Current Psychiatry Reports (2020) 22:69
https://doi.org/10.1007/s11920-020-01192-x

SEX AND GENDER ISSUES IN BEHAVIORAL HEALTH (CN EPPERSON AND L HANTSOO, SECTION EDITORS)

Sex Effects on Coping, Dissociation, and PTSD in Patients With Non-epileptic Seizures

Randi Libbon[1] · Sarah Baker[2] · Meagan Watson[2] · Crystal Natvig[1] · Laura Strom[2] · Susan Mikulich[1]

Accepted: 25 September 2020

Abstract

Purpose of Review Sex differences in non-epileptic seizures (NES) are of interest, as the diagnosis is more frequent in women than men (3:1 ratio). This paper reviews clinical findings regarding sex differences in NES through selective literature review and compares coping measures between women and men in our NES clinic.

Recent Findings Some distinguishing clinical features of NES in women and men are reported in the literature. However, we found few sex differences in demographics and coping. In our population, avoidance and dissociation were strongly related to one another and significantly related to co-occurring PTSD diagnosis, which was seen in over 50% in both sexes.

Summary Our findings confirm a high prevalence of PTSD in patients with NES, suggesting that comorbid PTSD may override sex differences in accounting for use of avoidant and dissociative coping. These findings raise the possibility that NES may, at times, represent an extreme variant in dysfunctional coping in patients with PTSD.

Keywords Gender differences · Non-epileptic seizures · Psychogenic non-epileptic seizures · Dissociative seizures · Coping · Dissociation

Introduction

Non-epileptic seizures (NES) are a subcategory of functional neurological symptom disorders in which patients present with motor and non-motor components of events resembling epileptic seizures but have no corresponding electrical abnormalities found on an electroencephalograph (EEG).

With most studies showing NES to be more common in women (3:1 ratio), many questions remain concerning how sex might affect diagnosis, presentation, coping styles, treatment, and outcomes [1–6]. Some authorities suggest the need to address women and men with NES separately [7, 8]. To date, examinations of sex differences in NES have been largely descriptive, focusing on demography, semiology, comorbidities, and more recently differences in brain structure and functioning [9–11].

Studies have led to the creation of calculators for predicting the likelihood of NES diagnosis based on diverse clinical characteristics [12, 13] including the ways in which women and men with NES differ with regard to their comorbidities and past psychiatric histories. For instance, women with NES have higher rates of chronic pain, prior psychiatric diagnoses, and sexual abuse [5], although reported rates of past physical abuse are similar in women and men [4, 14, 15]. Women are more likely to self-harm during NES events and cry after NES events while men are more likely to be unemployed and attribute the diagnosis to a physical injury such as traumatic brain injury or hypoxia at birth [3]. During a 1-year follow-up period after NES diagnosis, men were more likely to be spell-free [16]. This might suggest that NES has greater overall impact or greater severity in women, whose symptoms are more likely to persist.

Efforts to accurately diagnose and distinguish NES from epileptic seizures prior to epilepsy monitoring with video-EEG are important because epilepsy monitoring units and

This article is part of the Topical collection on *Sex and Gender Issues in Behavioral Health*

✉ Randi Libbon
randi.libbon@cuanschutz.edu; randilibbon@gmail.com

[1] Department of Psychiatry, University of Colorado, 13001 E 17th Place, campus box F546, Aurora, CO 80045, USA

[2] Department of Neurology, University of Colorado, Aurora, CO, USA

Published online: 15 October 2020

video-EEG are limited and expensive resources, available primarily in large cities and tertiary care centers [17]. Neurologists may more likely diagnose NES in women due to higher expectation of the illness based on sex. NES has been consistently more difficult to recognize and accurately diagnose in men, in part attributed to lower likelihood of capturing typical events on video-EEG [2] as well as longer delay to diagnosis [18]. On average, NES first occurs later in life in men [18, 19], consistent with generally later initial occurrence of health-related NES-inciting traumas [19].

Risk for Development and Iatrogenic Harms in NES

Considering other risks for developing NES, women with intractable epilepsy are more likely than men to develop NES after resective surgery, and those who develop NES are also more likely to develop somatic symptoms and other psychiatric symptoms post-surgically [20, 21]. Reasons for these unintended consequences are unclear. Among patients who inappropriately received a vagus nerve stimulator for refractory epilepsy, 70% were women who were subsequently found to have only NES [22], suggesting potential bias toward more aggressive treatment in women. The relatively small percentage of patients with NES who also have comorbid epilepsy (10–15%) [23] present additional clinical challenges concerning treating both of these conditions appropriately, especially when patients are unable to distinguish between their epileptic and non-epileptic seizures. This challenge seems more pronounced in women.

