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Personality traits, illness behaviors, and psychiatric comorbidity in individuals with psychogenic nonepileptic seizures (PNES), epilepsy, and other nonepileptic seizures (oNES): Differentiating between the conditions

Gabriele Vilyte *, Chrisma Pretorius *

Stellenbosch University, South Africa

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ABSTRACT

Objectives: The study aimed to investigate if South African individuals with psychogenic nonepileptic seizures (PNES) differ from individuals with epileptic seizures (ES) and other nonepileptic seizures (oNES) in terms of demographic and seizure characteristics, personality traits, illness behaviors, and depression, anxiety, and posttraumatic stress disorder (PTSD) comorbidity in statistically significant ways; and if so, to test if these differences can be utilized in raising suspicion of PNES as the differential diagnosis to epilepsy and oNES in practice.
Methods: Data were analyzed from 29 adults with seizure complaints recruited using convenience sampling from a private and a government hospital with video-electroencephalography (vEEG) technology. A quantitative double-blind convenient sampling comparative design was used. A demographic and seizure questionnaire, the NEO Five Factor Inventory-3 (NEO-FFI-3), an abbreviated version of Illness Behavior Questionnaire (IBQ), and the Beck Anxiety Inventory — Primary Care (BAI-PC) were administered. Cronbach's alphas, analysis of variance (ANOVA), cross-tabulation, Fisher exact test, and receiver operating characteristic (ROC) analyses were performed on the dataset.
Results: The total sample consisted of 29 participants, of which 5 had PNES (17%), 21 ES (73%), and 3 oNES (10%). The final sample was comprised of 24 participants from the private hospital and 5 from the government hospital. The group with PNES was found to be significantly more male, to experience significantly more monthly seizures, and chronic pain when comparing the PNES with the ES group, and the PNES with the combined ES and oNES group in both private only sample, as well as the private and government hospital combined sample. Patients with PNES also had a higher level of education compared with the group with ES in the combined private and government hospital sample, something that was not evident in the private hospital only sample. No significant differences between groups were found in either sample in terms of age, population group, language, age at first seizure, and the NEO-FFI-3 subscales. All three groups scored above the cutoff point of 5 exhibiting depression, anxiety, and PTSD symptoms on the BAI-PC in both samples. However, the group with PNES tended to score significantly higher than the group with ES and the combined ES and oNES group in the private hospital sample. A cutoff point of 12 on the BAI-PC was found to predict PNES in this seizure population with 80% sensitivity and 89% specificity. However, once the analysis was repeated on the combined private and government hospital sample, significance in BAI-PC scores between groups was lost. All scales showed good reliability in our study, with the exception of the "Openness to Experience" subscale of the NEO-FFI-3 once reliability analysis was carried out on the combined private and government hospital group.
Conclusions: This study provides an important stepping stone in the understanding of demographic and seizure factors, personality domains, abnormal illness behaviors, and psychiatric comorbidity in the South African population with PNES. The study also reported on a cutoff score of 12 on the BAI-PC predicting PNES with 80% sensitivity and 89% specificity in a private hospital sample.

1. Introduction

Psychogenic nonepileptic seizures (PNES) are seizure-like events that mimic epileptic seizures (ES), but are caused by psychological

* Corresponding authors at: Department of Psychology, Wilcocks Building, Victoria Street, Stellenbosch 7130, South Africa.
E-mail addresses: gvilyte@su.ac.za (G. Vilyte), chrismapretorius@sun.ac.za (C. Pretorius).

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distress rather than abnormal electrical discharges in the brain [1]. The current gold standard of PNES diagnosis – prolonged video-electroencephalography (vEEG) – is not accessible to the majority of the population in middle-income countries, such as South Africa [2]. Hence, many of those with PNES are erroneously diagnosed as having ES and are treated with antiepileptic drugs (AEDs) [3,4]. However, unlike those with ES, people with PNES do not benefit from AEDs and, instead, are often left with numerous side effects [5] and the financial strain [6] that comes with using AEDs. Therefore, finding quicker, cheaper, and reliable alternative methods that do not require expert knowledge for PNES diagnosis is of paramount importance. So far, most successful attempts at such a measure have been multifaceted approaches covering multiple variables that have shown potential in differentiating PNES from ES [7–9]. Differences in seizure semiology [10,11], personality factors [12,13], abnormal illness behaviors [14,15], and increased psychiatric comorbidity, such as anxiety, depression, and posttraumatic stress disorder (PTSD) [16,17], in PNES when compared with ES have been well-researched, however, have yet to be investigated in South Africa. Hence, the present study sought to examine if these factors could be used to successfully differentiate between PNES, and ES or other nonepileptic seizures (oNES).

2. Methods

The study followed a quantitative double-blind (i.e., neither the researcher nor the participant was aware of the participant's diagnosis during data collection) convenient sampling comparative design.

Data were collected from February 2017 to July 2017 for a period of five months. The target population group of this study were English-speaking adults (i.e., at least 18 years of age [18]) with seizure complaints visiting the Neuroscience unit at Constantiaberg Medi-Clinic (a private hospital) and the Department of Neurology in Tygerberg Hospital (a government hospital) in Cape Town for vEEG monitoring during the period of data collection. These facilities were chosen because of being the only two in the Western Cape with vEEG equipment needed to ensure accurate PNES diagnosis [19].

Once potential participants were identified by the head nurse in the private hospital or head technologist in the government hospital, they were approached by the principal investigator telling them about the study and inviting to participate. Interested patients communicated their willingness to participate to the researcher on the spot and were asked to sign an informed consent form, which included permission to access their diagnoses. All the participants were able to complete the questionnaires while staying at the clinic. Since the researcher was blinded to the participants' diagnoses during data collection, once the data were collected from the participants, the researcher would send a request to the points of contact at the two hospitals for access to the participants' diagnoses. Ethical approval (**SU-HSD-002711**) was obtained from the Research Ethics Committee at Stellenbosch University. Institutional permissions were obtained from the hospital management for Constantiaberg Medi-Clinic and the Western Cape Government for Tygerberg Hospital (Appendix J).

