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Subjective symptoms of functional/dissociative seizures and their diagnostic value: A systematic review

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Abstract

Objective

While subjective symptoms have received less attention than observable manifestations of functional/dissociative seizures (FDS), patient-reported experiences provide important insights for diagnosis and management. This systematic review summarizes and synthesizes studies describing the subjective symptomatology of FDS and narratively discusses their potential diagnostic value.

Methods

MEDLINE, PsycINFO, and CINAHL were searched from January 1990 to May 2025 for studies reporting qualitative or quantitative data on FDS symptoms. The review was registered in PROSPERO (CRD420251008332) and reported in accordance with PRISMA 2020 guidelines. Study quality was assessed using Critical Appraisal Skills Programme (CASP) tools. Data were extracted on study design, sample characteristics, data acquisition method, and reported symptoms. Qualitative data were analysed thematically following ENTREQ principles, while quantitative findings were synthesised narratively within the same thematic framework.

Results

Forty-seven studies were included. Subjective symptoms of FDS were highly variable both within and between individuals. Across studies, six broad symptom domains were identified: sensory/pain, arousal, emotional, consciousness-related, cognitive, and motor symptoms. Sensory symptoms (particularly pain and headache), arousal-related symptoms (especially hyperarousal), and emotional symptoms (especially panic and anxiety) were most frequently reported across studies. Symptoms related to altered awareness and dissociation between awareness and responsiveness were described in a smaller number of studies but were more consistently reported as differentiating FDS from epileptic seizures. In contrast, the differential diagnostic value of other subjective symptoms was limited by lack of specificity and insufficient detail regarding context, mode of onset, spread, duration and quality.

Significance

Subjective symptoms in FDS are diverse, but common themes emerge. Detailed descriptions are required to extract differential diagnostic value from subjective FDS symptoms. Future studies should collect structured information about FDS symptoms and study them using systematic, multimodal, and cross-cultural approaches.

Keywords: Functional/dissociative seizures; psychogenic nonepileptic seizures; subjective

symptoms; PNES; diagnosis

Key points

- The subjective symptoms of functional / dissociative seizures (FDS) are variable intra- and intersubjectively.
- Six domains of FDS symptoms emerged across 47 studies: sensory, arousal, emotional, consciousness-related, cognitive and motor symptoms.
- Sensory symptoms/pain, arousal and emotional symptoms are most frequently reported (especially pain/headache, hyperarousal and anxiety).
- The dissociation of awareness and responsiveness may hold diagnostic value and warrants further study.
- To be diagnostically relevant, detailed contextual and qualitative information about subjective symptoms must be sought.

Introduction

There is an increasing emphasis on diagnosing of functional neurological disorders (FND) including functional/dissociative seizures (FDS), also known as psychogenic nonepileptic seizures (PNES), on the basis of 'positive' clinical features rather than on the exclusion of other conditions.[1-3] These positive diagnostic features include both patients' subjective symptoms and objective features, such as clinical signs or investigation results supporting the diagnosis. In this review, the term *subjective symptoms* refers to patients' self-reported experiences during FDS, including sensory, emotional, cognitive, autonomic or awareness-related phenomena, among others.[4]

While the documentation of objective biomarkers of seizure manifestations using video-electroencephalography (vEEG) plays an important role in the diagnostic process,[5] the consideration of subjective symptoms, i.e. what the patient experienced around the time objective seizure manifestations were visible, makes an important contribution to the diagnostic interpretation of video-EEG recordings. The elicitation of subjective seizure symptoms is particularly important, when patients first present with their seizure disorder. At this stage, witness reports or seizure recordings are often unavailable, and patients' own recollections of their seizure experiences are likely to play a central role in diagnostic reasoning.[6]

Although previous reviews have examined various aspects of FDS, to our knowledge, no systematic review has specifically focused on the subjective symptoms reported during FDS. This review therefore aimed to (1) summarise the subjective symptoms reported during FDS, and (2) discuss their potential diagnostic value.

Methods

Design

Design and focus of this review were guided by the PICO framework (Population, Intervention, Comparison, Outcome). Qualitative and quantitative studies were

summarised by narrative synthesis. Descriptive findings were analysed thematically to identify ictal FDS symptom types. This review was pre-registered with PROSPERO on 22nd April 2025 (registration number: CRD420251008332) and conducted in accordance with the PRISMA 2020 guidelines (see Table S1).[7]

Search Strategy

MEDLINE (via OVID), CINAHL and PsycINFO (via EBSCO) were searched in July 2025, from 1 January 1990 to 31 May 2025. We included peer-reviewed journal articles in English exploring self-reported ictal, immediately pre-ictal and post-ictal symptoms of FDS. Quantitative and qualitative studies were considered. We excluded studies focusing solely on interictal symptoms; seizure symptom reports only based on witnesses' accounts; or investigating other FND conditions (see Table S2).

Study selection

All identified records were imported into EndNote™ 21 (Clarivate, Philadelphia, PA, USA) for management and deduplication. Three-stage screening of all titles, abstracts, and full-text was completed by the first author (QX). A random 10% sample of records at the title and abstract screening stage was independently screened by a second author (ZP) to assess consistency of screening decisions. Only one discrepancy was identified and resolved through discussion. The selection of all studies included in the final synthesis (n = 47) was independently reviewed by another author (MR). This process resulted in the inclusion of two studies that had initially been excluded.

Quality Appraisal

Studies were assessed using relevant Critical Appraisal Skills Programme (CASP) checklists. Checklist items were scored as "Yes" = 1, "Can't Tell" = 0.5 and "No" = 0. Similar to the approach of Butler et al.,[8] We adapted proportional thresholds to classify the quality of all study types as high, moderate, or low (see Table S3).

Quality appraisal of all included studies was conducted independently by two authors (QX and ZP). Any discrepancies were resolved through discussion. No major disagreements were identified.

Data analysis

Data were extracted into a structured Excel spreadsheet (Microsoft Excel 365, Microsoft Corporation, Redmond, WA, USA). One author (QX) conducted line-by-line coding of symptom descriptions from full-text articles, using medical terminology (e.g., "paraesthesias") when direct quotes were unavailable. Codes were discussed within the authorship team.

Qualitative data were analysed using thematic synthesis following the ENTREQ framework[9] (see Table S4) and the three-phase method by Thomas and Harden.[10] Codes were developed inductively from verbatim and closely paraphrased patient-reported symptom descriptions and grouped into descriptive and analytical themes through team discussions (see Table S5). Original thematic structures from individual studies were not adopted.

For quantitative studies, narrative synthesis was performed based on Popay et al.[11] Meta-analysis was not possible owing to heterogeneity. Structured tables summarized study characteristics and patterns across studies. Non-specific terms such as "auras" or "pre-ictal symptoms" were recorded verbatim rather than reclassified.

Interpretations regarding diagnostic value were derived at the review level through integration of symptom themes, considering quantitative frequency, saliency and comparative findings, rather than inferred from individual quotations. This approach reflects limitations inherent in the existing literature, as primary studies were not consistently designed to assess the diagnostic value of specific symptoms. Consequently, symptom reporting may be under- or over-represented across studies.

Results

Relevant literature

Our initial search identified 5,769 publications. After duplicate removal, title and

abstract screening, 66 articles were selected for full-text review and 43 met our inclusion criteria. Four additional papers were found through forwards and backwards searches (see Figure 1 for a PRISMA flow diagram).

-Insert Figure 1 here-

Among the 47 studies ultimately included, 38 were quantitative (31 cross-sectional, 2 cohort, 4 diagnostic accuracy, one case series) and 9 qualitative. Of note, 17 (involving a total of 2,243 participants) analysed overlapping participant cohorts. The extent of overlap could not always be determined; however, assuming full or no overlap among studies from the same research groups, sites and periods, our synthesis is based on a minimum of 3,257 and a maximum of 5,039 unique participants with FDS across 20 countries.

Of the included studies, 24 compared FDS with at least one other medical condition. Comparator groups included epilepsy (22 studies; 2,911 patients), other episodic events (5 studies; 471 patients), syncope (4 studies; 468 patients), panic attacks (1 study; 32 patients), functional movement disorders (1 study; 29 patients), migraine (1 study; 11 patients), and cardiac conditions (1 study; 1 patient).
In 15 studies, FDS cohorts included patients with comorbid epilepsy, whereas the remaining studies explicitly excluded FDS patients with comorbid epilepsy.

In 29 studies FDS symptoms were sampled using questionnaires or interviews, 21 studies extracted patient symptom descriptions retrospectively from vEEG reports or medical records (three used both methods, see Table 1 for details).

-Insert Table 1 here-

Quality appraisal

Quality ratings of 19 studies were high, and 27 were moderate. Frequent limitations

included small sample sizes and inadequate reporting of diagnostic ascertainment procedures (see Table S6a-d). No rating instruments were available for one non-consecutive, retrospective case series based on data extracted from medical records and did not employ any standardized outcome measures.[12] It was included in this review because it provides detailed insights into the phenomenon of 'wilful submission'.

Thematic synthesis

Six themes were identified: sensory symptoms / pain (described in 28 studies), arousal symptoms (24 studies), emotional symptoms (24 studies), alterations of consciousness (20 studies), cognitive symptoms (15 studies) and motor symptoms (14 studies) (see Table S7).

Data from 14 studies contributed to a single symptom theme, ten studies included two themes, three covered three, another five four, and four discussed five themes. Seven studies mentioned all six themes (see Table S8 and Figure 2). In contrast, findings from four studies did not fit into any of the emergent themes and were thus not assigned to a specific theme. Three of these[13-15] referred to "auras" without specification, and one comparative study[16] reported more "pre-ictal" and fewer "intra-ictal" symptoms in patients with FDS (PwFDS) than in patients with epilepsy (PwE).

-Insert Figure 2 here-

While key findings of the original research studies supporting our description of the 19 subthemes are summarised in Table 2, we evaluate the original research relating to each of the six main themes in the paragraphs below. Themes are discussed in the order of the frequency with which they were described in different studies. In our characterisation of the different themes, experiential salience is illustrated using qualitative material, while statements regarding diagnostic value are derived from a review-level synthesis of comparative qualitative and quantitative findings across studies.

-Insert Table 2 here-

Theme 1: Sensory symptoms / pain

Sensory symptoms, including pain, were the most frequently reported symptom category across studies of FDS. Quantitative comparisons indicated that pain and headache were reported more often in FDS than in epilepsy, with pain-related symptoms documented by approximately 20-90% of PwFDS. Qualitative accounts highlighted the intensity of pain experiences and their association with distress. Across studies, pain - particularly headache - was reported in pre-, ictal, and postictal phases, although considerable heterogeneity in definitions and timing was evident. While pain appeared more common in FDS than in epilepsy, its differential diagnostic value remained uncertain.

Non-pain somatosensory symptoms, such as tingling and numbness, were also frequently reported. Quantitative evidence suggested that these symptoms occurred more often in FDS than in epilepsy or syncope, with reported frequencies in FDS ranging from 6% to 60%. Qualitative descriptions characterised these sensations as diffuse, fluctuating, or difficult to localise, often lacking clear anatomical boundaries. Taken together, non-pain somatosensory symptoms were commonly reported in FDS but were typically described in non-specific descriptive terms.

Other sensory symptoms affecting taste, smell, vision, hearing, or visceral sensation were reported less frequently. Quantitative data indicated slightly higher reporting rates in FDS than in epilepsy (15-50% versus 2-20%). Qualitative material characterised these symptoms as vivid, unusual, or unreal, with occasional hallucination-like experiences.

Dizziness-related or light-headedness sensations were described by 10-80% of PwFDS. Qualitative accounts portrayed dizziness as fluctuating and emotionally coloured.

Taken together, sensory symptoms were common in FDS but, in isolation, showed limited differential diagnostic value without additional contextual and semiological

detail.

Theme 2: Arousal symptoms

Arousal symptoms referred to subjective experiences related to altered autonomic activation and encompassed hyperarousal, hypo-arousal, or mixed patterns.