Why Is NES More Common in Women?

Several hypotheses to account for sex differences in NES have been suggested. First, sensory processing has been a new area of interest in the NES literature as loud or unexpected sensory input, such as sirens or flashing lights, can trigger NES episodes. Women show greater sensory sensitivity, meaning greater discomfort to sensory input [24], possibly creating more vulnerability to external or sensory triggers for their NES events. Impairment in emotional recognition and processing is well-defined in NES [25], as is alexithymia [26], which classically includes not understanding connections between physical sensations and emotions. Conceivably, this greater sensitivity to physical sensory input may lead to elevated emotional arousal outside of conscious awareness, causing women to ignore or mislabel emotions so that the conscious experience of NES becomes linked to external triggers rather than to the internal sensations or emotions evoked by those triggers. Aside from symptoms related to increased startle in post-traumatic stress disorder (PTSD), these sensory processing anomalies do not classically fit into current psychiatric diagnostic criteria and thus can be confusing to patients and clinicians alike. The distressing physical symptom of NES can generate further distress from subsequent catastrophizing about the meaning of the sensations, as when being startled causes elevated heart rate, which in turn might lead to worrying about heart attack and death.

Sex differences in brain structure, connectivity, and responses to stress and trauma have also been implicated to account for the predominance of women patients with NES [27]. In particular, sex differences in regions involved in emotional and cognitive processing associated with trauma may predispose women to developing psychopathology [28]. Asadi-pooya et al. propose that hormonal differences may also contribute [29].

Dissociation and Coping

Maladaptive coping strategies have been associated with NES. Myers et al. found that women with NES have more dissociative symptoms, suggesting greater reliance on dissociative coping strategies, whereas men with NES use more avoidant coping strategies [30]. Type of coping has been connected to differences in brain structure in patients with motor functional neurological disorders [31], of which NES is a prime example. Roberts and Reuber propose that NES with dissociation might comprise a subgroup type of NES, in which suppression of consciousness during dissociation results from high levels of inhibiting emotional processing, which may also point to different neural pathways [32].

As dissociative coping might represent a severe way of escaping from triggering experiences related to past traumatic events, we wanted to compare women and men with regard to their use of dissociative and avoidant coping. Such comparisons have not previously been reported in NES patients. This article will evaluate sex differences in dissociation, coping styles, PTSD, and other co-occurring conditions gathered from patients seen in a multi-disciplinary treatment program developed for NES [33]. In accord with other studies in the literature [30], we hypothesized that men would show more self-reported avoidant coping and women would show more dissociation and that these coping strategies would be positively correlated with one another.

Methods

Literature Review

We conducted a librarian-guided search using OVID Medline from 1946 to March 17, 2020, for relevant articles concerning non-epileptic seizures using both text words and MeSH terms and terms related to sex and gender (Table 1). Due to the well-known associations of NES to trauma, we also included search terms related to abuse and PTSD. No year nor language limits were applied. In total, 305 articles were reviewed for

Table 1 Literature review search terms

#	Searches
1	(Nonepileptic or non-epileptic or (psychogenic adj1 seizure*) or (psychogenic adj1 attack*) or (dissociative adj2 seizure*)).ti,ab,kf. or exp. Seizures/px or (Seizures/ and Psychophysiologic Disorders/) or (Seizures/ and Somatoform Disorders/)
2	((sex adj3 factor*) or (sex adj3 ratio*) or (sex adj3 difference*) or sex-related or gender-related or (gender adj3 difference*) or (gender adj3 variation*) or (men and women)).ti,ab,kf. or Sex factors/ or (*men/ and *women/)
3	1 and 2
4	((child adj2 abuse) or (sexual adj abuse) or ptsd or "Post-traumatic stress" or "posttraumatic stress").ti,ab,kf. or exp. Child Abuse/ or exp. Sex Offenses/ or stress disorders, traumatic/ or battered child syndrome/ or exp. psychological trauma/ or stress disorders, post-traumatic/ or stress disorders, traumatic, acute/
5	1 and 4
6	3 or 5

relevance to sex differences in NES including articles addressing presentation, pathophysiology, etiology, diagnosis, comorbidities, treatment, and outcomes. Articles were eliminated if they did not include non-epileptic seizures, gender or sex differences, as were case reports or case series with fewer than 10 patients.