2.1. Measures

Participants completed a demographic and seizure questionnaire, the NEO-Five Factor Inventory-3 (NEO-FFI-3), the Illness Behavior Questionnaire (IBQ), and the Beck Anxiety Inventory — Primary Care (BAI-PC).

2.1.1. Demographic and seizure questionnaire

Information was gathered about participants' gender, age, educational level, ethnicity, home language as well as age at seizure onset and monthly seizure number.

2.1.2. NEO-FFI-3

The NEO-FFI-3 is a shortened version of the full NEO Personality Inventory - 3 (NEO-PI-3) measure developed by McCrae and Costa [20]. The NEO-FFI-3 contains five 12-item scales (60 items overall) measuring each of the "Big Five" trait domains: Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness. The questionnaire measures traits that approximate normal, bell-shaped distributions [20]. As per questionnaire manual [20], once raw scores for each of the scales were calculated for each participant, they were converted into T-scores, which are based on normative samples, with a mean of 50 and a standard deviation (SD) of 10. The T-scores indicate a percentile at which a participant scores, hence comparing characteristics across people rather than within an individual [20]. The T-scores are divided into the following ranges: "Very Low" (≤25–34), "Low" (35–44), "Average" (45–55), "High" (56–65), and "Very High" (66–≥75) [20].

The NEO-FFI-3, which is the short version of the NEO-PI-3, was chosen because of the reduced time it takes to administer it. The NEO-FFI-3 takes 5–10 min to complete compared with the 30–40 min for the NEO-PI-3 [20]. This is important for a few reasons. Firstly, the measure was administered during a period that the participants spend in the epilepsy unit as part of their observation, meaning that participation in the study was a secondary endeavor for the patients. Hence, taking the minimum amount of time to administer the measure was important to ensure likely participation. Secondly, one of the aims of the study was to see if the NEO-FFI-3 could aid healthcare practitioners in PNES screening, especially in resource-challenged contexts, where the available time and attention per patient is limited. Lastly, while the NEO-FFI-3, unlike the NEO-PI-3, does not provide information on the specific facets within each personality domain, the correlations between the brief NEO-FFI-3 scales and those of the corresponding full NEO-PI-3 questionnaire range from 0.87 to 0.95, making them a good approximation of the full measure [20].

2.1.3. Illness Behavior Questionnaire

The IBQ is a questionnaire comprised of 62 yes–no items designed to measure abnormal illness behaviors. It was developed with a specific focus on psychosomatic illnesses, such as somatoform or conversion disorders, which can be understood as expressions of abnormal illness behavior [21]. The questionnaire is comprised of seven subscales, namely: General Hypochondriasis, Disease Conviction, Psychological versus Somatic illness focus, Affective Inhibition, Affective Disturbance, Denial, and Irritability. The questionnaire uses a yes/no format and is scored by attributing one point to each answer indicating an abnormal behavior.

Perhaps most relevantly to the current study, discriminant validity of the measure has been shown to be good with different subscales efficiently discriminating between patients with PNES and patients with ES [15]; clinical psychiatric outpatients as opposed to general community sample and young healthy university students [22]; and patients with motor conversion disorder as opposed to patients with definite organic lesions [23].

2.1.4. Beck Anxiety Inventory — Primary Care

In light of the need for short, valid, and reliable measures to screen for psychopathology in medical primary care settings, the well-known Beck Anxiety Inventory (BAI; [24]) was shortened to create the BAI-PC and the Beck Depression Inventory — Primary Care. Unlike the BAI, which consists of 21 items, the BAI-PC consists of seven and takes around 1 min to complete [25]. Beck et al. [26] demonstrated that the measure was 85% sensitive and 81% specific in detecting those who did or did not meet criteria for clinical anxiety (i.e., panic, generalized anxiety, or both). Additionally, Mori et al. [25] tested the clinical efficacy of BAI-PC in screening for clinical anxiety simultaneously with PTSD and depression. The researchers examined the BAI-PC in comparison with the BAI, Beck Depression Inventory (BDI), and PTSD Checklist (PCL; [27]) and with the recommended cutoff score of 5 reported 84.5% sensitivity and 79.5% specificity as a clinical anxiety screen, 91.1% sensitivity

Table 1
Demographic characteristics of the PNES, ES, and ES + oNES groups in the private hospital sample.

	Group (private)		Group (private)						Group (private)					
	Total (N = 24)		PNES		ES				PNES		ES + oNES			
	N	%	N	%	N	%	χ^2	p	N	%	N	%	χ^2	p
Gender							**5.73**	**0.02**					**5.47**	**0.02**
Male	15	63	5	100	8	50			5	100	10	53		
Female	9	38	0	0	8	50			0	0	9	47		
Population group							0.56	0.76					0.49	0.78
White	18	75	4	80	12	75			4	80	14	74		
Brown/Colored[1]	5	21	1	20	3	19			1	20	4	21		
Black African	1	4	0	0	1	6			0	0	1	5		
Language							3.73	0.29					3.62	0.31
Afrikaans	12	50	1	20	9	56			1	20	11	58		
English	7	29	3	60	3	19			3	60	4	21		
English & Afrikaans	4	17	1	20	3	19			1	20	3	16		
English & German	1	4	0	0	1	6			0	0	1	5		
Education							7.78	0.10					7.19	0.1
Before Grade 12	1	4	0	0	1	6			0	0	1	5		
Grade 12	7	29	2	40	4	25			2	40	5	26		
Tertiary	7	29	0	0	7	44			0	0	7	37		
Bachelor's	8	33	2	40	4	25			2	40	6	32		
Master's	1	4	1	20	0	0			1	20	0	0		

The bold entries denote statistically significant results.
[1] "White", "Colored", and "Black African" are the official terms used to denote racial belonging by Statistics South Africa — the national statistical service in South Africa [73].

and 74.7% specificity in identifying patients with and without depression, and 97.2% sensitivity and 72.6% specificity as a screen for PTSD. When screening for anxiety, depression, or PTSD together, sensitivity of 82.4% and a specificity of 82.7% was reported [25]. Furthermore, it is endorsed by the United States Department of Veterans Affairs as a screen for PTSD [28]. Hence, using BAI-PC in the current study offers the benefit of minimizing the number of measures needed to administer to the sample, while maximizing the information available about relevant psychiatric comorbidities.