Hyperarousal symptoms were most prominently described. Quantitative comparisons indicated that hyperarousal symptoms occurred more frequently in FDS than in epilepsy, with palpitations or shortness of breath reported in approximately 20-60% of PwFDS across studies, compared with 15-30% in PwE. Qualitative accounts portrayed autonomic sensations such as palpitations, sweating, or hyperventilation as intense and emotionally charged, often coloured by anxiety and heightened bodily awareness. However, objective autonomic measures suggested that epileptic seizures were associated with more rapid and ultimately higher physiological autonomic activation than FDS, highlighting a dissociation between subjective arousal experiences and objective autonomic indices in FDS.[17,18, 19] Taken together, hyperarousal symptoms were common in FDS but, in isolation, offered limited differential diagnostic value.

Hypo-arousal symptoms, including fatigue and exhaustion, were most commonly described in postictal contexts. Quantitative data suggested that postictal fatigue was frequent in both FDS and epilepsy, affecting approximately 15-60% and 45-65% of patients respectively. Qualitative descriptions emphasised disabling tiredness or slowed bodily functioning. Hypo-arousal symptoms appeared non-specific.

Mixed arousal patterns, involving shifts from hyperarousal to hypo-arousal within a single episode, were reported less frequently. Quantitative evidence indicated low prevalence (<5%), and qualitative descriptions suggested dynamic subjective experiences; however, such patterns were uncommon and not unique to FDS.

We concluded that arousal symptoms were common and often emotionally salient in FDS, but without supportive contextual or physiological information, they demonstrated limited differential diagnostic value.

Theme 3: Emotional symptoms

Emotional symptoms were highly salient in FDS. Panic and anxiety symptoms were most prominently reported, with quantitative studies indicating ictal fear or panic in approximately 25-90% of PwFDS, compared with 10-70% in PwE but 90% in patients with panic disorder. Qualitative accounts described emotionally intense experiences ranging from overwhelming dread to fear of dying, often characterised by heightened bodily sensations with limited cognitive elaboration ("panic without panic"). Taken together, despite their prominence, similar symptoms also occurred in other conditions, limiting their discriminatory value.[20]

Other emotional symptoms emerged less frequently but encompassed a broad range of peri-ictal experiences. Quantitative data suggested a variety of prevalence (1-40%). Qualitative material described emotions such as frustration, anger, embarrassment, sadness, especially accompanied by paradoxical relief after episodes.[12, 21]

Taken together, emotional symptoms were common in FDS, with paradoxical relief emerging as a potentially distinguishing feature requiring prospective validation.

Theme 4: Consciousness

Although experts have considered impairment of consciousness, dissociation, or loss of self-control to be core features of FDS,[3] these features were described in only 20/47 studies. Quantitative data indicated that alterations of consciousness encompassed heterogeneous patterns involving awareness, unresponsiveness, dissociation, and loss of control.

Awareness showed marked variability. Quantitative measures suggested a substantial proportion of preserved awareness in PwFDS (70%). Qualitative accounts described preserved internal awareness despite behavioural disruption or impaired responsiveness - a dissociation uncommon in epilepsy and may be diagnostically informative.

Unresponsiveness was reported by 10–80% of PwFDS; qualitative descriptions suggested either an inability to respond despite preserved awareness, or reduced awareness.

Dissociative experiences were reported more often in FDS than in epilepsy (20-60% vs. 28% of patients) across studies. Qualitative material vividly described depersonalisation and derealisation, often using metaphor. However, variability in timing and context limited diagnostic specificity.

Loss of control was reported less frequently in included studies, occurring in 20-60% PwFDS from quantitative studies. Qualitative accounts conveyed distress and helplessness from patients.

We concluded that complex patterns of altered consciousness appeared more informative than single features, with diagnostic value depending on specific combinations rather than isolated symptoms.

Theme 5: Cognitive symptoms

Cognitive symptoms in FDS were described as both negative (e.g. confusion, memory loss) and positive (e.g. intrusive thinking) phenomena.

Confusion was reported in 20–85% of PwFDS, occurring ictally or postictally, with inconsistent group differences compared with epilepsy. Qualitative accounts portrayed fog, disorientation, and difficulty thinking, varying in severity.

Memory gaps ranged much broader from brief forgetfulness to amnesia in FDS than in epilepsy (8-60% vs. 30-40% of patients).

Flashback-like intrusions were also reported (fewer than 40% of PwFDS) in only four studies, but were described as striking, involving vivid, involuntary re-experiencing of past events.

Taken together, while cognitive symptoms were common in FDS, their diagnostic value depended on qualitative features such as timing, evolution, and associated arousal rather than their mere presence.

Theme 6: Motor symptoms

Subjectively reported motor symptoms were less commonly captured in the included studies than other symptom domains. Speech-related motor symptoms were the most reported motor features, with quantitative data suggesting higher frequencies in FDS

than epilepsy (20-75% vs 10-35%), although findings were inconsistent. Qualitative accounts described slurred, arrested, or stuttering, more often than involuntary vocalisation. Although infrequent, speech phenomena may carry diagnostic relevance, but current evidence is limited.

Falling and other negative motor features were mentioned only in two quantitative studies (by 4% and 50% of PwFDS respectively) but frequently described qualitatively. Reports emphasised sudden and unpredictable falls reflecting loss of postural control. Their diagnostic relevance was greatest when occurring alongside preserved awareness.

Positive motor features, such as shaking or tremor, were commonly described (30-85%). Qualitative material highlighted diverse movement patterns and partial loss of control, often with preserved awareness. Motor symptoms alone showed limited diagnostic value, with relevance dependent on accompanying features such as awareness and responsiveness.

Discussion

We identified a total of 47 studies discussing the subjective ictal or immediately peri-ictal experiences of patients with FDS. These studies were of high or moderate quality and drew on a variety of data sources, including written accounts, interviews, structured questionnaires, and medical record reviews. Six themes and 19 subthemes emerged from the analysis.

Studies describing sensory symptoms were most numerous, perhaps reflecting the greater ease with which patients can provide subjective accounts of such symptoms rather than complex disturbances of consciousness or motor control. Interestingly sensory symptoms also featured in more studies than emotional symptoms, although historical accounts conceptualise FDS as a manifestation of conversion processes involving the translation of emotional distress into physical symptoms.

There were inconsistencies in the reported frequency, quality, or timing of particular

symptoms. For instance, pain symptoms were infrequently mentioned in Cardeña et al.'s study,[22] but featured prominently in the findings of a quantitative study by Reuber et al.[23] This discrepancy may be due to methodological differences as well as the small sample size in Cardeña et al.'s study. However, the variability of findings could also reflect the well-recognised phenomenological heterogeneity of the FDS patient population and the effects of differences of referral pathways and participant selection.

Although sensory symptoms were frequently reported by patients with FDS, most accounts did not specify spread or anatomical distribution, such as whether symptoms were unilateral, bilateral, or crossed. Greater diagnostic value could potentially be achieved if future studies capture both the location and the timeline of sensory symptom development. For instance, a patient describing sequential numbness in the left upper limb followed by the right lower limb would present a pattern highly characteristic of FDS rather than epilepsy. Furthermore, the evolution of sensory symptoms over the course of a seizure disorder could be diagnostically useful. For example, if a patient experiences different sensory symptoms across separate episodes, such as visual phenomena during one attack and auditory symptoms during another, the lack of stereotypy would point to a functional origin. Similarly, the co-occurrence of multiple sensory experiences within a single episode may further support an FDS diagnosis, especially when such combinations do not conform to neuroanatomical patterns seen in epilepsy.

The most important differential diagnosis when dizziness or light-headedness are followed by loss of consciousness is syncope. A previous paediatric study demonstrated that features making FDS more likely included supine, prolonged and frequent (at least daily) attacks.[24] Adults with syncope-like FDS also reported more traumatic falls (despite a higher number of supine attacks),[25] or "atypical" / "emotional" triggers.[26-28]

Across the included studies, reports of heightened autonomic activation were more frequent than reports of reduced arousal (18 vs. 9 studies); however, when subjective symptoms and objective manifestations of arousal were captured simultaneously, subjective and objective findings were not always concordant.[29] This discrepancy could be the result of impaired interoceptive processing in patients with FDS, aligning with broader theoretical models of functional neurological disorders.[30, 31]

When emotional symptoms featured in the identified original studies, panic or anxiety symptoms were most prominent. Such symptoms were found more frequently among PwFDS than PwE and resembled those described in panic attacks.[20, 32-36] This suggests that FDS and panic attacks may share overlapping pathophysiological mechanisms, such as heightened autonomic arousal. However, possibly meaningful distinctions were identified. For example, in the study by Vein et al.,[37] the sensation of "dying" was reported far more frequently by patients with panic disorder than PwFDS. This particular symptom could therefore help to distinguish panic attacks from FDS, although the most important feature differentiating these two diagnoses would be the more prominent motor manifestations and alterations of consciousness characterising FDS.

Descriptions of alterations of consciousness varied considerably across studies. These findings illustrate a common but paradoxical pattern in FDS. Patients may report unresponsiveness with preserved awareness or subjective impaired awareness, highlighting the complexity of disturbances of consciousness in this population. While in ICD-11 FDS are listed under dissociative disorders,[38] patients do not universally report dissociative symptoms such as derealisation and depersonalisation. For instance, the proportion of patients reporting dissociative symptoms in the small but detailed, interview study by Cardeña et al.[22] was low, although dissociative symptoms were reported more prominent in larger questionnaire-based studies.[34, 39, 40]

Cognitive symptoms in FDS appeared complex and often overlapped with alterations

in consciousness. While negative symptoms such as amnesia or confusion predominated, positive symptoms such as intrusive memories which could be part of reliving experiences in the context of flashbacks were also endorsed by approximately one third of patients in a large questionnaire-based study by Reuber et al.[23] These experiences may have aetiological significance, as they were found more commonly in individuals with a history of sexual abuse than those without.[41] This observation suggests that closer attention to subjective phenomena may not only aid the differential diagnosis of seizure disorders but may also shed light on underlying aetiology and help guide treatment approaches.

In terms of motor symptoms, self-reported accounts of falling attacks were relatively common across qualitative studies. In contrast, they were rarely mentioned in studies based on video-EEG monitoring records. It is likely that such studies relied mostly on objective evidence (where falls were captured during the recording period and documented by clinicians), rather than reported subjectively by patients themselves. Falls may be less likely to occur during vEEG monitoring when patients spend most of their time in seated or recumbent positions.

While research examining the diagnostic value of home video recordings suggests that motor behaviour allows experts to discriminate reliably between epileptic seizures and FDS,[42] the differential diagnostic significance of subjective accounts of motor symptoms is more limited. However, combinations of involuntary motor symptoms and characterisations of awareness and reduced responsiveness may offer greater discriminatory potential. For instance, patient-reported experiences of bilateral limb shaking with retained awareness and reduced self-control could serve as a distinguishing feature, strongly suggestive of FDS rather than epileptic seizures. If such combinations can be reliably elicited through patient narratives, they may have diagnostic implications.