Clinic Sample and Data Collection

For our purposes, usable data was available for 172 patients selected from a patient database consisted of NES patients treated by the University of Colorado Interdisciplinary NES Clinic ($N = 503$) [33]. All patients were evaluated by a board-certified neurologist for confirmation of NES diagnosis and assessment of co-occurring epilepsy. Each patient was also evaluated by a board-certified psychiatrist to assess for DSM-5 diagnoses and other clinically relevant symptoms and pathology. Patients were consented and completed a battery of self-report surveys. These were routinely collected as part of standard clinical care with a HIPPA compliant, electronic interface, and collated in Filemaker Pro to support clinical analysis. Patients have the option to consent with an IRB-approved protocol at the time of enrollment in clinic for the use of aggregated patient-reported outcome data. For this study, we analyzed only The Brief Cope and Dissociative Experience Scale (DES) surveys. Data were baseline evaluations collected between 8/13/2016 and 5/22/2020. Patients' data were included if they met the following criteria: consented, completed a baseline Brief Cope and DES scale, seen for an initial intake appointment by the clinic psychiatrist, and identified as either male or female.

The Brief Cope scale is a 28-item Likert scale [34] based on questions that provide information on different aspects of coping. As previously described and validated [35], subcategories of Denial (questions 3 and 8) and Behavioral Disengagement (questions 6 and 16) were then summed independently and averaged to generate an Avoidant Coping score ranging from 2 to 8. The Dissociative Experiences Scale (DES) is a validated 28-item scale [36] with each item scored from 0 to 100. The DES is scored by averaging all questions, resulting in a final score between 0 and 100.

Patient demographics, psychiatric comorbidities, and clinically significant psychiatric pathology that was a focus of treatment were collected through medical record chart review from initial psychiatric clinical assessments.

Statistical Methods

Distributions of variables were examined for outliers and to assess approximate normality; non-parameteric tests were utilized when necessary. NES patient characteristics were compared by sex using independent *t* tests, chi-square tests, and Fishers Exact tests as appropriate. The association between co-occurring PTSD and epilepsy diagnoses was evaluated with a chi-square test. To evaluate the first two hypotheses predicting sex differences in Avoidant coping score and DES score, independent *t* tests were first utilized to compare women and men. Next two-way analysis of variance (ANOVA) models were used to evaluate effects of sex, PTSD, and the sex by PTSD interaction. To evaluate the relationship between avoidance and dissociation, Pearson correlations were conducted in the full sample and separately in those NES patients with and without a PTSD diagnosis. All analyses specified significance level alpha = 0.05 two-tailed and were completed in SAS statistical software version 9.4.

Results

Of 503 screened patients, 172 patients met our criteria and were included (126 women, 46 men). Baseline patient characteristics are summarized and compared by sex in Table 2. There were no sex differences in demographic variables. NES