2.2. Data analysis

After data were collected, the diagnoses of the patients were revealed to the primary researcher by the responsible neurologist. The sample was divided into three groups: patients with PNES, patients with ES, and a group combining both ES and oNES patients. Because of the lack of known common characteristics among the participants in the group with oNES other than the experience of seizure-like events and its small size, it was combined with the group with ES for further analyses in order to see if any confounding effects can be observed.

Furthermore, because of the small eventual size of the government hospital sample (n = 5) and it being composed solely of participants with ES, it was decided not to compare the private with government hospitals directly. However, a similar approach to that of the group with oNES was taken, and additional analyses were done by combining the private and government hospital samples and repeating the comparisons between the PNES, ES, and joint ES and oNESgroups in this combined sample.

Reliability analysis in the form of Cronbach's alphas [29] was conducted on data collected from the measurement instruments. The ANOVA [30] was used to compare measured traits between groups with PNES, ES, and the combined ES and oNES groups. Cross-tabulation [31] and the Fisher exact two-tailed test [32] were used for categorical variables. Receiver operating characteristic (ROC) curve analyses [33,34] were conducted to investigate the ability of measured variables to discriminate between the two groups. Sensitivity and specificity are reported.

3. Results

3.1. Demographic and seizure-related questionnaire

The final sample in the current study consisted of 29 participants, out of which 5 (17%) were diagnosed with PNES, 21 (73%) with ES, and 3 (10%) with oNES. A ratio of 5:21 or 19% and 81% was found between PNES and ES participants in this sample. Demographic and seizure-related characteristics and differences among these groups are summarized in Tables 1, 2, 3, 4, and 5.

In the private hospital only sample, the groups exhibited significant differences in terms of gender (Table 1) with the group with PNES being significantly more male than both the groups with ES (p = 0.02) and the combined ES and oNES group (p = 0.02). Furthermore, the group with PNES experienced significantly more monthly seizures (Table 2) when compared with the group with ES (p = 0.03) and the combined ES and oNES group (p = 0.02).

Once the government hospital data were combined with that of the private hospital, the group with PNES remained significantly more male than female when compared with the groups with ES (p = 0.01), and the combined ES and oNES group (p = 0.01) (Table 3), as well as reported significantly more monthly seizures when compared with the groups with ES (p = 0.01) and the combined ES and oNES group (p = 0.01) (Table 4). Additionally, a result emerged (Table 3) suggesting a

Table 2
ANOVA of PNES, ES, and ES + oNES group age, first seizure, and monthly seizure frequencies in the private hospital sample.

	Group (private)						Group (private)					
	PNES		ES				PNES		ES + oNES			
	M	SD	M	SD	F	p	M	SD	M	SD	F	p
Age	34.80	16.63	33.44	11.82	0.04	0.84	34.80	16.63	35.37	15.19	0.01	0.94
First seizure	31.20	13.37	16.91	13.90	4.09	0.06	31.20	13.37	20.42	19.42	1.34	0.26
Monthly seizures	**18.40**	**24.44**	**3.21**	**4.17**	**5.52**	**0.03**	**18.40**	**24.44**	**2.94**	**3.97**	**6.59**	**0.02**

Table 3
Demographic characteristics of the PNES, ES, and ES + oNES groups in the combined private and government hospital sample.

	Group (priv + gov)		Group (priv + gov)						Group (priv + gov)					
	Total (N = 29)		PNES		ES				PNES		ES + oNES			
	N	%	N	%	N	%	χ^2	p	N	%	N	%	χ^2	p
Gender							**7.20**	**0.01**					**6.79**	**0.01**
Male	16	55	5	100	9	43			5	100	11	46		
Female	13	45	0	0	12	57			0	0	13	54		
Population group							0.88	0.65					0.83	0.66
White	19	66	4	80	13	62			4	80	15	63		
Brown/Colored	9	31	1	20	7	33			1	20	8	33		
Black African	1	3	0	0	1	5			0	0	1	4		
Language							2.98	0.39					3.00	0.39
Afrikaans	14	48	1	20	11	52			1	20	13	54		
English	9	31	3	60	5	24			3	60	6	25		
English & Afrikaans	5	17	1	20	4	19			1	20	4	17		
English & German	1	3	0	0	1	5			0	0	1	4		
Education							**9.44**	**0.05**					8.67	0.07
Before Grade 12	4	14	0	0	4	19			0	0	4	17		
Grade 12	8	28	2	40	5	24			2	40	6	25		
Tertiary	8	28	0	0	8	38			0	0	8	33		
Bachelor's	8	28	2	40	4	19			2	40	6	25		
Master's	1	3	1	20	0	0			1	20	0	0		

significant association between the diagnosis and education variables concerning the PNES and the ES groups ($p = 0.05$).

To investigate the significant association between diagnosis and education in the PNES and the ES groups within the combined private and government hospital sample, adjusted standardized residual calculations and z-test for column proportions comparison with Bonferroni correction were performed (Table 5). The results of the z-test indicate that within the group with PNES, there were significantly more individuals with a Master's compared with Tertiary education ($p = 0.05$) while there were significantly less Master's-educated individuals compared with those with Tertiary education in the group with ES ($p = 0.05$). According to Agresti [35], any absolute value of the adjusted residual that exceeds 2 denotes statistical significance. Hence, investigating the adjusted residuals for the Master's column suggests that more individuals with PNES reported having Master's than could be expected by chance. However, it has to be noted that this deduction is based on only one instance and thus should be interpreted with caution.