Speech-related symptoms appear to have limited discriminative value between

epilepsy and FDS, as an inability to speak can be observed in both.[22] However, qualitative reports suggest that slurred speech and stuttering may be more commonly described by PwFDS. This is supported by a video-EEG based quantitative study showing that 8.5% of patients with FDS (n=117), but none with epilepsy (n=113) exhibited ictal stuttering.[43]

Limitations

This review has several limitations. Although 47 studies were included, the majority were qualitative or retrospective / cross-sectional, limiting conclusions about symptoms, causal relationships, or intervention effects. Frequency ranges were wide, reflecting both clinical heterogeneity and methodological differences across studies. The lack of standardized assessment tools increased heterogeneity and reduced comparability. Differences in the descriptions and interpretation of subjective phenomena may have introduced bias. Data was derived from a variety of sources, including interviews, diverse questionnaires, EEG reports, and clinical notes, making cross-study comparisons challenging. Our approach to synthesising the findings of different studies by identifying common themes and categorising symptoms will inevitably have simplified complex FDS experiences and detracted from the fact that different symptoms may be experienced at the same time. For instance, without a link to other, simultaneous symptoms (such as hyperarousal), it remains unclear whether the “recurring memories” were a cognitive aspect of re-experiencing previous trauma, i.e. a phenomenon characteristic of flashbacks in the contest of PTSD. More generally, most FDS involve mixed symptom combinations, and our categorisation, while informing readers of the range of possible symptoms, is less well suited to reflecting their complexity and phenomenological dynamic. In part this is a problem emerging from the methodologies of the synthesised literature: While the larger studies provide quantitative insights into the relative frequency of symptoms, these studies provide little information about the sequence or evolution of symptoms. Only a few studies combined subjective reports with multimodal data such as objective seizure semiology, psychological assessment, physiological or neuroimaging

measures. By beginning to explore typical combinations of subjective FDS manifestations such as preserved responsiveness, unresponsiveness or auras and visible seizure manifestations, the five semiological FDS clusters proposed by Hubsch et al.[44] represent a valuable step towards a more nuanced classification framework, but their work was dominated by observable clinical signs. We did not integrate additional modalities capturing seizure manifestations and did not take full account of the timeline of the manifestation of different ictal symptoms. Last but not least, only English-language publications were reviewed, and most studies originated from Western countries.

Conclusion

FDS are associated with a wide range of sensory, arousal, and emotional symptoms, but there is a considerable phenomenological overlap with conditions like epilepsy and panic disorder, and the diagnostic value of such symptoms depends on specific combinations, context, and variability across episodes. Features such as non-stereotyped sensory experiences, preserved awareness with impaired responsiveness and inconsistencies between objective recorded and subjectively perceived arousal are indicative of a diagnosis of FDS but future research will need to capture FDS symptoms and their sequential development more systematically and validate findings in larger, cross-cultural cohorts to realise the full diagnostic potential of patient reportable symptoms. What is more, future research should integrate subjective symptom descriptions with additional modalities (including observable semiological features, objective neurophysiological and autonomic measures, imaging findings, and psychological measures). Machine learning and multimodal approaches may enhance diagnostic precision and predictive power and provide a more nuanced understanding of relationships between seizure manifestations, etiological factors, relevant therapeutic approaches and outcomes.

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Author Contributions:

- **Qing Xue**: Conceptualisation, literature search, data extraction, data analysis, drafting and revision of the manuscript.
- **Zuzana Pastircakova**: Contributed to study selection and quality appraisal of included studies.
- **Gregg H. Rawlings**: Provided methodological guidance, conceptualisation, and revised the manuscript.
- **Markus Reuber**: Supervision, methodological guidance, conceptual refinement, interpretation of findings, and manuscript revision.

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Table 1. Characteristics of included studies (1a cross-sectional studies / case series; 1b diagnostic accuracy studies; 1c cohort studies; 1d qualitative studies)

Table 1a. Cross-sectional studies / case series

Author (year)	Country	Data source	Participants	FDS with additional epilepsy included?	Study type	Method
Ali F, et al. (2010) [45]	United Kingdom	ICI Level (ICI-L) and ICI Content (ICI-C) scores from outpatients recruited at a neuropsychiatry setting	66 PwE (39.9±12.2y, 36.4% M); 29 PwFDS (37.4±14.2y, 27.6% M)	No	Cross-sectional	Mann–Whitney U tests
Asadi-Pooya AA, et al. (2016) [46]	United States	Long-term vEEG reports from patients admitted to an EMU setting	24 PwFDS (15 F), 10 PwE (8 F), 11 (9 F) with migraine, and one female with a cardiac problem	No	Cross-sectional	Chi-square test, t-test, and Kolmogorov–Smirnov test
Asadi-Pooya AA, et al. (2019) [47]	Iran, United States	Retrospective database from patients at a comprehensive epilepsy centre setting	324 PwFDS (211 F)	Yes	Cross-sectional	Pearson Chi-square, Mann-Whitney, Kolmogorov-Smirnov, and t-test
Asadi-Pooya AA, et al. (2019) [48]	Iran, United States	Retrospective database from patients at a comprehensive epilepsy centre setting	258 PwFDS(165 F)	No	Cross-sectional	Univariate and multivariate analysis, including logistic regression
Asadi-Pooya AA, et al. (2019) [49]	Iran, United States	Retrospective database from patients at a comprehensive epilepsy centre setting	259 PwFDS (165 F)	No	Cross-sectional	Pearson Chi-square, Mann-Whitney, Kolmogorov-Smirnov, and t-test, logistic regression

Asadi-Pooya AA, et al. (2020) [50]	Iran, Qatar, United States, France, Georgia, Egypt, and United Arab Emirates.	vEEG data and patient reports from patients evaluated at epilepsy centre settings in seven countries	509 PwFDS (349 F; 31 ± 11 y)	No	Cross-sectional	Pearson chi-square,one-way analysis of variance (ANOVA), and Bonferroni correction tests
Asadi-Pooya AA, et al. (2021) [51]	Iran, United States	Both open-ended and closed-ended questions collected in a structured, prospective manner from outpatients evaluated at an epilepsy clinic setting	480 PwIGE, 617 PwTLE, and 294 PwFDS; 768 (55%) F, mean age at onset 17.9±10.7 y	No	Cross-sectional	Pearson Chi-Square test and Bonferroni correction test and logistic regression test
Deli A, et al. (2021) [29]	United Kingdom	vEEG reports, clinic letters, MDT reports, psychology assessments, and patient notes from patients admitted for vEEG in an EMU	39 PwFDS,30 PwE, 8 mixed	Yes	Cross-sectional	t-test, Chi-square test
Galimberti CA, et al. (2003) [52]	Italy	Ictal recordings from patients referred to an epilepsy centre	Group 1 (PwE/FDS): 38 (34 F); Group 1C (PwE controls): 38 (34 F); Group 2 (PwFDS): 31 (24 F); Group 2C (PwE controls): 31 (24 F)	Yes	Cross-sectional	Wilcoxon- Mann- Whitney test, ANOVA, logistic regression models
Goldstein LH and Mellers JD (2006) [36]	United Kingdom	Questionnaires from patients attending tertiary neuropsychiatry or neurology services	25 PwFDS (19F), mean age 35.52 y; 19 PwE (14F), mean age 35.84y	No	Cross-sectional	One way analysis of variance (ANOVA) (or the Mann–Whitney U test if data were not normally distributed),analyses of covariance (ANCOVA), Chi-square or Fisher's exact test
Hendrickson R, et al. (2014) [34]	United States	Face-to-face clinical interviews of panic attack criteria from patients recruited for vEEG at a centre's EMU	224 PwFDS, 74.6% F, age at spell onset 30.6y; 130 PwE, 46.9% F, age at spell onset 25.7y	No	Cross-sectional	Mann–Whitney U or the Chi-square test analysis

Hendrickson R, et al. (2015) [39]	United States	Neuropsychological or psychological assessments from patients evaluated with vEEG at a centre's EMU	223 PwFDS, 74.4% F, age at spell onset 30.57y; 128 PwE, 47.6% F, age at spell onset 25.52y	No	Cross-sectional	Mann–Whitney U analysis or the Chi-square test analysis
Ho R, et al. (2019) [13]	United States	Retrospective chart review from patients referred to an EMU for vEEG	51 PwFDS (33 F, mean age 44y), 47 PwE (19 F, mean age 49y), 41 others (22 F, mean age 56y)	No	Cross-sectional	Descriptive and bivariate statistical analysis
Hubsch C, et al. (2011) [44]	France	Retrospective review of vEEG and medical records from patients evaluated at a clinical neurophysiology unit	52 PwFDS (38 F), mean age at diagnosis 34.9y	Yes	Cross-sectional	Cluster analysis
Kerr WT, et al. (2019) [53]	United States	Retrospective chart review or standardized interviews from patients admitted to an adult vEEG monitoring unit	749 PwE, 332 PwFDS, 53 mixed, 238 others	Yes	Cross-sectional	Multivariate logistic regression
Kerr WT, et al. (2021) [54]	United States	The standardized interviews from patients admitted to an adult vEEG monitoring unit	241 PwE, 77 PwFDS, 16 mixed, 156 others	Yes	Cross-sectional	Linear or log-linear heteroskedastic t-tests or Fisher exact tests
Korucuk M, et al. (2018) [14]	Turkey	All patients' medical records and video recordings from patients referred to an epilepsy centre	41 PwFDS (31 F) age 27.2± 12.2y (range: 16–65)	No	Cross-sectional	Student's t test and/or the Mann–Whitney U test
Patidar Y, et al. (2013) [55]	India	vEEG monitoring and detailed clinical evaluation from patients attending a neurology outpatient at a tertiary care hospital	63 PwFDS (90.46% F), age at onset 25.44 ± 10.22 y	Yes	Cross-sectional	Chi-square test and Student's t-test

Rather MA, et al. (2020) [56]	United Kingdom	Retrospective review of outpatient clinic letters from patients at a specialist neuropsychiatry clinic	117 PwFDS (85 F, mean 40.2y); 29 with FMD (22 F, mean 44.7y)	No	Cross-sectional	Mann–Whitney U test, Pearson's Chi-square tests or Fisher's exact tests
Rawlings GH, et al. (2017) [20]	United Kingdom	Invitation letters with an information sheet and self-report questionnaires from patients identified through clinical databases at three hospitals	98 PwFDS (69 F, median age 43y), 95 PwE (68 F, median age 31y), 100 PwS (77 F, median age 57.5y)	No	Cross-sectional	Chi-square or Mann-Whitney U test, an analysis of covariance (ANCOVA)
Reuber M, et al. (2016) [40]	United Kingdom, United States	An 86-item PEP using a 5-point Likert scale from patients recruited by post	100 PwE (71 F, mean age 35.4y), 100 PwFDS (71 F, mean age 41.6y), 100 PwS (77 F, mean age 53.5y)	No	Cross-sectional	Exploratory factor analysis (EFA) followed by confirmatory factor analysis (CFA)
Reuber M, et al. (2011) [23]	United Kingdom	Postal questionnaires containing 12 demographic and clinical questions and the 86-item PEP from patients recruited by post	100 PwFDS, 71 F, mean 41.7y (range: 19-81)	No	Cross-sectional	Chi-square or t-tests, descriptive statistics
Rosso BI, et al. (2021) [57]	Argentina	A retrospective review of medical records from patients admitted to an adult vEEG unit	143 PwFDS, 81.8% F, mean 33.74 y (range: 18–83).	Yes	Cross-sectional	Descriptive analysis
Sawchuk T, et al. (2020) [15]	Iran, Brazil, Venezuela, Canada, Argentina, and United States	Routine clinical care data and medical records from patients in EMUs across six countries	448 PwFDS, 68% F, 27 ±11 y (range: 4–58)	No	Cross-sectional	Pearson chi-square, One-way analysis of variance (ANOVA) and Bonferroni post hoc comparisons
Selkirk M, et al. (2008) [41]	United Kingdom	Clinical interviews of patients referred to a specialist clinic, with diagnosis confirmed through inpatient vEEG monitoring.	176 PwFDS (146 F, 30 M); 66 reported antecedent sexual abuse	No	Cross-sectional	T-tests, chi-square tests, and logistic regression