Table 2 Demographics and comorbidities

	Total ($n = 172$)	Women ($n = 126$)	Men ($n = 46$)	Test (degrees of freedom)	Significance
Age in years					
Mean, SD	40.8, 12.8	40.5, 12.8	41.7, 12.6	$t(170) = -0.56$	$p = 0.58$
Race					
White/Caucasian	139 (80.8%)	100 (79.4%)	39 (84.8%)	$X^2(1) = 0.66$ White versus the other categories	$p = 0.41$
Black/African American	17 (9.9%)	13 (10.3%)	4 (8.7%)		
Asian	1 (0.6%)	1 (0.8%)	0 (0%)		
American Indian and Alaska Native	1 (0.6%)	1 (0.8%)	0 (0%)		
Other	10 (5.8%)	8 (6.3%)	2 (4.3%)		
Unknown[a]	4 (2.3%)	3 (2.4%)	1 (2.2%)		
Ethnicity					
Not Hispanic/Latino	150 (87.2%)	112 (88.9%)	38 (82.6%)	$X^2(1) = 1.92$	$p = 0.16$
Hispanic/Latino	20 (11.6%)	12 (9.5%)	8 (17.4%)		
Unknown[a]	2 (1.2%)	2 (1.6%)	0 (0%)		
Marital status					
Married	74 (43.0%)	57 (45.2%)	17 (37.0%)	$X^2(1) = 1.73$ Couples (married, significant other) versus the other categories	$p = 0.19$
Significant other	6 (3.4%)	5 (4.0%)	1 (2.2%)		
Single	63 (36.6%)	42 (33.3%)	21 (45.6%)		
Divorced	15 (8.7%)	10 (7.9%)	5 (10.9%)		
Separated	1 (0.6%)	1 (0.8%)	0 (0%)		
Widowed	3 (1.7%)	3 (2.4%)	0 (0%)		
Unknown[a]	10 (5.8%)	8 (6.4%)	2 (4.3%)		
Zip designation					
Urban	157 (91.3%)	114 (90.5%)	43 (93.5%)	$X^2(1) = 0.38$ Urban versus other categories	$p = 0.54$
Rural	3 (1.7%)	3 (2.4%)	0 (0%)		
Frontier	4 (2.3%)	2 (1.6%)	2 (4.3%)		
Out of state	8 (4.7%)	7 (5.5%)	1 (2.2%)		
Medicaid insurance					
Yes	63 (36.6%)	45 (35.7%)	18 (39.1%)	$X^2(1) = 0.17$	$p = 0.68$
Disability status					
Disability	67 (39.0%)	51 (40.5%)	16 (34.8%)	$X^2(1) = 0.57$ Disability versus other categories	$p = 0.45$
None	73 (42.4%)	52 (41.3%)	21 (45.6%)		
Unable to work	30 (17.4%)	21 (16.7%)	9 (19.6%)		
Unknown[a]	2 (1.2%)	2 (1.6%)	0 (0%)		
Co-occurring epilepsy					
Yes	26 (15.1%)	20 (15.9%)	6 (13.0%)	$X^2(1) = 0.21$	$p = 0.65$
Age in years at Dx					
Mean, SD ($n = 171$)	38.2, 13.9	38.1, 14.3	38.5, 12.8	$t(169) = -0.17$	$p = 0.87$
Psychiatric comorbidities					
PTSD	92 (53.5%)	68 (54.0%)	24 (52.7%)	$X^2(1) = 0.04$	$p = 0.83$
GAD	24 (14.0%)	19 (15.1%)	5 (10.9%)	$X^2(1) = 0.05$	$p = 0.48$
MDD	44 (25.6%)	32 (25.4%)	12 (26.1%)	$X^2(1) = 0.01$	$p = 0.93$
Bipolar disorder	17 (9.9%)	15 (11.9%)	2 (4.3%)	FE[b]	$p = 0.25$
Substance use disorder	16 (9.3%)	10 (7.9%)	6 (13.0%)	$X^2(1) = 1.04$	$p = 0.31$
Insomnia	41 (23.8%)	28 (22.2%)	13 (28.3%)	$X^2(1) = 0.68$	$p = 0.41$
Clinically significant pathology					
Personality disorder	2 (1.2%)	2 (1.6%)	0 (0%)	FE[b]	$p = 1.0$
Trauma	6 (3.5%)	4 (3.2%)	2 (4.4%)	FE[b]	$p = 0.66$
Dissociation	4 (2.3%)	3 (2.4%)	1 (2.2%)	FE[b]	$p = 1.0$
Anxiety	43 (25.0%)	29 (23.0%)	14 (30.4%)	$X^2(1) = 0.99$	$p = 0.32$
Depression	29 (16.9%)	21 (16.7%)	8 (17.4%)	$X^2(1) = 0.01$	$p = 0.91$
Mood disorder	6 (3.5%)	2 (1.6%)	4 (8.7%)	FE[b]	$p = 0.04$*
Cognitive abnormalities	13 (7.6%)	6 (4.8%)	7 (15.2%)	$X^2(1) = 5.27$	$p = 0.02$*

* = statistically significant; $p <= 0.05$

[a] "Unknown" in all categories were treated as missing and excluded from analysis

[b] "FE" is Fisher's exact test

patients averaged about 41 years of age and were primarily white/Caucasian (80.8%) and not of Hispanic/Latino ethnicity (86.6%). Residences for over 90% were classified as urban. Over 1/3 of the sample had Medicaid Insurance and nearly 40% received Social Security Disability.

Few sex differences were seen with respect to medical record notations of co-occurring psychiatric diagnoses and conditions (Table 2). Significantly more men had a mood disorder noted in the medical record (8.7%) compared with women (1.6%). These mood disorders were unspecified and did not meet full criteria for either Major Depressive Disorder (MDD) or Bipolar Disorder, which were considered separate categories. Significantly more men were noted to have cognitive abnormalities (15.2%) compared with women (4.8%). Cognitive abnormalities included predominately memory deficits and word-finding difficulties. In considering the most common co-occurring DSM-V conditions with NES, over half of patients had a PTSD diagnosis noted and about a quarter had a major depressive disorder diagnosis. Twenty-five percent of patients had anxiety and over 20% reported insomnia. Fifteen percent had co-occurring epilepsy; epilepsy in these NES patients did not differ by sex (Table 2) nor by also having PTSD (12.0%) versus not having PTSD (18.8%; $\chi^2(1) = 1.53$, $p = 0.21$).