3.2. NEO-Five Factor Inventory-3

The NEO-FFI-3 has yet to be used for research purposes with the PNES population, unlike the NEO Personality Inventory-Revised (NEO-PI-R) [12,36]. While the English version of NEO-FFI-3 has been widely validated [20], English is only the fourth most spoken language in South Africa [37]. Hence, a reliability analysis was considered not to be amiss here (Table 6). Bland and Altman [38] suggest that alpha values of 0.7 to 0.8 are adequate for research purposes, hence, this was taken as the benchmark. As evident from Table 6, all scales showed good reliability in the private hospital only sample.

The reliability analysis was repeated on a combined private and government hospital sample, and alpha values remained above the 0.7 mark for all but one scale. The alpha value for the Openness to Experience scale dipped to 0.66 (Table 7). Further item–total statistics analysis was performed on the government sample separately with regard to the Openness to Experience scale of the NEO-FFI-3, and no specific items emerged as problematic, instead suggesting that the subscale as a whole may need to be adjusted when used on participants from government hospitals in South Africa (Table 8).

Average T-scores and standard deviations for the PNES, ES, and the combined ES and oNES groups on the NEO scales Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness are presented in Tables 9 and 10 (all T-scores were calculated based on gender norms). No significant differences were found neither between the PNES and ES groups nor the PNES and the combined ES and oNES groups on any of the NEO-FFI-3 scales in the private hospital sample only (Table 9). No significant results were found once repeating the analysis on the combined private and government hospital sample either (Table 10).

3.3. Illness Behavior Questionnaire

While the original IBQ consists of 62 items, because of a clerical error, only the first 36 items could be used for data collection in this study. While this makes it impossible to use the IBQ subscales mentioned earlier, Pilowsky [39] has suggested that the IBQ is also useful as an item pool. Furthermore, there has been a considerable number of studies that have used various shortened versions of the questionnaire. For example, Prior and Bond [40] recently validated a 31-item version of IBQ on patients with chronic illness, Main and Waddell [41] with a 33-item version on patients with chronic back pain, and an early IBQ version of 52 items has been used a number of times on various populations [42–44]. Importantly, in an earlier 52-item version of the IBQ, only 30 of them loaded onto a subscale, and only 40 out of the 62 items in the newest version load onto one of the seven subscales; other items

Table 4
ANOVA of PNES, ES, and ES + oNES group age, first seizure, and monthly seizure frequencies in the combined private and government hospital sample.

	Group (private + gov)						Group (private + gov)					
	PNES		ES				PNES		ES + oNES			
	M	SD	M	SD	F	p	M	SD	M	SD	F	p
Age	34.80	16.63	35.81	12.52	0.02	0.88	34.80	16.63	37.04	14.85	0.09	0.77
First seizure	31.20	13.37	17.95	13.74	3.79	0.06	31.20	13.37	20.61	18.11	1.51	0.23
Monthly seizures	**18.40**	**24.44**	**3.31**	**3.78**	**7.11**	**0.01**	**18.40**	**24.44**	**3.08**	**3.66**	**8.17**	**0.01**

Table 5
Diagnosis * education cross-tabulation table and the results of the adjusted standardized residual calculations and z-test for column proportions comparison with Bonferroni correction.

Diagnosis * education cross-tabulation								
			Education					Total
			Before Grade 12	Grade 12	Tertiary	Bachelor's	Master's	
Diagnosis	PNES	Count	$0_{a, b}$	$2_{a, b}$	0_{b}	$2_{a, b}$	1_{a}	5
		Expected count	0.8	1.3	1.5	1.2	0.2	5.0
		% within diagnosis	0.0%	40.0%	0.0%	40.0%	20.0%	100.0%
		% within education	0.0%	28.6%	0.0%	33.3%	100.0%	19.2%
		% of total	0.0%	7.7%	0.0%	7.7%	3.8%	19.2%
		Adjusted residual	−1.1	0.7	−1.7	1.0	2.1	
	ES	Count	$4_{a, b}$	$5_{a, b}$	8_{b}	$4_{a, b}$	0_{a}	21
		Expected count	3.2	5.7	6.5	4.8	0.8	21.0
		% within diagnosis	19.0%	23.8%	38.1%	19.0%	0.0%	100.0%
		% within education	100.0%	71.4%	100.0%	66.7%	0.0%	80.8%
		% of total	15.4%	19.2%	30.8%	15.4%	0.0%	80.8%
		Adjusted residual	1.1	−0.7	1.7	−1.0	−2.1	
Total		Count	4	7	8	6	1	26
		Expected count	4.0	7.0	8.0	6.0	1.0	26.0
		% within diagnosis	15.4%	26.9%	30.8%	23.1%	3.8%	100.0%
		% within education	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of total	15.4%	26.9%	30.8%	23.1%	3.8%	100.0%

Each subscript letter denotes a subset of Education categories whose column proportions do not differ significantly from each other at the 0.05 level.

intended to provide information about the patient [45]. Hence, in order to extract some knowledge from the data that were collected in the end, this study used the retained first 36 IBQ items as an item pool.

The only item exhibiting a significant difference between groups on the abbreviated IBQ was item IBQ26: "Do you experience a lot of pain with your illness?", with participants with PNES answering "Yes" significantly more than either the ES group with χ^2 (df = 1) = 9.19, p = 0.002 or the combined ES and oNES group with χ^2 (df = 1) = 9.41, p = 0.002. Once the government hospital data were added, responses on item IBQ26 remained significantly different between the PNES and ES groups with χ^2 (df = 1) = 9.16, p = 0.002, as well as the PNES and the combined ES and oNES groups with χ^2 (df = 1) = 9.34, p = 0.002.

3.4. Beck Anxiety Inventory — Primary Care

Similar to the NEO-FFI-3, there is no published research of the BAI-PC being used with the PNES or South African populations, hence, reliability analyses were performed (Tables 11 and 12). Cronbach's alpha was found to be 0.89 and 0.91 in both the private hospital only and the combined hospital samples, indicating excellent internal consistency [38].