Stone J and Carson AJ (2013) [12]	United Kingdom	Retrospective review of medical records of patients diagnosed by a consultant neurologist	11 PwFDS, 10 F, 17-54y	No	Case series	Descriptive
Vein AM, et al. (1994) [37]	Russia	Symptom list including panic attack (DSM-III-R) and neurological conversion symptoms from patients at a clinic specializing in autonomic disorders	32 (6 M) PwPA, age 33.2±1.1 y; 15 (1 M) PwFDS, age 30.9±2.4 y	No	Cross-sectional	Confidence intervals of Student's distribution
Vilyte G, et al. (2024) [58]	South Africa	Digital patient records from private and public EMUs	372 PwFDS, median 28y, 75% F. 305 patients from a private hospital and 67 patients from a public hospital	No	Cross-sectional	Descriptive statistics, Logistic regression, Bivariate analysis
Wang CY, et al. (2023) [59]	China Taiwan	Retrospective medical records from patients at a tertiary hospital including outpatient clinic, emergency department, and hospital admissions	26 PwFDS (17 F), mean age 13 years 8 months	Yes	Cross-sectional	Descriptive statistics
Watson NF, et al. (2002) [60]	United States	Telephone interviews including a standard questionnaire from patients in a database who had undergone inpatient evaluation to document episodes	26 PwE, 22 PwFDS	No	Cross-sectional	Pearson chi-square and Fisher exact test
Whitfield A, et al. (2023) [16]	United Kingdom	Open questioning followed by structured closed questioning from patients recruited at two hospitals	24 PwE (18 F) and 28 PwFDS (17 F)	No	Cross-sectional	Chi-squared tests, Fisher's exact test, Mann–Whitney U tests, Holm–Bonferroni corrections
Witgert ME, et al. (2005) [61]	United States	Medical records and video tapes of events from patients referred for vEEG in an EMU of a comprehensive epilepsy program	39 PwFDS (21 adults, 18 adolescents)	No	Cross-sectional	Descriptive statistics and independent-sample t test

Table 1b. Diagnostic accuracy studies

Author (year)	Country	Data source	Participants	FDS with additional epilepsy included?	Study type	Method
Bianchi E, et al. (2019) [62]	Italy and United States	Questionnaires and medical records from patients admitted for vEEG LTM	46 cases (17 PwFDS, 11 PwE, 18 others)	Yes	Diagnostic accuracy study	Sensitivity, specificity
Erba G, et al. (2017) [63]	United States, Italy	Questionnaires from patients referred to the LTM unit	46 cases (17 PwFDS, 11 PwE, 18 others)	Yes	Diagnostic accuracy study	Sensitivity, specificity
Wardrope A, et al. (2025) [35]	United Kingdom	Questionnaires from patients admitted to the ED and AMU with TLOC, and from new referrals to neurology and cardiology departments	134 PwS (56% F, median age 64y), 32 PwE (43.8% F, median age 47.5y), 12 PwFDS (75% F, median age 31y)	No	Diagnostic accuracy study	Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV)
Wardrope A, et al. (2025) [64]	United Kingdom	Online questionnaires from patients in the ED, AMU, and first seizure or syncope clinics	134 PwS (56% F, median age 64y), 32 PwE (43.8% F, median age 47.5y), 12 PwFDS (75% F, median age 31y)	No	Diagnostic accuracy study	A secondary analysis of a dataset; Sensitivity, specificity, PPV and NPV

Table 1c. Cohort studies

Author (year)	Country	Data source	Participants	FDS with additional epilepsy included?	Study type	Method
Lancman ME, et al. (1993) [65]	United States	Clinical records and questionnaires from patients evaluated in a comprehensive epilepsy program	93 PwFDS (80 F), mean age at diagnosis 31.7y	No	cohort	Chi-square and Fisher exact test
Silva W, et al. (2001) [66]	Argentina	Ictal vEEG and follow-up data from patients at a municipal epilepsy centre	17 PwFDS (12 F), mean age 33y, mean age at onset 25y	Yes	Cohort	Logistic regression and Fisher's exact test

Table 1d. Qualitative studies (Further details on coding and interpretation of qualitative studies are provided in Supplementary Table S5)

Author (year)	Country	Data source	Participants	FDS with additional epilepsy included?	Study type	Method
Cardena E, et al. (2020) [22]	Sweden, UK, United States	Semi-structured interviews from patients recruited by a neuropsychologist at an epilepsy centre	10 PwFDS (30.5 y, 100% F), 30 PwE (35.2 y, 45% F)	No	Qualitative and mixed	Content analysis and mixed methods
Dickinson P, et al. (2011) [67]	Canada	Semi-structured interviews from patients recruited by two hospitals	5 PwFDS (30-50 y, 3 F)	No	Qualitative	Thematic content analysis
Green A, et al. (2004) [68]	United Kingdom	Semi-structured interviews from patients attending neuropsychiatry outpatient clinics	9 PwFDS (5 F), 30-65 y	Yes	Qualitative	Thematic content analysis
Pick S, et al. (2016) [21]	United Kingdom	Semi-structured interviews from patients recruited by tertiary referral neuropsychiatry services	15 PwFDS (10 F)	No	Qualitative	Interpretative Phenomenological Analysis
Plug L, et al. (2009) [69]	United Kingdom	Audio- and video-recorded interviews from patients admitted for continuous vEEG monitoring in an EMU	8 PwE, 13 PwFDS	No	Qualitative	Semantic analysis, and logistic regression analysis
Rawlings GH, et al. (2017) [70]	United Kingdom	Self-report measures and writing booklets from participants recruited through membership-led organizations	19 PwFDS (3 M), median age 42y	No	Qualitative	Thematic analysis

Rawlings GH, et al. (2018) [32]	United Kingdom	Self-report measures and writing booklets from participants recruited from outpatient neurology clinics and membership-led organizations as part of a randomized controlled trial on expressive writing for seizure disorders	20 PwE (85% F, mean age 52.5y); 19 PwFDS (84.2% F, mean age 42y)	No	Qualitative	Thematic comparison
Walsh G, et al. (2024) [33]	Ireland	Semi-structured research interviews conducted virtually from patients at a tertiary hospital neurology department outpatient clinic	one M and 11 F, ages from twenties to seventies (median age 25 y)	Yes	Qualitative	Reflexive thematic analysis
Xue Q, et al. (2025) [4]	China, United States, United Kingdom	Written accounts from individuals with FDS recruited through FND Hope and FND Action, via clinicians, and from participants in a previous research study	75 PwFDS	Yes	Qualitative	Summative content analysis

Abbreviations:

ICI = Ictal Consciousness Inventory; FDS = functional/dissociative seizures; M = male; F = female; vEEG = video-electroencephalography; EMU = epilepsy monitoring unit; PwFDS = patients with functional/dissociative seizures; PwE = patients with epilepsy; PwIGE = patients with idiopathic generalized epilepsy; PwTLE = patients with temporal lobe epilepsy; PwS = patients with syncope; PwPA = patients with panic attack; LTM = long-term monitoring; MDT = multidisciplinary team; FMD = functional movement disorder; PEP = Paroxysmal Event Profile; ED = emergency department; AMU = acute medical unit; TLOC = transient loss of consciousness

Table 2. Themes and subthemes of studies exploring subjective FDS experiences

Themes	Sub-themes	Articles	Key quantitative findings in PwFDS	Exemplary qualitative findings	Key differential diagnostic observations
Sensory symptoms / pain	*Pain / Headache*	N = 24 [4, 12, 22, 23, 34-36, 40, 44, 46, 48, 51, 53-56, 58, 59, 62, 63, 65, 67, 68, 70]	▪ 89/100 PwFDS experienced postictal muscle ache, only 7/100 "never" experienced this symptom [23]. ▪ 13/75 PwFDS spontaneously mentioned pain in writings about FDS [4]. ▪ 54/100 PwFDS endorsed the statement "*My attacks feel like a knife through the head*" [23]. ▪ Pre-ictal headaches were reported across multiple studies, despite differences in sample characteristics and methodological approaches [51, 55, 62, 63, 65, 68]. ▪ Wang et al. [59] and Hubsch et al. [44] also documented abdominal pain symptoms in studies from Taiwan and France.	▪ PwFDS described body pain (e.g., "*my body hurts like everything happened all over again*") and headaches (e.g., "*If I concentrate I get pains in my head*") in writings suggesting an ictal context [70]. ▪ Interview and medical record-based studies document headaches before and after FDS [54, 58]. ▪ Head pain was frequently described in patients' accounts, typically characterised as sharp, severe, and highly distressing (e.g., "*It starts with a sharp, shooting pain in my forehead.*") [4]. ▪ Pain was described in various parts of the body, and typically characterised as severe, burning, or electric in quality (e.g., "*My whole body hurt*"; "*my arms and legs become achy… I felt my head was burning. The pain is like being electrocuted from the brain down through my spine*") [4].	▪ 82/224 PwFDS vs. 16/132 PwE reported chest pain [34]. ▪ 8/12 PwFDS, 9/32 PwE and 23/134 pwS reported postictal muscle aches [35]. ▪ Only 1/10 PwFDS versus 9/30 PWE described postictal muscle aches [22] ▪ 12/24 PwFDS vs. 3/10 PwE reported ictal headaches [46]. ▪ 11/25 PwFDS vs. 1/19 PwE described chest pains [36]. ▪ 3/24 PwFDS vs. 1/11 with migraine and 0/10 PwE reported abdominal pain [46].
	Non-pain somatosensory symptoms	N = 17 [4, 12, 22, 29, 34-36, 40, 44, 48, 51, 54, 57, 58, 62, 63, 65]	▪ 40/372 PwFDS reported paresthesiae as auras [58]. ▪ 31/143 PwFDS described ictal paresthesia [57]. ▪ 5/75 PwFDS reported tingling and	▪ Some patients reported a pre-ictal bodily sensation, often described as a tingling feeling spreading through the body (e.g., "*this tingling in my body*") [22]. ▪ Patients described abnormal sensory experiences such as tingling and numbness, often expressed as strange, widespread, or	▪ 130/224 PwFDS vs. PwE 30/130 endorsed ictal paresthesias ($p < 0.001$) [34]. ▪ 17/25 PwFDS vs. 7/19 PwE in the UK reported numbness or tingling in the arms, legs, or face ($p = 0.04$) [36]. ▪ 15/77 PwFDS vs. 17/241 PwE described ictal numbness

		6/75 numbness in written accounts [4]. ▪ 3/10 PwFDS endorsed the pre-ictal paresthesias in a content analysis study [22].	difficult to localise (e.g., "*a strange tingling and burning sensation all over my body*"; "*I felt numb*") [4].	(p = 0.004) [54]. ▪ 15/77 PwFDS vs. 19/241 PwE described ictal tingling (p = 0.01) [54]. ▪ 7/12 PwFDS, 6/32 PwE and 36/134 pwS reported skin tingling as an ictal symptom [35].
Other sensory symptoms	N = 15 [4, 12, 22, 23, 34, 40, 44, 48, 53, 58, 59, 62, 65, 68, 70]	▪ 22/93 PwFDS reported auras, such as burning sensations, funny tastes, and flashing lights [65]. ▪ 2/173 PwFDS mentioned visual symptoms and 1/173 mentioned hearing aura in medical records [48]. ▪ 10/372 PwFDS reported epigastric sensations [58]. ▪ 14/100 PwFDS reported "always" and 52/100 "never" experiencing "a bad taste" in their mouth during a seizure [23]. ▪ 55/100 PwFDS endorsed a "*rising sensation in the body*", representing a visceral or autonomic experience, often associated with dissociative experiences [23]. ▪ 2/26 PwFDS reported a sensation of swelling in the throat [59]	▪ Patients wrote that their FDS involved a "*metallic*" taste, or mentioned olfactory hallucinations (e.g., "*I can smell odd smells*"), whereas others referred to heightened auditory sensitivity (e.g., "*My hearing is acute, and so I hear all the laughter*") [4]. ▪ One patient described the auditory experience in their seizure as "*like dentists' drills in my head, takes over*", conveying an associated sense of loss of control and distress [68]. ▪ Accounts of sensory symptoms can seem odd (e.g., "*Grinding sensation in teeth and chest as if being pulled underwater*") [12]	▪ 50-60/332 PwFDS vs. 10-20/749 PwE reported ictal hallucinations in the medical records [53]. (estimated from supplementary figures, no raw data) ▪ 5/10 PwFDS vs. 6/30 PwE described pre-ictal impaired vision [22]. ▪ 1/10 PwFDS vs. 0/30 PwE described pre-ictal hallucinations [22]. ▪ 2/10 PwFDS vs. 1/30 PwE described pre-ictal smell [22]. ▪ 3/10 PwFDS vs. 3/30 PwE described ictal impaired hearing [22].
Dizziness-related sensations	N= 15 [4, 12, 22, 23, 29, 34, 40, 48,	▪ 48/372 PwFDS described dizziness/light-headedness as auras	▪ Patients reported dizziness before or during attacks (e.g., "*I remember all of a sudden feeling panicked, sweaty, and dizzy…*";	▪ 31/294 PwFDS vs. 33/617 PwTLE and 22/480 PwIGE reported dizziness or vertigo as auras [51].