Distributions of variables were evaluated and determined to be approximately normal; thus, parameteric statistical procedures were utilized to test hypotheses. Unadjusted means for Avoidant Coping did not differ for men (mean = 3.2) compared with women (mean = 3.3; t (170) = 0.59, $p = 0.55$). Similarly, unadjusted means for DES did not differ for men (mean = 23.5) compared with women (mean = 24.2; t (170) = 0.23, $p = 0.82$). As shown in Fig. 1 with avoidance, results from the two-way ANOVA of Avoidant Coping also found no sex effect ($F(1,168) = 0.36$, $p = 0.55$), and no sex by PTSD interaction ($F(1,168) = 0.39$, $p = 0.53$). However, there was a significant effect of PTSD ($F(1,168) = 5.27$, $p = 0.02$), such that those with PTSD had greater scores (adjusted mean = 3.5) on average than those without PTSD (adjusted mean = 3.0). As shown in Fig. 1 with dissociation, results from the two-way ANOVA of DES also showed no sex effect ($F(1, 168) = 0.08$, $p = 0.77$), but there was a significant effect of PTSD ($F(1,168) = 8.84$, $p = 0.003$), such that patients with PTSD had greater dissociation (adjusted mean = 27.8) than those without PTSD (adjusted mean = 19.4) on average. There was a trend for sex by PTSD interaction ($F(1, 168) = 3.06$, $p = 0.08$) such that the difference in DES scores between those with and without PTSD tended to be larger in men (adjusted mean difference = 13.4) than in women (adjusted mean difference = 3.5).

A moderate linear association was determined between avoidance and dissociation by an estimated Pearson correlation coefficient of $r = 0.43$ ($p < 0.0001$) for the total sample ($n = 172$). Furthermore, the strength of that relationship was equivalent when estimated in the 92 NES patients with PTSD ($r = 0.41$, $p < 0.0001$) and in the 80 NES patients without PTSD ($r = 0.41$, $p < 0.0001$) separately.

Conclusions

In NES, clinical differences between patients, including sex, can impact clinical presentation, treatment response, course, and outcome. One important difference may be the presence of co-occurring PTSD [26]. Attempts to understand how the presence of PTSD affects NES are partly motivated by desires to design better treatments for identifiable subgroups, since even the most effective current treatments, primarily CBT, leave about half of NES patients symptomatic and suffering [37]. Additionally, finding qualified treatment can be challenging, and many behavioral health specialists are not comfortable with or do not understand NES well enough to deliver proper psychotherapeutic care [38]. Encouragingly, preliminary studies show that prolonged exposure therapy in patients with both NES and PTSD resulted in improvement in both conditions [39].

We found dissociation and avoidant coping to be moderately positively correlated with one another, with similar severity of dissociative and avoidant coping in women and men with NES. Both dissociation and avoidant coping were significantly greater in patients with a co-occurring PTSD diagnosis. This suggests that PTSD is likely to be an overwhelming