The PNES group average for BAI-PC was 12 points (SD = 6.4) and 5.81 points (SD = 5.23) for the group with ES (Table 13). It is suggested that a BAI-PC cutoff score of 5 and above is used to screen for anxiety, depression, and PTSD symptoms [25]. Thus, both groups exhibited symptoms of anxiety, depression, and PTSD.

The ANOVA results for the BAI-PC are presented in Tables 13 and 14. In the private hospital sample (Table 13), BAI-PC scores were significantly higher among the participants with PNES when compared with those with ES (p = 0.04) and the combined ES and oNES group (p = 0.03).

As a result, a ROC curve was plotted in order to determine the optimal cutoff score for BAI-PC in determining PNES group belonging in the private hospital sample (Fig. 1). This score was determined to be 12 and could differentiate between PNES and ES or oNES with 80% sensitivity and 89% specificity with area under the curve equal to 0.76 (Fig. 1).

However, once the government hospital data were added, the differences between groups on the BAI-PC became statistically insignificant (Table 13), suggesting that the BAI-PC may not be appropriate for differentiating between PNES and ES or oNES in government hospital samples. However, having in mind the small sample of the present study, investigation with bigger samples is necessary first.

Table 6
Reliability analysis for NEO-FFI-3 in the private hospital sample.

Instrument	M	SD	α
NEO-FFI-3			
Neuroticism	25.21	10.10	0.87
Extraversion	30.17	7.03	0.77
Openness to Experience	29.46	6.90	0.73
Agreeableness	31.50	8.96	0.86
Conscientiousness	33.00	7.97	0.86

Table 7
Reliability analysis for NEO-FFI-3 in the combined private and government hospital sample.

Instrument	M	SD	α
NEO-FFI-3			
Neuroticism	26.10	9.93	0.87
Extraversion	29.90	6.63	0.71
Openness to Experience	29.17	6.35	0.66
Agreeableness	31.24	8.21	0.82
Conscientiousness	32.62	7.43	0.82

Table 8
Item–total statistic for the Openness to Experience scale of the NEO-FFI-3 in the government sample.

	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Squared multiple correlation	Cronbach's alpha if item deleted
NEO_O_3	26.86	33.909	0.354	0.627	0.627
NEO_O_8	25.97	38.320	0.181	0.377	0.654
NEO_O_13	26.59	32.108	0.593	0.745	0.590
NEO_O_18	26.69	37.222	0.142	0.398	0.662
NEO_O_23	27.03	31.106	0.459	0.607	0.604
NEO_O_28	27.10	36.953	0.116	0.456	0.670
NEO_O_33	27.21	37.241	0.115	0.504	0.668
NEO_O_38	26.00	35.929	0.416	0.468	0.628
NEO_O_43	27.34	29.663	0.494	0.644	0.594
NEO_O_48	26.90	35.810	0.177	0.492	0.661
NEO_O_53	26.24	36.975	0.219	0.564	0.649
NEO_O_58	26.97	33.677	0.383	0.666	0.622

Table 9
ANOVA of PNES, ES, and ES + Other group T-scores on the NEO-FFI-3 in the private sample.

	Group (private)						Group (private)					
	PNES		ES				PNES		ES + oNES			
Instrument	M	SD	M	SD	F	p	M	SD	M	SD	F	p
NEO-FFI-3												
Neuroticism	60.00	14.40	55.06	13.09	0.52	0.48	60.00	14.40	55.32	13.14	0.49	0.49
Extraversion	58.20	12.72	53.06	11.78	0.70	0.41	58.20	12.72	52.53	10.90	1.01	0.33
Openness to Experience	56.40	15.21	50.69	9.49	1.04	0.32	56.40	15.21	51.11	9.17	1.00	0.33
Agreeableness	53.80	16.75	50.25	14.25	0.22	0.65	53.80	16.75	49.58	13.51	0.35	0.56
Conscientiousness	48.20	11.03	52.31	15.11	0.31	0.58	48.20	11.03	51.58	13.97	0.25	0.62

4. Discussion

4.1. Demographic and seizure-related questionnaire results

International research suggests that in an epilepsy clinic, the prevalence of epilepsy is 17–49%, PNES is 20–42%, and physiologic events other than epilepsy is 13% [46–49]. While oNES usually comprise a small number of cases [50,51], these cases may nevertheless pose a difficulty when trying to differentiate between them and PNES, and even epilepsy if vEEG is not available. In fact, one study found that oNES were diagnosed correctly without the use of vEEG only between 60 and 91.7% of the times [52]. However, compared with studies investigating factors differentiating between PNES and ES, those that include oNES are almost nonexistent [7,8]. As the results from the BAI-PC ROC analysis show (discussed below), inclusion of oNES in the development of any alternative PNES screening measures may be important for future studies.

As of yet, there is only one South African study on PNES prevalence conducted in a private clinic in Johannesburg [53], where a ratio of 1:1 (50%/50%) was found after discounting comorbid PNES and ES, and no information was given about individuals with other types of nonepileptic seizures. In the case of the present study, the ratio between the groups with PNES and ES was found to be 5:21 or 19% and 81% respectively, if one was to discount patients with other diagnoses, suggesting a lower proportion of PNES than in the abovementioned study. Nevertheless, both studies concern a very small subset of the population, and larger studies in the future should shed more light on this.

In the South African PNES prevalence study mentioned above, the sample consisted of 27% males and 73% females in the group with PNES [53]. Similarly, a South African convenient sampling study, where participants were referred to the researcher by the same two clinics as approached in this study, collected a sample with PNES consisting of 23% males and 77% females [19]. The sample with PNES in our study consisted solely of males, hence, literature would suggest that while the current group with ES approximated previous South African findings in terms of sex, the constitution of the group with PNES was more male than in previous research. In line with this is the finding that the difference in sex was significant between the two groups, with the group with PNES having significantly more males in it and suggesting the possibility that the current sample may not be fully representative of the South African population with PNES. However, the fact that the aforementioned South African study by Anderson et al. [53] was conducted in a private healthcare setting may also suggest a nonrepresentative sample in a country where the majority of the population does not have access to private healthcare [4].