		[51, 54, 58-60, 65, 70]	in medical records [58]. ▪ 26/258 PwFDS reported dizziness or vertigo before seizures [48]. ▪ 72/100 PwFDS endorsed the item "*In my attacks I feel lightheaded, like I might pass out*" [23]	"*I will feel dizzy, my blood pressure drops…*") [4] ▪ Patients described difficulties with balance and posture, accompanied by vague sensations such as feeling "funny" or dizzy (e.g., "*not being able to stand properly, feeling 'funny' and 'dizzy'*") [70].	▪ 175/224 PwFDS vs. 65/130 PwE endorsed feeling dizzy, unsteady, lightheaded, or faint during seizures [34]. ▪ 12/77 PwFDS vs. 17/241 PwE reported ictal dizziness [54]. ▪ 31/39 PwFDS vs. 3/30 PwE described lightheadedness/dizziness [29]. ▪ 3/10 PwFDS vs. 4/30 PwE reported lightheadedness [22]. ▪ 0/22 PwFDS vs. 6/26 PwE, spontaneously misattributed the event to a seizure in an interview about an earthquake [60].
Arousal symptoms	*Hyperarousal*	N = 18 [4, 12, 21-23, 29, 33-36, 40, 48, 52, 58, 62-64, 66]	▪ 9/17 PwFDS reported heart racing as a preictal warning symptom [62]. ▪ 9/41 FDS events of 17 PwFDS included hyperventilation in Argentina [66]. ▪ 2/12 PwFDS reported pre-ictal palpitations at first presentation of TLoC (sensitivity 0.17, specificity 0.96) [64]. ▪ 5/75 PwFDS described their palpitations and 5/75 hyperventilation [4].	▪ Patients described their palpitations as a pounding heartbeat (e.g., "*my heart rate pounds.*") [4]. ▪ Patients wrote their hyperventilation characterised by rapid breathing (e.g., "*My breaths are getting faster.*") [4].	▪ 103/224 PwFDS vs. 30/130 PwE endorsed palpitations [34]. ▪ 114/224 PwFDS vs. 34/130 PwE endorsed sweating [34]. ▪ 125/224 PwFDS vs. 18/130 PwE endorsed shortness of breath [34]. ▪ 9/17 PwFDS vs. 1/11 PwE reported "heart racing" as a warning symptom [63]. ▪ 10/12 PwFDS, 12/32 PwE, 53/134 PwS endorsed palpitations (PPV for FDS 0.13, NPV 0.98) [35]. ▪ 15/25 PwFDS vs. 5/19 PwE reported racing or pounding heart (p = 0.026) [36]. ▪ 16/25 PwFDS vs. 6/19 PwE endorsed shortness of breath (p = 0.033) [36]. ▪ 16/25 PwFDS vs. 6/19 PwE endorsed sweating (p = 0.033) [36].
	Hypo-arousal	N= 9 [4, 21, 22, 32, 33, 53, 58, 59, 68]	▪ 215/372 PwFDS identified confusion or fatigue as the most common post-ictal symptoms [58].	▪ Some patients described episodes of reduced arousal, often characterised by grogginess and physical weakness (e.g., "*have no idea what is going on and wake up sometimes groggy and*	▪ 50-80/332 PwFDS vs. 350-400/749 PwE reported post-ictal fatigue [53]. (estimated from supplementary figures, no raw data)

			▪ 10/75 PwFDS described fatigue [4].	*really weak…*") [32]. ▪ Fatigue also featured in several accounts, with one patient noting that they felt "*very, very tired*" and "*more worn out than before*" [21].	▪ 6/10 PwFDS vs. 20/30 PwE endorsed post-ictal exhausted/sleepy [22].
	Mixed arousal	N = 4 [4, 22, 33, 48]	▪ 11/258 PwFDS mentioned palpitations, 10/258 breathing difficulty and 10/258 weakness when reporting auras [48].	▪ Some patients described hyperventilation during seizures, followed by fatigue with statements such as "*my energy will run out*" and feeling tired [33].	
Emotional symptoms	*Panic/Anxiety*	N= 23 [4, 12, 20-23, 32-37, 39, 40, 44, 48, 58, 59, 61, 64, 66, 67, 70]	▪ 76/100 PwFDS endorsed the statement "*I feel very frightened*" during at least some of their seizures [23]. ▪ In 17 PwFDS, 9/41 events featured anxiety symptoms [66]. ▪ 17/75 PwFDS volunteered anxiety-related symptoms in their written accounts [4].	▪ Patients frequently described panic-like experiences, accompanied by hyperventilation and intense anxiety sensations (e.g., "*after, …I would get more panic sensations, hyperventilation and…*") [33]. ▪ Seizure experiences were at times marked by an overwhelming sense of fear, with patients perceiving them as life-threatening (e.g., "*I was indeed dying*.") [32]. ▪ Anxiety-related symptoms were commonly described, occurring either pre-ictally or during seizures. Patients portrayed these experiences as intense and often distressing (e.g., "*I will feel panic, I will feel anxious and scared and experience the warning sign, which is that feeling of dissociation from everything. And then that's when the seizures happen*"; "*I remember all of a sudden feeling panicked, sweaty, and dizzy, and saying I couldn't move*") [4].	▪ 63/224 PwFDS vs. 16/130 PwE expressed a fear of dying [34]. ▪ 8/98 PwFDS, 28/95 PwE, and 43/100 PwS reported *never experiencing* any of the listed ictal panic symptoms [20]. ▪ 6/12 PwFDS, 3/32 PwE, and 26/134 PwS felt frightened during seizures [35]. ▪ 3/15 PwFDS vs. 29/32 PwPA reported the symptom "*fear of dying*" [37].
	Other emotions	N = 8 [4, 12, 21, 22, 36, 39, 58, 68]	▪ 3/372 PwFDS reported aura aggression/irritability, and 7/372 reported post-ictal	▪ Patients with FDS sometimes described episodes accompanied by strong emotional reactions, highlighting the intensity and disruptive nature of such experiences (e.g., "I repeatedly lost	▪ 11/25 PwFDS vs. 3/19 PwE felt "*going crazy*" (p = 0.047) [36]. ▪ 43/223 PwFDS vs. 14/128 PwE reported the feeling of

			aggression/irritability [58]. ▪ 4/75 PwFDS mentioned anger or irritability during seizures [4].	consciousness and even began to lash out in anger.") [4]. ▪ Patients reported episodes of aggression (e.g., "*I start slurring my words a bit and I start getting extremely aggressive.*") [68]. ▪ Some patients felt a sense of relief (e.g., "*it was almost like all that fear had gone, almost like a relief feeling*") [21].	frustration, and 18/223 PwFDS vs. 8/128 PwE expressed depression [39]. ▪ 1/10 PwFDS vs. 0/30 reported anger, and 1/10 PwFDS vs. 1/30 PwE described embarrassment before seizures [22].
Consciousness	*Awareness*	N = 14 [4, 22, 23, 32, 33, 35, 40, 45, 56, 58, 59, 67, 68, 70]	▪ 261/372 PwFDS reported loss of consciousness or awareness during their seizures [58]. ▪ 72/100 PwFDS "always", "frequently" or "sometimes" agreed with the statement "*I'm conscious*" [23].	▪ Patients have written about the preserved awareness (e.g., "*I am aware of what is happening*") [4]. ▪ A similar description in a semi-structured interview is: "*I can hear what's going on around me*" [33].	▪ PwFDS (n=29, 48 seizures) scored higher on both ICI subscales than PwE (n=66, 119 seizures): mean ICI-L 5.6 vs. 3.7 and mean ICI-C 11.5 vs. 8.0, indicating greater responsiveness and more vivid ictal experiences in PwFDS vs. PwE [45].
	Unresponsiveness	N = 10 [4, 22, 23, 33, 40, 45, 47, 58, 59, 70]	▪ 275/324 reported loss of responsiveness during seizures [47].	▪ In some written accounts: "*completely aware of the conversation but I couldn't respond*" [70] ▪ A description in a semi-structured interview is: "*I can hear what's going on around me, but I can't respond and react*" [33] ▪ One patient volunteered "*I am absent and start falling down and then have convulsions. During that time, I am completely unconscious. I do not respond to pain stimuli*" [4]	▪ 1/10 PwFDS vs. 2/30 PwE reported "*aware but cannot respond*" [22]
	Dissociation	N = 11 [4, 12, 22, 23, 32-34, 39, 40, 69, 70]	▪ 20/100 PwFDS agreed with the description "*I feel as if I'm not in the living world*" [23]. ▪ 27/100 PwFDS "*During my attacks I feel as if I am outside my body*" [23]. ▪ 49/100 PwFDS endorsed "*During my attacks I feel as if I'm in a*	▪ Patients employed metaphors such as "*like the lights are on but nobody's at home*", vividly capturing the sense of outward presence despite inner detachment. [69]. ▪ In written accounts, participants used descriptions such as "*My thoughts feel mushy, not sure what is real and what I dreamt*", highlighting the blurred boundaries between reality and imagination that often accompany dissociative states. [70].	▪ 138/224 PwFDS vs. 38/130 PwE endorsed derealisation or depersonalisation symptoms ($p < 0.001$) [34]. ▪ 137/223 PwFDS vs. 37/128 PwE reported dissociative features ($p < 0.001$) [39].

			dream" [23]. ▪ 15/75 written accounts described "disconnection" [4]. ▪ 3/75 participants wrote a complete loss of identity [4].	▪ Semi-structured interviews included descriptions of dissociation, such as "*a disconnect between mind and body*", "*it was like the brain just slows down and the body functions at a normal pace*" [33]. ▪ Some patients described "disconnection" (e.g., "*I feel as if I'm separated from my body…I feel very disconnected to my body.*"), illustrating the profound sense of detachment from one's physical self [4]. ▪ A few patients reported a complete loss of identity (e.g., "*I lost all awareness of who I was*" [4]; "*not knowing who or where I am*" [32]).	
	Loss of control	N = 7 [4, 12, 21-23, 33, 40]	▪ 60/100 PwFDS endosed this item in a questionnaire "*I am aware of shaking uncontrollably during an attack.*" [23].	▪ Patients often described feeling "*vulnerable*", "*not in control*" in an interview study [33]. ▪ Patients highlighted the emotional distress when loss of control was combined with retained awareness (e.g., "*I will cry in anger during my attacks as I am aware of what is happening; I am just failing to control it and unable to respond.*"), capturing the frustration and helplessness in such episodes [4]. ▪ One participant wrote: "*I'm losing control of my body, I become tense, so tense I'm shivering*", conveying an overwhelming bodily tension associated with loss of voluntary control [4].	▪ 2/10 PwFDS vs. 4/30 PwE reported "*loss of control*" before their seizures [22]. ▪ PwFDS described seizures as entering a state/place with some retained agency (e.g., "*back in that hell hole*"), reflecting partial awareness despite impaired control whereas PwE tended to describe seizures as hostile, independent agents (e.g., "*Bob just paid me a visit*"), emphasising abrupt and total loss of control [32].
Cognitive symptoms	*Confusion*	N = 8 [4, 22, 23, 35, 40, 58, 62, 65]	▪ 215/372 PwFDS reported post-ictal confusion [58]. ▪ 85/100 PwFDS agreed with the statement "*I have no idea what is happening around me*" [23].	▪ Patients' descriptions of their cognitive problems illustrate how impaired cognition may feature in FDS (e.g., "*I become foggy, and thinking/memory becomes difficult.*" [4])	▪ 10/17 PwFDS vs. 3/11 PwE reported post-ictal confusion [62]. ▪ 2/10 PwFDS vs. 4/30 PwE endosed impaired thinking during seizures [22]. ▪ 3/10 PwFDS vs. 13/30 PwE experienced post-ictal