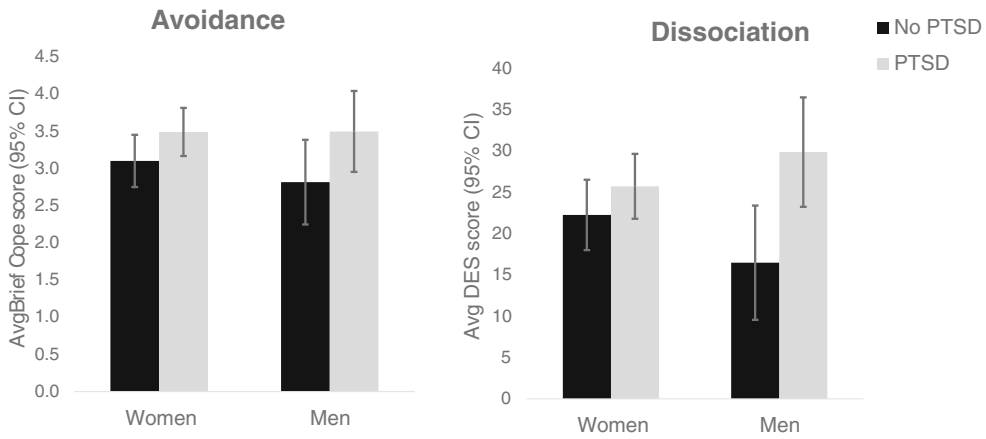

Fig. 1 Avoidant and dissociative coping measures

consideration for these coping styles in patients with NES regardless of sex. These observations support the view that for many patients NES might represent an extreme variant of symptomatic response in PTSD [40]. These findings also support the suggestion that in addition to patients with epilepsy, comparison groups for NES should be composed of patients with PTSD [32]. Since women are at 2–3 times higher risk of developing PTSD compared with men [41], many of the factors contributing to this degree of increased risk for PTSD are also likely to be contributing to the higher prevalence of NES in women. Our sample of NES patients had similar rates of comorbid epilepsy as other clinical samples (10–15%), and PTSD had no significant impact on the rate of epilepsy diagnosis.

Treatment Challenges

In our observations, sex affects NES treatment for women in several important ways. Notably, women may not be comfortable in therapy groups with men or being treated by men. These concerns inject extra barriers to providing care and are particularly pronounced in our interdisciplinary clinic where the primary treatment modality is group therapy [33]. This preference is often fear driven in women who have experienced horrible traumas at the hands of male perpetrators or negative interactions with health care providers. Patients already experience barriers by feeling uncomfortable or unheard by health care professionals [42]. We encourage patients to try working through their fears and discomforts by talking openly about them, as these processes can constitute reparative and personal growth experiences by which to overcome social impairments imposed by NES, and in turn help patients form better therapeutic relationships and connections with others. In line with previous literature, our cohort of patients consisted of more women with a ratio of 3:1.

Our treatment team is also often challenged in attempts to engage family members to support patients during particularly difficult times, e.g., when they have debilitating symptoms. Some evidence suggest that compared with men, women with NES display better family functioning and support [43] resulting in their having better chances of having helpful treatment allies.

Where Do We Go From Here?

Due to lack of differences in avoidant and dissociative coping strategies between women and men with NES, we cannot consider women and men distinct patient populations with respect to these measures. With all patients, it remains important to continue individualized approaches to treatment [1], taking into account psychiatric comorbidities [44]. We found only two statistically significant comorbidity variables between women and men, which included notations of mood disorders and cognitive abnormalities. This is likely to be of limited clinical significance for two reasons. First, these conditions were rare in both women and men. Second, both constitute bothersome symptoms and not actual DSM-V diagnoses.

How can sex differences that are already known to affect NES guide diagnostic and treatment decisions? Most importantly, clinicians can try to avoid availability bias, i.e., too quickly diagnosing NES in women based on the known sex difference in prevalence. Clinicians can also be more diligent concerning the physical safety of women who are more likely to incur physical injuries during NES events. For any patients who have difficulty accepting the emotional and psychological basis of NES, it may be more palatable to utilize physiological diagnostic explanations, including differences in brain structure and function between NES and epilepsy. Patient resistance to the NES diagnosis is more common when doctors use psychological explanations [42].

This study has several limitations. First, co-occurring psychiatric diagnoses were based on clinical notations in the medical record, not on formal screening or structured interview. Second, we had data only on the subset of clinic patients who actually completed the baseline questionnaires (only about 34% of the clinic population). Patients who completed these questionnaires might differ from those who did not, reducing the representativeness of the sample. Third, measures used for this study sampled only a small portion of coping mechanisms used by patients with NES.

Future studies of sex differences in patients with NES might start with more fully characterizing their biological, psychopathological, and social profiles. Following on this study, questions also concern how dissociation and avoidant coping might vary in women by developmental phase and stage, e.g., with menstrual cycle, pregnancy, post-partum, and menopause. Finally, of utmost importance to patients, future studies should examine how level of dissociation, avoidant coping, and severity and duration of traumas relate to seizure frequency, severity of specific features of co-occurring PTSD, and quality of life.

Compliance with ethical standards

All study participants gave informed, written consent prior to enrollment in the research in accordance with IRB.

Conflict of Interest Randi H. Libbon, Sarah Baker, Meagan Watson, Crystal Natvig, Laura Strom, and Susan Mikulich declare that they have no conflicts of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with animal subjects performed by any of the authors. Human participants gave informed consent in accordance with IRB protocol.