The mean age of 35 years among this study's participants with PNES seems to be right on point when compared with other South African studies suggesting a mean of 33–35 years [53,54]. Furthermore, in line with international studies [55], both the abovementioned study by Anderson et al. [53] and the present study results suggest that no significant age differences are found between the ES and PNES groups, suggesting that age may not be a good differentiating factor for PNES.

The reported age at first seizure becomes relevant here. International research indicates that patients with PNES tend to have an older age at seizure onset [55] when compared with patients with ES, and this difference has been shown to be significant [56] as well as has been used successfully in screening for PNES [8,9]. While there were no significant differences between the PNES, ES, and the combined ES and oNES groups in terms of age at first seizure in the present study, $p = 0.06$ between the PNES and ES groups is close to significance when one considers the small sample of participants with PNES and the concomitant higher probability of Type 2 error [57] and thus, may warrant further investigation where a bigger sample can be obtained. However, it is of interest that once the group with ES was combined with the group with oNES for comparative analysis, the p value of the difference jumped considerably to $p = 0.26$. Similarly, in a recent study, Kerr et al. [8] have shown that oNES can present in a similar way to PNES in terms of age at onset, once again highlighting the importance of oNES inclusion in studies of this nature.

Anderson et al. [53] reported that 81% of their PNES sample was White, and similarly, in the present sample, the group with PNES consisted of 80% White participants, as did the majority of the whole sample (66%). Both the present study and the aforementioned South African PNES prevalence study [53] used data from private clinics, which may explain higher the prevalence of White participants in a country where they are a minority [37]. Access to private healthcare in South Africa tends to be reserved for the wealthier and hence, remains unaffordable to the majority of the population [4]. Lastly, no significant difference was found between the study groups in terms of population group in our study. This may suggest that population group is a poor PNES differentiating factor in South Africa, however, more investigation needs to be made at government hospitals, which are more accessible to the broader South African population [4].

While no epidemiological data exist in terms of home languages of patients with PNES in South Africa, a study by Pretorius and Cronje done in the Western Cape [54] may give an indication. The authors reported that 50% of their sample with PNES were Afrikaans-speaking and 50% English-speaking [54]. Similarly, in the present study, the Afrikaans language appeared to predominate (50% — Afrikaans, 17% — Afrikaans and English, 29% — English, and 4% — English and German). However, the 2011 Census [37] shows that three of the most spoken languages in the Western cape are Afrikaans (49.7%), IsiXhosa (24.7%), and English (20.2%), hence, while Afrikaans and English — two out of the three most spoken languages in the Western Cape were represented in the present study, there were no IsiXhosa participants. Furthermore, no significant difference in group home language distribution was found. However, before suggesting that language may not be a useful differentiating factor for PNES in South Africa, the study should be replicated on a larger sample.

The only South African study that has recorded education level in its sample of participants with PNES [54] reported that “Before Grade 12” was the highest educational level for 50% of the participants with PNES, “Grade 12” for 23%, a tertiary diploma for 9%, and a degree at university for 14%. In the present study, 60% of the participants with PNES had a university degree and 40% had finished Grade 12 (Table 1),

Table 10
ANOVA of PNES, ES and ES + Other group T-scores on the NEO-FFI-3 in the combined private and government sample.

	Group (private + gov)						Group (private + gov)					
	PNES		ES				PNES		ES + oNES			
Instrument	M	SD	M	SD	F	p	M	SD	M	SD	F	p
NEO-FFI-3												
Neuroticism	60.00	14.40	56.62	12.65	0.28	0.61	60.00	14.40	56.63	12.73	0.28	0.60
Extraversion	58.20	12.72	51.71	12.78	1.04	0.32	58.20	12.72	51.46	11.99	1.29	0.27
Openness to Experience	56.40	15.21	50.14	8.49	1.60	0.22	56.40	15.21	50.54	8.38	1.51	0.23
Agreeableness	53.80	16.75	49.00	12.70	0.51	0.48	53.80	16.75	48.63	12.23	0.66	0.43
Conscientiousness	48.20	11.03	51.00	13.56	0.18	0.67	48.20	11.03	50.58	12.76	0.15	0.70

which suggests the current sample with PNES to be more educated compared with the aforementioned study. In the present study, there were no significant differences between the groups in terms of educational level when only the private hospital sample was analyzed, however, in the combined private and government hospital sample, the group with PNES reported having a Master's compared with Tertiary education significantly more ($p = 0.05$) in comparison to the group with ES ($p = 0.05$). International studies also paint a conflicting picture. While some suggest that the population with PNES tends to be less educated [58,59] when compared with those with ES, others maintain that the two groups are usually of a similar educational level [55]. However, since there is no epidemiological data in South Africa on the educational level of individuals with PNES, it is impossible to judge whether the study sample is representative on this variable. It is also of note that the fact that the present study involves a relatively small sample and used convenience sampling may impact any comparative findings on education levels between the groups.

A number of international research studies report a tendency for higher seizure frequency among patients with PNES when compared with those with ES [60,61]. Furthermore, Syed et al. [9] found that monthly seizure frequency was a useful variable in predicting PNES. Similarly, the present study found that patients with PNES had significantly more monthly seizures than those with ES. Pretorius and Cronje [54] in their study also suggest that patients with PNES have a high number of seizures with 50% of their sample reporting seizures at least once a day. Interestingly, when the group with PNES was compared with the combined ES and oNES group, the significance of the difference only increased ($p = 0.02$), suggesting that knowing a patient's seizure frequency may be a valuable factor in differentiating PNES from ES as well as oNES.