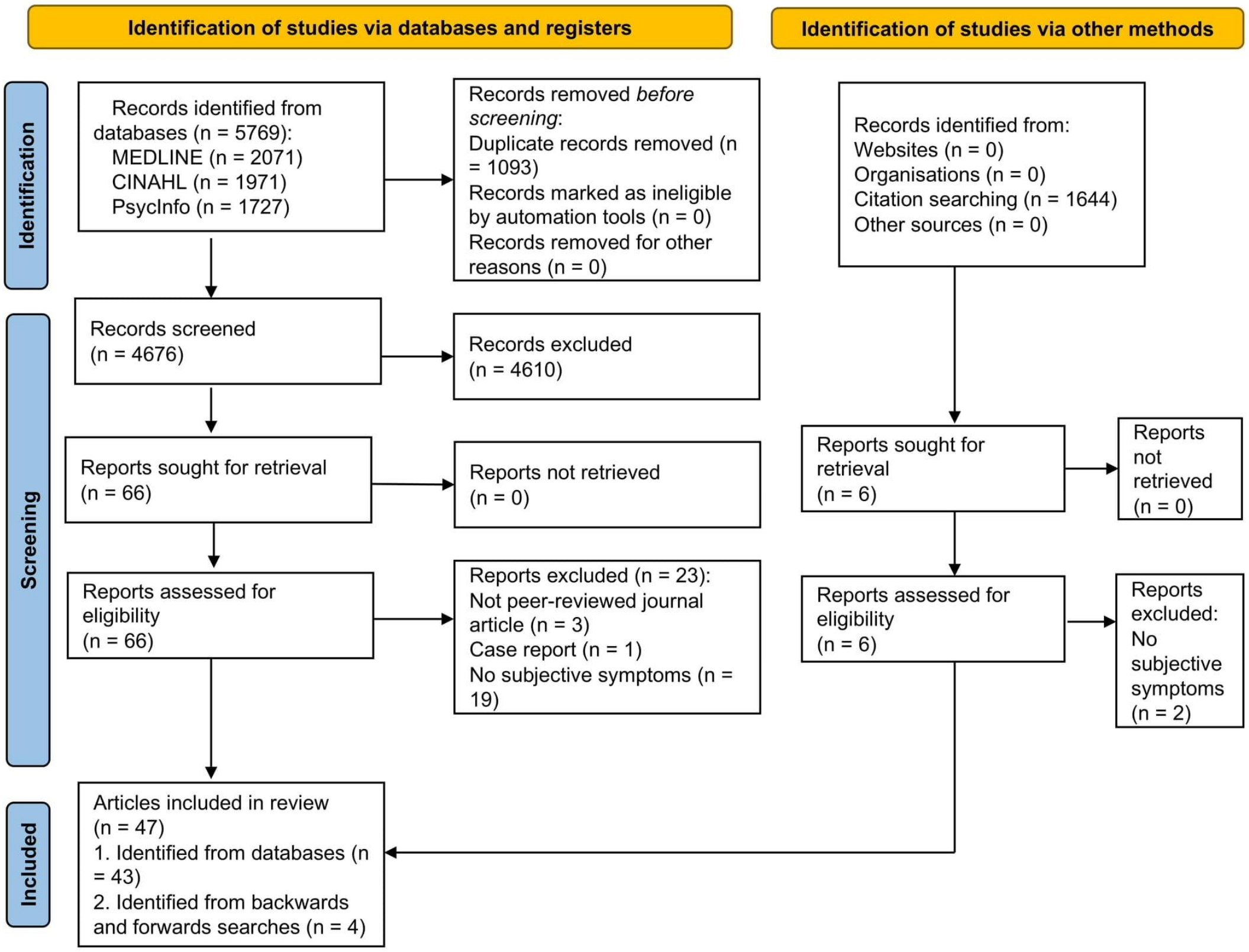
					disorientation [22].
	Memory gaps	N = 7 [4, 12, 22, 23, 33, 68, 69]	▪ 6/75 PwFDS wrote about memory loss [4]. ▪ 63/100 PwFDS endorsed the item "*Afterwards I have no idea that I have had an attack*" [23].	▪ One patient volunteered in the written accounts "*lost my short-term memory*" [4] ▪ One patient reported "*after that I don't remember nothing*" in the post-ictal phase [68]	▪ 1/10 PwFDS vs. 9/30PwE described ictal memory loss [22]. ▪ 1/10 PwFDS vs. 11/30 PwE reported amnesia after seizures [22].
	Flashbacks	N = 4 [23, 39, 41, 70]	▪ 34/100 PwFDS reported unusual memory phenomena during seizures, such as memories suddenly "*flashing*" into their minds [23]. ▪ 109/223 PwFDS described recurrent thoughts associated with their episodes [39].	▪ Some accounts described intrusive or flashback-like cognitive phenomena (e.g., "*I relive everything whilst talking others through the whole thing even though I'm not aware*") [70].	▪ 29/64 PwFDS with antecedent sexual abuse vs. 13/112 without abuse reported flashback-like intrusive memories [41]
Motor symptoms	*Vocalisation or problems with speech production*	N = 7 [4, 22, 33, 58, 62, 68, 70]	▪ 281/372 PwFDS reported ictal aphasia or speech arrest [58]. ▪ 70/372 PwFDS described vocalisation during seizures [58]. ▪ Post-ictal speech or language disturbances were present in 80/372 [58].	▪ FDS can be associated with ictal motor speech problems (e.g., "*slurring my words*") [68]. ▪ One patient reported that "*panting and stuttering*", showing how seizures may disrupt breathing and fluency of speech at the same time [33].	▪ 7/17 PwFDS vs. about 4/11 PwE endorsed the questionnaire item "*trouble speaking*" after seizures [62]. ▪ 2/10 PwFDS vs. 9/30 PwE reported pre-ictal speech/vocalisation disturbances [22]. ▪ 0/10 PwFDS vs. 3/30 PwE described ictal scream/vocalisation [22]. 2/10 PwFDS vs. 3/30 PwE expressed inability to speak during seizures [22].
	Falling and other negative motor features	N = 6 [4, 33, 48, 67, 68, 70]	▪ 4/9 PwFDS used the word "*fall*" when describing their seizures [68]. ▪ 38/75 patients wrote other "negative motor" events other than falls [4]. ▪ 10/258 PwFDS reported weakness	▪ Patients frequently used the word "*fall*" when describing their seizures, emphasising the suddenness and unpredictability of these events (e.g., "*I don't know when they're going to happen, I fall to the floor*"; "*I'll just go out anywhere and I fall to the ground*"; "*fall on the floor convulsions*") [68].	

		as an aura [48]. ▪	▪ One individual described their episodes as "*fall to the floor or just drop to the floor*" [70]. ▪ One participant stated "*it feels like I'm falling and then bang, I can't remember anything else*" [33]. ▪ Written narratives reported other "negative motor" events than falls with impaired awareness (e.g., "*I could barely walk… The next thing I remember, I was in the ambulance*") [4]. ▪ The same written narratives described "negative motor" with preserved consciousness (e.g., "*I could not move any part of my body during the blackout, but I was conscious and could hear all that was said*"), highlighting the paradoxical dissociation between intact awareness and profound motor inhibition, a feature that can be diagnostically informative in FDS [4].	
Positive motor features	N = 8 [4, 12, 21-23, 34, 40, 68]	▪ 60/100 PwFDS endorsed the item "*I am aware of shaking uncontrollably during an attack*" in the questionnaire [23]. ▪ 41/75 PwFDS mentioned ictal motor symptoms in their written accounts [4].	▪ Patients used a rich variety of expressions to describe motor experiences, such as "*sitting and start mumbling*", "*fumble around*" and "*shake*", reflecting the heterogeneity of motor manifestations [68]. ▪ Patients mentioned ictal motor symptoms in their written accounts included shaking movements, tremors, twitching motions, convulsions (e.g., "*My body began thrashing wildly, my head was jerking from left to right, and my limbs were hitting my body and the bed.*") [4].	▪ 190/224 PwFDS vs. 104/130 PwE reported trembling or shaking [34]. ▪ 7/10 PwFDS vs. 18/30 PwE reported ictal *major/minor automatisms* (this term was used by the authors) [22]. ▪ 3/10 PwFDS vs. 13/30 PwE described ictal *coordinated/complex behavior* (this term was used by the authors) [22].

Abbreviations: ICI-L = Ictal Consciousness Inventory-Level subscale; ICI-C = Ictal Consciousness Inventory-Content subscale; PPV = positive predictive value; NPV = negative predictive value. Other abbreviations as in Table 1.

Figure 1. PRISMA flow diagram

Figure 2. Themes (oval boxes) and subthemes (square boxes) of subjective FDS experiences.


Identification of studies via databases and registers
Identification of studies via other methods
Identification
Records identified from databases (n = 5769):
MEDLINE (n = 2071)
CINAHL (n = 1971)
PsycInfo (n = 1727)
Records removed *before screening*:
Duplicate records removed (n = 1093)
Records marked as ineligible by automation tools (n = 0)
Records removed for other reasons (n = 0)
Records identified from:
Websites (n = 0)
Organisations (n = 0)
Citation searching (n = 1644)
Other sources (n = 0)
Screening
Records screened (n = 4676)
Records excluded (n = 4610)
Reports sought for retrieval (n = 66)
Reports not retrieved (n = 0)
Reports sought for retrieval (n = 6)
Reports not retrieved (n = 0)
Reports assessed for eligibility (n = 66)
Reports excluded (n = 23):
Not peer-reviewed journal article (n = 3)
Case report (n = 1)
No subjective symptoms (n = 19)
Reports assessed for eligibility (n = 6)
Reports excluded: No subjective symptoms (n = 2)
Included
Articles included in review (n = 47)
1. Identified from databases (n = 43)
2. Identified from backwards and forwards searches (n = 4)