References

1. Dworetzky BA, Baslet G. Psychogenic nonepileptic seizures in women. Semin Neurol. 2017;37(6):624–31.
2. Noe KH, Grade M, Stonnington CM, Driver-Dunckley E, Locke DEC. Confirming psychogenic nonepileptic seizures with video-EEG: sex matters. Epilepsy Behav. 2012;23(3):220–3.
3. Oto M, Conway P, McGonigal A, Russell AJ, Duncan R. Gender differences in psychogenic non-epileptic seizures. Seizure. 2005;14(1):33–9.
4. van Merode T, de Krom MC, Knottnerus JA. Gender-related differences in non-epileptic attacks: a study of patients' cases in the literature. Seizure. 1997;6(4):311–6.
5. Thomas AA, Preston J, Scott RC, Bujarski KA. Diagnosis of probable psychogenic nonepileptic seizures in the outpatient clinic: does gender matter? Epilepsy Behav. 2013;29(2):295–7.
6. Korucuk M, Gazioglu S, Yildirim A, Karaguzel EO, Velioglu SK. Semiological characteristics of patients with psychogenic nonepileptic seizures: gender-related differences. Epilepsy Behav. 2018;89:130–4.
7. Francis P, Baker GA. Non-epileptic attack disorder (NEAD): a comprehensive review. Seizure. 1999;8(1):53–61.
8. Reuber M, Pukrop R, Bauer J, Helmstaedter C, Tessendorf N, Elger CE. Outcome in psychogenic nonepileptic seizures: 1 to 10-year follow-up in 164 patients. Ann Neurol. 2003;53(3):305–11.
9. Allendorfer JB, Nenert R, Hernando KA, DeWolfe JL, Pati S, Thomas AE, et al. FMRI response to acute psychological stress differentiates patients with psychogenic non-epileptic seizures from healthy controls – a biochemical and neuroimaging biomarker study. Neuroimage Clin. 2019;24:101967.
10. Asadi-Pooya AA, Homayoun M Structural brain abnormalities in patients with psychogenic nonepileptic seizures. Neurol Sci, 2019.
11. Szaflarski JP, Curt LaFrance W Jr. Psychogenic nonepileptic seizures (PNES) as a network disorder – evidence from neuroimaging of functional (psychogenic) neurological disorders. Epilepsy Curr. 2018;18(4):211–6.
12. Kerr WT, Janio EA, Braesch CT, le JM, Hori JM, Patel AB, et al. An objective score to identify psychogenic seizures based on age of onset and history. Epilepsy Behav. 2018;80:75–83.
13. Kerr WT, Janio EA, Braesch CT, le JM, Hori JM, Patel AB, et al. Identifying psychogenic seizures through comorbidities and medication history. Epilepsia. 2017;58(11):1852–60.
14. Alper K, Devinsky O, Perrine K, Vazquez B, Luciano D. Nonepileptic seizures and childhood sexual and physical abuse. Neurology. 1993;43(10):1950–3.
15. Bowman ES. Etiology and clinical course of pseudoseizures. Relationship to trauma, depression, and dissociation. Psychosomatics. 1993;34(4):333–42.
16. 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):64–9.
17. Kanemoto K, LaFrance WC Jr, Duncan R, Gigineishvili D, Park SP, Tadokoro Y, et al. PNES around the world: where we are now and how we can close the diagnosis and treatment gaps—an ILAE PNES Task Force report. Epilepsia Open. 2017;2(3):307–16.
18. O'Sullivan SS, Spillane JE, McMahon EM, Sweeney BJ, Galvin RJ, McNamara B, et al. Clinical characteristics and outcome of patients diagnosed with psychogenic nonepileptic seizures: a 5-year review. Epilepsy Behav. 2007;11(1):77–84.
19. Duncan R, Oto M, Martin E, Pelosi A. Late onset psychogenic nonepileptic attacks. Neurology. 2006;66(11):1644–7.
20. Glosser G, Roberts D, Glosser DS. Nonepileptic seizures after resective epilepsy surgery. Epilepsia. 1999;40(12):1750–4.
21. Markoula S, de Tisi J, Foong J, Duncan JS. De novo psychogenic nonepileptic attacks after adult epilepsy surgery: an underestimated entity. Epilepsia. 2013;54(12):e159–62.
22. Arain AM, Song Y, Bangalore-Vittal N, Ali S, Jabeen S, Azar NJ. Long term video/EEG prevents unnecessary vagus nerve stimulator implantation in patients with psychogenic nonepileptic seizures. Epilepsy Behav. 2011;21(4):364–6.
23. Kutlubaev MA, Xu Y, Hackett ML, Stone J. Dual diagnosis of epilepsy and psychogenic nonepileptic seizures: systematic review and meta-analysis of frequency, correlates, and outcomes. Epilepsy Behav. 2018;89:70–8.
24. Ranford J, MacLean J, Alluri PR, Comeau O, Godena E, Curt LaFrance W Jr, et al. Sensory processing difficulties in functional neurological disorder: a possible predisposing vulnerability? Psychosomatics. 2020;61:343–52.
25. Jungilligens J, Wellmer J, Schlegel U, Kessler H, Axmacher N, Popkirov S. Impaired emotional and behavioural awareness and control in patients with dissociative seizures. Psychol Med. 2019: 1–9.
26. Zeng R, Myers L, Lancman M. Post-traumatic stress and relationships to coping and alexithymia in patients with psychogenic non-epileptic seizures. Seizure. 2018;57:70–5.
27. Asadi-Pooya AA. Psychogenic nonepileptic seizures and sex differences in stress responses. Epilepsia. 2016;57(5):853.
28. Asadi-Pooya AA. Psychogenic nonepileptic seizures are predominantly seen in women: potential neurobiological reasons. Neurol Sci. 2016;37(6):851–5.
29. Asadi-Pooya AA, Homayoun M. Psychogenic nonepileptic seizures: the sex ratio trajectory across the lifespan. Seizure. 2020;75:63–5.
30. Myers L, Trobliger R, Bortnik K, Lancman M. Are there gender differences in those diagnosed with psychogenic nonepileptic seizures? Epilepsy Behav. 2018;78:161–5.
31. Williams B, Jalilianhasanpour R, Matin N, Fricchione GL, Sepulcre J, Keshavan MS, et al. Individual differences in corticolimbic structural profiles linked to insecure attachment and coping styles in motor functional neurological disorders. J Psychiatr Res. 2018;102:230–7.
32. Roberts NA, Reuber M. Alterations of consciousness in psychogenic nonepileptic seizures: emotion, emotion regulation and dissociation. Epilepsy Behav. 2014;30:43–9.
33. Libbon R, Gadbaw J, Watson M, Rothberg B, Sillau S, Heru A, et al. The feasibility of a multidisciplinary group therapy clinic for the treatment of nonepileptic seizures. Epilepsy Behav. 2019;98: 117–23.
34. Carver CS. You want to measure coping but your protocol's too long: consider the brief COPE. Int J Behav Med. 1997;4(1):92–100.
35. Hagan TL, Fishbein JN, Nipp RD, Jacobs JM, Traeger L, Irwin KE, et al. Coping in patients with incurable lung and gastrointestinal cancers: a validation study of the Brief COPE. J Pain Symptom Manag. 2017;53(1):131–8.
36. Fischer DG, Elnitsky S. A factor analytic study of two scales measuring dissociation. Am J Clin Hypn. 1990;32(3):201–7.
37. Carlson P, Nicholson Perry K. Psychological interventions for psychogenic non-epileptic seizures: a meta-analysis. Seizure. 2017;45: 142–50.