The present study sought to replicate the circumstances in which a patient with seizures would visit a clinic to find out their diagnosis. This meant that at the moment of questionnaire administration, both the researcher, the participant, and the neurologist were blinded to the diagnosis. While such an approach works great to ensure external validity, it inevitably minimizes the control the researcher has over their ultimate sample. Hence, the apparent mismatch of the current sample profile in terms of gender with that of the earlier mentioned South African epidemiological study [53] may be partly explained by the fact that, unlike the aforementioned study, where the age of the participants with PNES ranged between 12–69 years ($M = 34.88$, $SD = 13.5$), the sample in the present study comprised entirely of adults. This would discount any of those below 18 years of age who have PNES thus, possibly resulting in a lower number of total PNES cases as well as thwarting the gender balance.

4.2. NEO-FFI-3

While there is no published data on personality profiles of South African patients with PNES, international research is an indication. A recent study by Ekanayake et al. [36] found that their group with PNES tended to score high on Neuroticism and average on all other scales. Furthermore, the scores for Neuroticism were significantly higher than that of healthy controls. Similarly, Cragar et al. [12] found that participants with PNES in their study on average scored high on Neuroticism, which was significantly higher than the group with ES, and scored average across other domains. The participants with ES in the same sample scored average on all domains except for Conscientiousness where they scored low. While generally, in the present study, the group with ES scored average on all the NEO domain scales, the group with PNES scored in the high range on the Neuroticism, Extraversion, and Openness to Experience scales, while scoring in the average range on the Agreeableness and Conscientiousness scales.

According to McCrae and Costa [20], the tendency of the participants with PNES on average to score high on the Neuroticism scale in the present study ($M = 60$; $SD = 14.4$) would indicate individuals who are less emotionally stable and less well-adjusted, as well as more prone to experience negative affect such as fear, sadness, and guilt. Interestingly, the tendency to score high on the scale of Extraversion in the group with PNES suggests individuals who also enjoy large groups and stimulation and are active and energetic [20]. Furthermore, scoring high on the Openness to Experience scale would suggest participants with PNES having an active imagination, being attentive to inner feelings, and experiencing emotion more keenly [20]. Lastly, the results indicate that participants with PNES exhibited average levels of Agreeableness and Conscientiousness. Nevertheless, while these findings give preliminary indications, no significant differences were found between the groups in terms of any of the NEO scales, neither when comparing PNES with ES, nor PNES with the combined ES and oNES group.

4.3. Illness Behavior Questionnaire

Only one item from the abbreviated IBQ (the first 36 of 62 items) investigated showed a significant difference between the groups, with all the participants with PNES answering in the affirmative to item IBQ26 "Do you experience a lot of pain with your illness?", which was significantly more than either in the ES ($p = 0.002$; $p = 0.002$) or the combined ES and oNES group ($p = 0.002$; $p = 0.002$) in both private and combined private and government hospital samples, respectively.

This finding is in line with available research. Benbadis [62] found that a diagnosis of "fibromyalgia" or "chronic pain" in patients with seizures had an independent predictive value of 75% for cases of PNES.

Table 11
Reliability analysis for BAI-PC in the combined private hospital sample.

Instrument	M	SD	α
BAI-PC	7.21	5.80	0.89

Table 12
Reliability analysis for BAI-PC in the combined private and government hospital sample.

Instrument	M	SD	α
BAI-PC	7.93	6.30	0.91

Table 13
ANOVA of PNES, ES, and ES + oNES group scores on the BAI-PC in the private hospital sample.

	Group (private)						Group (private)					
	PNES		ES				PNES		ES + oNES			
Instrument	M	SD	M	SD	F	p	M	SD	M	SD	F	p
BAI-PC	12.00	6.40	5.81	5.23	4.82	0.04	12.00	6.40	5.95	5.08	5.07	0.03

Similar outcomes can be seen in a recent attempt by Kerr et al. [7] to screen for PNES based on comorbidities and medication-taking characteristics. Using patients' medical records, Kerr et al. [7] found that chronic pain was significantly more common in patients with PNES, when compared with those with ES, and had a 4.5-point weight in their screening measure, where a score of more than 4.5 indicated a presence of PNES. This suggests that chronic pain alone in some seizure patients may be indicative of PNES.

4.4. Beck Anxiety Inventory — Primary Care

Time and time again, people with PNES have been shown to experience higher psychiatric comorbidity when compared with those with epilepsy [16,17], with PTSD, depression, and anxiety being the most common of the disorders [61,63–67]. The current study confirms previous findings in demonstrating that the group with PNES scored significantly higher on the BAI-PC when compared with ES ($p = 0.04$) and combined ES and oNES ($p = 0.03$) in the private hospital sample. As mentioned earlier, trauma is prevalent among the population with PNES and has even lead some to speculate that PNES might be a special type of PTSD [68,69], which may be partly responsible for the measure being able to predict PNES with high sensitivity (80%) and specificity (89%) in this seizure population. Indeed, even in such a small sample, the group with PNES exhibited clear differences when compared with patients with ES and oNES. Furthermore, the ROC curve finding of a 12-point cutoff score for PNES is especially useful and may prove to be an indispensable as well as quick and easy tool in PNES screening in primary care contexts when combined with other information.

However, interestingly, once the analysis was performed on the combined private and government hospital sample, the previously significant difference between the seizure groups became insignificant. South African studies suggest that lower socioeconomic status can largely account for an increased likelihood of having a mental illness among South Africans [70,71]. Additionally, it is known that government hospitals in South Africa are mainly used by those who cannot afford private healthcare [4]. Hence, because the government sample in this study consisted solely of patients with ES, combining these participants with seizure patients from the private hospital increased the ES + oNES group mean while the PNES group mean remained the same, thus resulting in an insignificant result. Hence, a larger study including patients with PNES from a government hospital and using the BAI-PC would be useful.

