Curr*. 2003;3(6):198-200.
6. Verducci C, Friedman D, Devinsky O. SUDEP in patients with epilepsy and nonepileptic seizures. *Epilepsia Open*. 2019;4(3):482-486.
7. LaFrance WC, Jr., Friedman JH. Cognitive behavioral therapy for psychogenic movement disorder. *Mov Disord*. 2009;24(12):1856-1857.
8. LaFrance WC, Jr., Deluca M, Machan JT, Fava JL. Traumatic brain injury and psychogenic nonepileptic seizures yield worse outcomes. *Epilepsia*. 2013;54(4):718-725.
9. LaFrance WC, Jr., Baker GA, Duncan R, Goldstein LH, Reuber M. Minimum requirements for the diagnosis of psychogenic nonepileptic seizures: a staged

- approach: a report from the International League Against Epilepsy Nonepileptic Seizures Task Force. *Epilepsia*. 2013;54(11):2005-2018.
10. Kalogjera-Sackellares D. Psychodynamics and psychotherapy of pseudoseizures, Crown House Publishing, Bancyfelin 2004.
 11. Myers L, Perrine K, Lancman M, Fleming M, Lancman M. Psychological trauma in patients with psychogenic nonepileptic seizures: trauma characteristics and those who develop PTSD. *Epilepsy Behav*. 2013;28(1):121-126.
 12. Durrant J, Rickards H, Cavanna AE. Prognosis and outcome predictors in psychogenic nonepileptic seizures. *Epilepsy Res Treat*. 2011;2011:274736.
 13. McKenzie P, Oto M, Russell A, Pelosi A, Duncan R. Early outcomes and predictors in 260 patients with psychogenic nonepileptic attacks. *Neurology*. 2010;74(1):64-69.
 14. Yadav A, Agarwal R, Park J. Outcome of psychogenic nonepileptic seizures (PNES) in children: A 2-year follow-up study. *Epilepsy Behav*. 2015;53:168-173.
 15. Sharpe D, Faye C. Non-epileptic seizures and child sexual abuse: a critical review of the literature. *Clin Psychol Rev*. 2006;26(8):1020-1040.
 16. Caller TA, Chen JJ, Harrington JJ, Bujarski KA, Jobst BC. Predictors for readmissions after video-EEG monitoring. *Neurology*. 2014 Jul 29;83(5):450-5. doi: 10.1212/WNL.0000000000000647. Epub 2014 Jun 20. PMID: 24951478; PMCID: PMC4132569.
 17. Keyhani S, Myers LJ, Cheng E, Hebert P, Williams LS, Bravata DM. Effect of clinical and social risk factors on hospital profiling for stroke readmission: a cohort study. *Ann Intern Med*. 2014;161(11):775-784.

18. Saunders BE, Adams ZW. Epidemiology of traumatic experiences in childhood. *Child Adolesc Psychiatr Clin N Am*. 2014;23(2):167-vii. doi:10.1016/j.chc.2013.12.003
19. Epstein NE. Multidisciplinary in-hospital teams improve patient outcomes: A review. *Surg Neurol Int*. 2014;5(Suppl 7):S295-S303. Published 2014 Aug 28. doi:10.4103/2152-7806.139612
20. Reuber M, Jamnadas-Khoda J, Broadhurst M, et al. Psychogenic nonepileptic seizure manifestations reported by patients and witnesses. *Epilepsia*. 2011;52(11):2028-2035.
21. Jacob L, Haro JM, Koyanagi A. Relationship between living alone and common mental disorders in the 1993, 2000 and 2007 National Psychiatric Morbidity Surveys. *PLoS One*. 2019;14(5):e0215182. Published 2019 May 1. doi:10.1371/journal.pone.0215182
22. Teagarden DL, Morton ML, Janocko NJ, et al. Socioeconomic disparities in patients with psychogenic nonepileptic seizures and their caregivers. *Epilepsy Behav*. 2020:107160.
23. Elbers J, Rovnaghi CR, Golianu B, Anand KJS. Clinical Profile Associated with Adverse Childhood Experiences: The Advent of Nervous System Dysregulation. *Children (Basel)*. 2017;4(11):98. Published 2017 Nov 15. doi:10.3390/children4110098

VITAE

Swetha Ramamurthy is currently a fourth-year medical student at UT Southwestern Medical School. She is originally from Houston, Texas and attended university at UT Dallas where she majored in Biology and assisted in psychology research. After starting at UT Southwestern, she became involved in community medicine and working with underserved populations through the free clinics, and research focusing on the intersection of physical and mental health which led to this functional neurologic disorder project. Swetha is now applying into the field of Psychiatry with a specific interest in Child Psychiatry. Outside of medicine, she enjoys music, dance, and eating good food around the city.

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