38. Tolchin B, Martino S, Hirsch LJ. Treatment of patients with psychogenic nonepileptic attacks. Jama. 2019;321(20):1967–8.
39. Myers L, Zandberg L. Prolonged exposure therapy for comorbid psychogenic nonepileptic seizures and posttraumatic stress disorder. Clin Case Stud. 2017;17(1):3–20.
40. Fiszman A, Alves-Leon SV, Nunes RG, D'Andrea I, Figueira I. Traumatic events and posttraumatic stress disorder in patients with psychogenic nonepileptic seizures: a critical review. Epilepsy Behav. 2004;5(6):818–25.
41. Olff M. Sex and gender differences in post-traumatic stress disorder: an update. Eur J Psychotraumatol. 2017;**8**(sup4):1351204.
42. Rawlings GH, Reuber M. What patients say about living with psychogenic nonepileptic seizures: a systematic synthesis of qualitative studies. Seizure. 2016;41:100–11.
43. LaFrance WC Jr, et al. Impact of family functioning on quality of life in patients with psychogenic nonepileptic seizures versus epilepsy. Epilepsia. 2011;52(2):292–300.
44. LaFrance WC Jr, Devinsky O. Treatment of nonepileptic seizures. Epilepsy Behav. 2002;3(5 Suppl):19–23.