5. Limitations and recommendations for future research

Perhaps, the most obvious limitation of the study is its small sample size curbing the power of the study to detect true effect — a problem that tends to be prevalent internationally when PNES research is still in its early stages [55,72]. However, this is the first study in South Africa where data from patients with PNES, ES, and oNES were gathered at a clinic during their hospital vEEG monitoring — a vulnerable population at a vulnerable time. Furthermore, because of the double-blind approach this study used when it came to knowledge of the diagnosis, it was impossible to ensure a certain diagnostic distribution in any way other than collecting data longer, which was not possible because of limited funding. Nevertheless, despite the eventual small sample size, some trends in terms of personality, illness behavior, and psychopathology profiles of the population with PNES (and ES) were reported, and some useful differences were found between PNES and other seizure populations that provide a stepping stone for further alternative diagnosis and descriptive research.

Furthermore, the study made use of a sample that came primarily from a private healthcare facility and was majority White (66%) with Black Africans (3%) being in the minority and Colored (31%) participants constituting the remaining. This suggests a sample population that is not representative of the broader South African population that is, in fact, 80.8% Black African, 8.8% Colored, only 8% White, and the rest (2.5%) identifying as Indian/Asian [73]. Hence, results of this study may not be generalized validly beyond the studied population.

Likewise, the sample may not be reflective of the general population with PNES, since it consisted solely of men. While there is no South African data on general population prevalence of PNES, the latest PNES prevalence data seem to suggest that South Africa follows the international 3:1 proportion, when it comes to women dominating the condition [53]. Hence, while the data collected in the abovementioned study at one private clinic in Johannesburg may not necessarily be applicable to the Western Cape, it is highly likely that a considerable proportion of South Africans with PNES are women, as indicated by most international research [46,74]. Thus, again, a longer data collection period should be afforded to ensure that an adequately representative sample can be collected. Related is the fact that the current study used a data collection approach novel to South African PNES research. The study sought to approximate the situation of a patient with a seizure complaint visiting a clinic for a diagnosis. This meant that at the moment of questionnaire administration, the researcher, the participant, and the neurologist were blind to the diagnosis. While such an approach works well to ensure excellent external validity, the trade-off is the control the researcher has over their ultimate sample.

Fourth limitation is due to the clerical error that prevented a part of the IBQ to be used. This was an unfortunate mistake, however, it is of note that Pilowsky has advocated the use of IBQ as an item pool [39], especially when it comes to his decision to keep the items that do not actually load on any of the IBQ scales [45]. Furthermore, as mentioned earlier, a few researchers have found different items useful for different

Table 14
ANOVA of PNES, ES, and ES + oNES group scores on the BAI-PC in the combined private and government hospital samples.

	Group (private + gov)						Group (private + gov)					
	PNES		ES				PNES		ES + oNES			
Instrument	M	SD	M	SD	F	p	M	SD	M	SD	F	p
BAI-PC	12.00	6.40	7.38	6.27	2.18	0.15	12.00	6.40	7.29	6.05	2.46	0.13

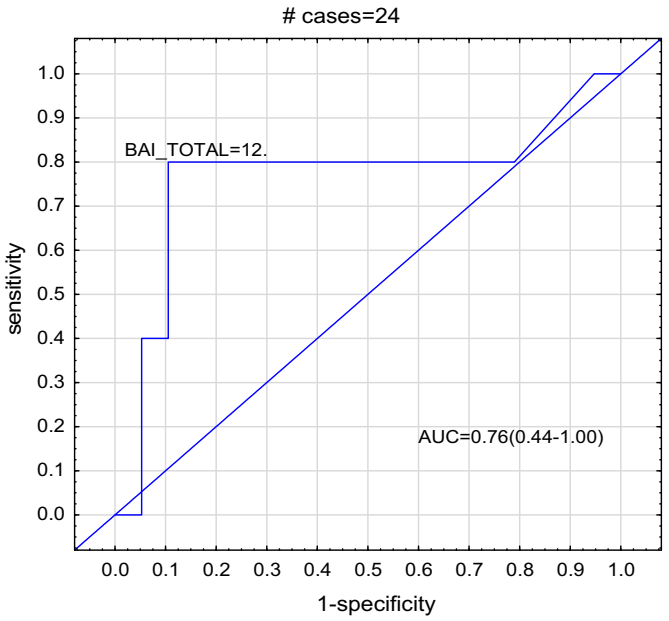

Fig. 1. ROC curve for differentiating PNES from ES and oNES in the private hospital sample.

populations and have accordingly shortened the questionnaire [40,41]. Nevertheless, using the full extent of the questionnaire would have been useful in getting a greater item pool, better insight into subscale results, and would have provided the possibility to do more complex statistical analyses with the data.

Lastly, this study largely made use of reporting and comparing means between the groups. However, the reporting of averages within the PNES population is not always considered to be the best approach. While the population with PNES shares similarities, it has perhaps even more differences and focusing on the averages may hide the important variation within this population. This is especially the case in studies with small samples.

6. Conclusion

While the sample consisted of only 29 patients and can be considered somewhat unrepresentative of the population with PNES in South Africa if one is to look at South African PNES prevalence research [53], certain significant and important differences still emerged. The data analysis showed that, overall, those with PNES tended to experience more monthly seizures when compared with those with ES or oNES. Furthermore, individuals with PNES tended to report significantly more pain than those with epilepsy or oNES. Patients with PNES in private care also reported significantly more comorbid depression, anxiety, and/or PTSD. These findings suggest that individuals with PNES in South Africa may be incapacitated by their condition even more than those with epilepsy, which is consistent with international findings [75,76]. Furthermore, BAI-PC emerged as a potentially useful tool in screening for PNES in those who experience seizures in private hospitals. The cut-off score of 12 was established to be able to predict PNES with high sensitivity (80%) and specificity (89%) and warrants further investigation with a larger sample. This study is a first of its kind in South Africa and serves as a basis for future research on this topic. Being able to screen for PNES in a more time and cost-effective way than vEEG is still of paramount importance, and such research is extremely necessary.

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