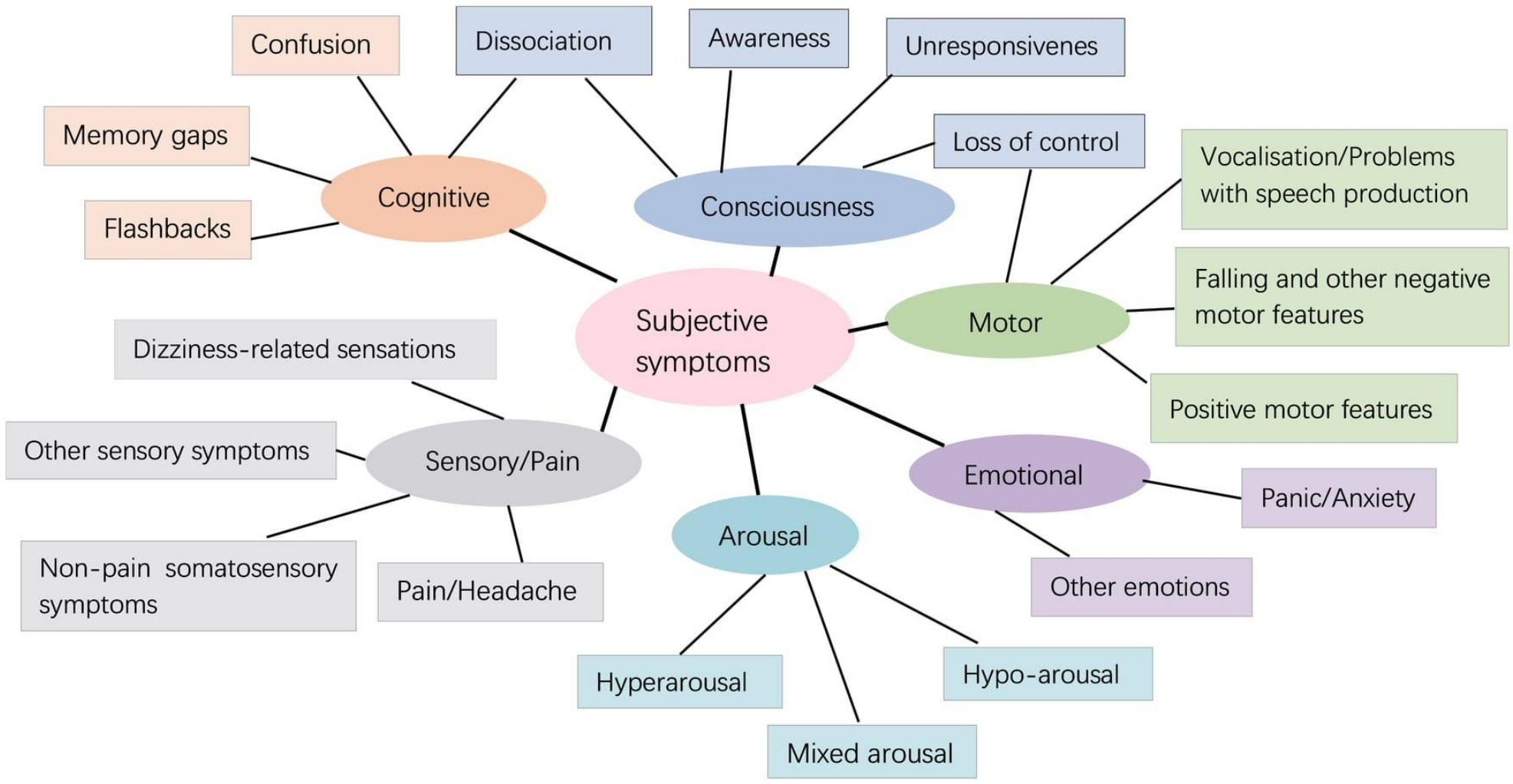

Confusion
Dissociation
Awareness
Unresponsivenes
Memory gaps
Loss of control
Vocalisation/Problems with speech production
Cognitive
Consciousness
Flashbacks
Subjective symptoms
Motor
Falling and other negative motor features
Dizziness-related sensations
Positive motor features
Other sensory symptoms
Sensory/Pain
Emotional
Panic/Anxiety
Arousal
Non-pain somatosensory symptoms
Pain/Headache
Other emotions
Hyperarousal
Hypo-arousal
Mixed arousal

Table S1

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 5
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 6
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 6, Figure 1, Table S2
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Table S2
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 6
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 6
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Table 1
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Table 1
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 6, Table S3
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Not applicable
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 7
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 7
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 7
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Not applicable
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Not applicable

Table S1

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Not applicable
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Not applicable
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Not applicable
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Figure 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Figure 1
Study characteristics	17	Cite each included study and present its characteristics.	Table 1
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Table S6
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Not applicable
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Table 1 and 2
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Not applicable
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Page 7-14
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Not applicable
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Not applicable
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Not applicable
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 14-18
	23b	Discuss any limitations of the evidence included in the review.	Page 18-19
	23c	Discuss any limitations of the review processes used.	Page 18-19
	23d	Discuss implications of the results for practice, policy, and future research.	Page 19
OTHER INFORMATION			
Registration and	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 6

Table S1

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
protocol	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 6
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Not applicable
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 19
Competing interests	26	Declare any competing interests of review authors.	Page 20
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Page 20

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

Table S2. Full search strategies

Database	Platform	Date of search	Search strategy
MEDLINE	Ovid	2025-07-01	(“functional dissociative seizure*”.mp. OR “functional seizure*”.mp. OR “dissociative seizure*”.mp. OR “nonepileptic seizure*”.mp. OR non-epileptic*.mp. OR “conversion disorder”.mp. OR “psycho* seizure*”.mp. OR “psychogenic nonepileptic seizure*”.mp. OR “non epileptic seizure*”.mp. OR PNES.mp. OR FDS.mp. OR “nonepileptic attack disorder”.mp. OR NEAD.mp. OR NES.mp. OR pseudoseizure*.mp.) AND (“subjective symptom*”.mp. OR “subjective experience*”.mp. OR “subjective description*”.mp. OR “subjective account*”.mp. OR “subjective phenomen*”.mp. OR feeling*.mp. OR perception*.mp. OR manifestation*.mp. OR complaint*.mp. OR feature*.mp. OR semiolog*.mp. OR experience*.mp. OR self-report*.mp. OR “self report*”.mp.)
PsycINFO	EBSCO	2025-07-01	TX ((“functional dissociative seizure*” OR “functional seizure*” OR “dissociative seizure*” OR “nonepileptic seizure*” OR non-epileptic* OR “conversion disorder” OR “psycho* seizure*” OR “psychogenic nonepileptic seizure*” OR “non epileptic seizure*” OR PNES OR FDS OR “nonepileptic attack disorder” OR NEAD OR NES OR pseudoseizure*)) AND TX ((“subjective symptom*” OR “subjective experience*” OR “subjective description*” OR “subjective account*” OR “subjective phenomen*” OR feeling* OR perception* OR manifestation* OR complaint* OR feature* OR semiolog* OR experience* OR self-report* OR “self report*”))
CINAHL	EBSCO	2025-07-01	TX ((“functional dissociative seizure*” OR “functional seizure*” OR “dissociative seizure*” OR “nonepileptic seizure*” OR non-epileptic* OR “conversion disorder” OR “psycho* seizure*” OR “psychogenic nonepileptic seizure*” OR “non epileptic seizure*” OR PNES OR FDS OR “nonepileptic attack disorder” OR NEAD OR NES OR pseudoseizure*)) AND TX ((“subjective symptom*” OR “subjective experience*” OR “subjective description*” OR “subjective account*” OR “subjective phenomen*” OR feeling* OR perception* OR manifestation* OR complaint* OR feature* OR semiolog* OR experience* OR self-report* OR “self report*”))

The number of records retrieved is shown in the PRISMA flow diagram (Figure 1).

Table S3 Grading thresholds

Study Design	CASP Checklist Items	Quality Rating Thresholds
Qualitative	10	High (≥8.5), Moderate (6–8), Low (<5.5) [Butler et al. [6]]
Cohort	14	High (≥12), Moderate (8.5–11.5), Low (<8)
Cross-sectional	11	High (≥9.5), Moderate (7–9), Low (<6.5)
Diagnostic accuracy	12	High (≥10), Moderate (7.5–9.5), Low (<7)

Table S4

ENTREQ Checklist

(Adapted from Tong et al., 2007)

Number	Item	Guide and Description	Location	Checked by independent reviewer
1	Aim	State the research question the synthesis addresses.	Page 5	✓
2	Synthesis methodology	Identify the synthesis methodology or theoretical framework which underpins the synthesis, and describe the rationale for choice of methodology.	Page 7	✓
3	Approach to searching	Indicate whether the search was pre-planned or iterative.	Page 6	✓
4	Inclusion criteria	Specify the inclusion/exclusion criteria (e.g. *in terms of population, language, year limits, type of publication, study type*).	Page 6	✓
5	Data sources	Describe the information sources used and when the searches conducted; provide the rationale for using the data sources.	Page 6	✓
6	Electronic search strategy	Describe the literature search.	Table S2	✓
7	Study screening	Describe the process of study screening and sifting	Figure 1	✓

	methods			
8	Study characteristics	Present the characteristics of the included studies	Table 1	✓
9	Study selection results	Identify the number of studies screened and provide reasons for study exclusion.	Figure 1	✓
10	Rationale for appraisal	Describe the rationale and approach used to appraise the included studies or selected findings	Page 6, Table S3	✓
11	Appraisal items	State the tools, frameworks and criteria used to appraise the studies or selected findings	Page 6, Table S3	✓
12	Appraisal process	Indicate whether the appraisal was conducted independently by more than one reviewer and if consensus was required.	Page 6	✓
13	Appraisal results	Present results of the quality assessment and indicate which articles, if any, were weighted/excluded based on the assessment and give the rationale.	Page 8, Table S6	✓
14	Data extraction	Indicate which sections of the primary studies were analysed and how were the data extracted from the primary studies?	Page 7	✓
15	Software	State the computer software used, if any.	Page 7	✓
16	Number of reviewers	Identify who was involved in coding and analysis.	Page 7	✓
17	Coding	Describe the process for coding of data.	Page 7	✓
18	Study comparison	Describe how comparisons were made within and across studies.	Page 7	✓
19	Derivation of	Explain whether the process of deriving the themes or constructs was	Page 7	✓

	themes	inductive or deductive.		
20	Quotations	Provide quotations from the primary studies to illustrate themes/constructs, and identify whether the quotations were participant quotations of the author's interpretation.	Table 2, Table S5, S7	✓
21	Synthesis output	Present rich, compelling and useful results that go beyond a summary of the primary studies	Page 7-14 Table 1-2	✓

Table S5. Tracing the analytical pathway from patient quotations to final thematic domains in qualitative studies: a worked example

Author, year	Illustrative patient quotations / descriptions	Interpretive coding (from quotations)	Final thematic domains
Cardeña et al., 2020[22]	*This tingling in my body.*	Paresthesias	Sensory symptoms / pain
	Exhausted after the seizures.	Fatigue	Arousal symptoms
	Experience fear, everything slows down.	Fear	Emotional symptoms
	I can respond and talk while it is happening.	Preserved responsiveness	Consciousness
	Impaired thinking.	Cognitive impairment	Cognitive symptoms
	My arm swinging.	Positive motor	Motor symptoms
Dickinson et al., 2011[67]	*I had migraines immediately following most seizures.*	Head pain	Sensory symptoms / pain
	I'm nervous.	Anxiety	Emotional symptoms
	Even sitting in my bed, I'd lose consciousness.	Loss of awareness	Consciousness
	Have seizures and then fall on the pavement.	Fall	Motor symptoms
Green et al., 2004[68]	*It's never ever changed: a headache.*	Head pain	Sensory symptoms / pain
	Complained mostly of fatigue.	Fatigue	Arousal symptoms
	I start getting extremely aggressive.	Negative emotions	Emotional symptoms
	I completely go blank.	Loss of awareness	Consciousness
	I don't remember nothing.	Memory loss	Cognitive symptoms
	I start slurring my words a bit.	Slurring	Motor symptoms
Pick et al., 2016[21]	*I feel very very tired, more worn out than before.*	Fatigue	Arousal symptoms
	It was almost like all that fear had gone, almost like a relief feeling.	Fear; Relief	Emotional symptoms
	I'm not in control.	No control	Consciousness
	I shake.	Positive motor	Motor symptoms

Plug et al., 2009[69]	*Seizures are like the lights are on but nobody's at home.*	Dissociation	Consciousness
	I can't remember.	Memory loss	Cognitive symptoms
Rawlings et al., 2017[70]	*My body hurts.*	Body pain	Sensory symptoms / pain
	Panic.	Anxiety	Emotional symptoms
	Completely aware of the conversation but I couldn't respond.	Preserved awareness with impaired responsiveness	Consciousness
	I relive everything whilst talking others through the whole thing.	Flashbacks	Cognitive symptoms
	I fall to the floor or just drop to the floor.	Fall	Motor symptoms
Rawlings et al., 2018[32]	*I wake up sometimes groggy and really weak.*	Fatigue	Arousal symptoms
	I was indeed dying.	Anxiety	Emotional symptoms
	I not knowing who or where I am.	Dissociation	Consciousness
Walsh et al., 2024[33]	*My energy will run out and tired.*	Fatigue	Arousal symptoms
	I would get more panic sensations.	Anxiety	Emotional symptoms
	I can hear what's going on around me, but I can't respond and react.	Preserved awareness with impaired responsiveness	Consciousness
	I can't remember anything else.	Memory loss	Cognitive symptoms
	I was gasping for breath, panting and stuttering like that.	Stuttering	Motor symptoms
Xue et al., 2025[4]	*It starts with a sharp, shooting pain in my forehead.*	Head pain	Sensory symptoms / pain
	My heart rate pounds.	Palpitations	Arousal symptoms
	I will feel anxious and scared.	Anxiety	Emotional symptoms
	I am aware of what is happening.	Preserved awareness	Consciousness
	I become foggy, and thinking/memory becomes difficult.	Cognitive impairment	Cognitive symptoms

I could barely walk. I could not move any part of my body	Negative motor	Motor symptoms

Table S6. Quality appraisal outcomes (5a cross-sectional studies; 5b diagnostic accuracy studies; 5c cohort studies; 5d qualitative studies)

Table S6a. Cross-sectional studies

Author	Paper title	Web link	Did the study address a clearly focused issue?	Did the authors use an appropriate method to answer their question?	Were the subjects recruited in an acceptable way?	Were the measures accurately measured to reduce bias?	Were the data collected in a way that addressed the research issue?	Did the study have enough participants to minimise the play of chance?	How are the results presented and what is the main result?	Was the data analysis sufficiently rigorous?	Is there a clear statement of findings?	Can the results be applied to the local population?	How valuable is the research?	SUMMARY
Ali F, et al. (2010)	Ictal consciousness in epilepsy and nonepileptic attack disorder.	https://doi.org/10.1016/j.yebeh.2010.08.014	1	0.5	0.5	0.5	1	0.5	1	1	1	0.5	1	8.5

Asadi-Pooya AA, et al. (2016)	Ictal pain: Occurrence, clinical features, and underlying etiologies.	https://doi.org/10.1016/j.yebeh.2016.05.006	1	0.5	0.5	0.5	0.5	0.5	1	1	1	0.5	1	8
Asadi-Pooya AA, et al. (2019)	Loss of responsiveness in psychogenic non-epileptic seizures	https://doi.org/10.1684/epd.2019.1044	1	1	0.5	0.5	1	1	1	1	1	0.5	1	9.5
Asadi-Pooya AA, et al. (2019)	Auras in psychogenic nonepileptic seizures.	https://doi.org/10.1016/j.seizure.2019.05.012	1	1	0.5	0.5	0.5	1	1	1	1	0.5	1	9
Asadi-Pooya AA, et al. (2019)	Dramatic presentations in psychogenic nonepileptic seizures	https://doi.org/10.1016/j.seizure.2019.01.019	1	1	0.5	0.5	1	1	1	1	1	0.5	1	9.5

Asadi-Pooya AA, et al. (2020)	Clinical characteristics of functional (psychogenic nonepileptic) seizures: An international retrospective study.	https://doi.org/10.1016/j.yebeh.2020.107197	1	1	0.5	0.5	1	1	1	1	1	0.5	1	9.5
Asadi-Pooya AA, et al. (2021)	Aura: epilepsy vs. functional (psychogenic) seizures	https://doi.org/10.1016/j.seizure.2021.03.026	1	1	0.5	0.5	1	1	1	1	1	0.5	1	9.5
Deli A, et al. (2021)	Distinguishing psychogenic nonepileptic, mixed, and epileptic seizures using systemic measures and reported experiences	https://doi.org/10.1016/j.yebeh.2020.107684	1	1	0.5	0.5	1	0.5	1	1	1	0.5	1	9

Galimberti CA, et al. (2003)	Patients with psychogenic nonepileptic seizures, alone or epilepsy-associated, share a psychological profile distinct from that of epilepsy patients	https://doi.org/10.1007/s00415-003-1009-0	1	1	0.5	0.5	1	0.5	1	1	1	0.5	1	9
Goldstein LH and Mellers JD (2006)	Ictal symptoms of anxiety, avoidance behaviour, and dissociation in patients with dissociative seizures	https://doi.org/10.1136/jnnp.2005.066878	1	1	0.5	1	1	0.5	1	1	1	0.5	1	9.5

Hendrickson R, et al. (2014)	Panic attack symptoms differentiate patients with epilepsy from those with psychogenic nonepileptic spells (PNES)	https://doi.org/10.1016/j.yebeh.2014.06.026	1	1	0.5	1	0.5	1	1	0.5	1	0.5	1	9
Hendrickson R, et al. (2015)	Thoughts, emotions, and dissociative features differentiate patients with epilepsy from patients with psychogenic nonepileptic spells (PNESs)	https://doi.org/10.1016/j.yebeh.2015.07.016	1	1	0.5	1	0.5	1	1	0.5	1	0.5	1	9
Ho R, et al. (2019)	Presentation of psychogenic nonepileptic seizures in	https://doi.org/10.1016/j.yebeh.2019.04.024	1	1	0.5	0.5	0.5	0.5	1	0.5	1	1	1	8.5

Hubsch C, et al. (2011)	Hawaii's ethnoracially diverse population Clinical classification of psychogenic non-epileptic seizures based on video-EEG analysis and automatic clustering	https://doi.org/10.1136/jnnp.2010.235424	1	1	0.5	0.5	1	0.5	1	0.5	1	0.5	1	8.5
Kerr WT, et al. (2019)	Reliability of reported peri-ictal behavior to identify psychogenic nonepileptic seizures	https://doi.org/10.1016/j.seizure.2019.02.021	1	1	0.5	0.5	0.5	1	1	1	1	0.5	1	9
Kerr WT, et al. (2021)	Reliability of additional reported seizure	https://doi.org/10.1016/j.yebeh.2020.107696	1	1	0.5	0.5	0.5	1	1	1	1	0.5	1	9

	manifestations to identify dissociative seizures													
Korucuk M, et al. (2018)	Semiological characteristics of patients with psychogenic nonepileptic seizures: Gender-related differences	https://doi.org/10.1016/j.yebeh.2018.10.032	1	1	0.5	0.5	1	0.5	1	1	1	0.5	1	9
Patidar Y, et al. (2013)	Clinical profile of psychogenic non-epileptic seizures in adults: A study of 63 cases.	https://doi.org/10.4103/0972-2327.112451	1	1	0.5	0.5	0.5	0.5	1	0.5	1	0.5	1	8
Rather MA, et al. (2020)	Nonepileptic attack disorder and functional	https://doi.org/10.1016/j.yebeh.2020.107028	1	1	0.5	0.5	1	0.5	1	1	1	0.5	1	9

	movement disorder: A clinical continuum?													
Rawlings GH, et al. (2017)	Panic symptoms in transient loss of consciousness: Frequency and diagnostic value in psychogenic nonepileptic seizures, epilepsy and syncope	https://doi.org/10.1016/j.seizure.2017.03.015	1	1	0.5	0.5	1	1	1	1	1	0.5	1	9.5
Reuber M, et al. (2016)	Value of patient-reported symptoms in the diagnosis of transient loss of consciousness	https://doi.org/10.1212/WNL.0000000000002948	1	1	0.5	0.5	1	1	1	1	1	0.5	1	9.5

Reuber M, et al. (2011)	Psychogenic nonepileptic seizure manifestations reported by patients and witnesses	https://doi.org/10.1111/j.1528-1167.2011.03162.x	1	1	0.5	0.5	1	1	1	1	1	0.5	1	9.5
Rosso BI, et al. (2021)	Usefulness of a new semiological classification for characterizing psychogenic nonepileptic seizures	https://doi.org/10.1590/0004-282x-anp-2019-0171	1	1	0.5	0.5	1	1	1	1	1	0.5	1	9.5
Sawchuk T, et al. (2020)	Clinical characteristics of psychogenic nonepileptic seizures across the lifespan: An international	https://doi.org/10.1016/j.yebeh.2019.106705	1	1	0.5	0.5	1	1	1	1	1	0.5	1	9.5

	retrospective study													
Selkirk M, et al. (2008)	Clinical differences between patients with nonepileptic seizures who report antecedent sexual abuse and those who do not	https://doi.org/ 10.1111/j.1528-1167.2008.01611.x	1	1	1	0.5	1	1	1	1	1	0.5	1	10
Vein AM, et al. (1994)	Is panic attack a mask of psychogenic seizures?-A comparative analysis of phenomenology of psychogenic	https://pubmed.ncbi.nlm.nih.gov/7988943/	1	1	0.5	0.5	0.5	0.5	1	1	1	0.5	1	8.5

	seizures and panic attacks												
Vilyte G, et al. (2024)	Functional seizure semiology and classification in a public and private hospital	https://doi.org/10.1016/j.seizure.2024.09.020	1	1	0.5	0.5	0.5	1	1	1	1	0.5	1	9
Wang CY, et al. (2023)	Clinical manifestations of psychogenic non-epileptic seizures in children: Experiences from a single center	https://doi.org/10.1016/j.pedneo.2021.09.008	1	1	0.5	0.5	0.5	0	1	0.5	1	0.5	1	7.5
Watson NF, et al. (2002)	The experience of earthquakes by patients	https://doi.org/10.1046/j.1528-1157.2002.41801.x	1	1	0.5	0.5	1	0.5	1	1	1	0	1	8.5

	with epileptic and psychogenic nonepileptic seizures													
Whitfield A, et al. (2023)	Subjective seizure symptom reporting in functional/dissociative seizures and epilepsy: Effects of sampling technique and patient characteristics	https://doi.org/10.1016/j.yebeh.2023.109331	1	1	0.5	0.5	1	0.5	1	1	1	0.5	1	9
Witgert ME, et al. (2005)	Frequency of panic symptoms in psychogenic nonepileptic seizures	https://doi.org/10.1016/j.yebeh.2004.11.005	1	1	0.5	0.5	0.5	0.5	1	0.5	1	0.5	1	8

Table S6b. Diagnostic accuracy studies

Author	**Paper title**	**Web link**	Did the study address a clearly formulated research question?	Was there a comparison with an appropriate reference standard?	Did all patients get the diagnostic test and reference standard?	Could the results of the test have been influenced by the results of the reference standard?	Is the disease status of the tested population clearly described?	Were the methods for performing the test described in sufficient detail?	What are the results?	How sure are we about the results? Consequences and cost of alternatives performed?	Can the results be applied to your patients/the population of interest?	Can the test be applied to your patient or population of interest?	Were all outcomes important to the individual or population considered?	What would be the impact of using this test on your patients/population?	**SUMMARY**
Bianchi E,et al. (2019)	Self-reporting versus clinical scrutiny: the value of	https://doi.org/10.1016/j.yebeh.2018.11.040	1	1	0.5	0.5	0.5	0.5	1	1	0.5	1	0.5	0.5	8.5

adding questionnaires to the routine evaluation of seizure disorders. An exploratory study on the differential diagnosis between epilepsy and psychogenic nonepileptic seizures.							

Erba G, et al. (2017)	Patients' and caregivers' contributions for differentiating epileptic from psychogenic nonepileptic seizures. Value and limitations of self-reporting questionnaires: A pilot study	https://doi.org/10.1016/j.seizure.2017.11.001	1	1	0.5	0.5	0.5	0.5	1	1	0.5	1	0.5	0.5	8.5

Ward rope A, et al. (2025)	Validation of a Machine-Learning Clinical Decision Aid for the Differential Diagnosis of Transient Loss of Consciousness	https://doi.org/10.1212/cpj.0000000000200448	1	1	0.5	0.5	1	1	1	0.5	0.5	1	0.5	0.5	9

Wardrope A, et al. (2025)	Diagnostic features of functional/ dissociative seizures in the first presentation of transient loss of consciousness	https://doi.org/10.1016/j.yebeh.2025.110263	1	1	0.5	0.5	1	1	1	0.5	0.5	1	0.5	0.5	9

Table S6c. Cohort studies

Author	**Paper title**	**Web link**	Did the study address a clea	Was the cohort recruited in an accept	Was the exposure accurately meas	Was the outcome accurately meas	Have the authors identified all important	Have they taken account of the confounding	Was the follow up of subjects	Was the follow up of subj ects	What are the results of	How precise are the	Do you believe the results?	Can the results be applied to the	Do the results of this study fit	What are the implications of this study for	**SUMMARY**

			rly focused issue?	able way?	ured to minimise bias?	ured to minimise bias?	confounding factors?	factors in the design and/or analysis?	complete enough?	long enough?	this study?	results?		local population?	with other available evidence?	practice?	
Lancman ME, et al. (1993)	Psychogenic seizures in adults: a longitudinal analysis	https://doi.org/10.1016/s1059-1311(05)80141-4	1	0.5	0.5	0.5	0.5	0.5	1	1	1	0.5	1	0.5	0.5	1	10
Silva W, et al. (2001)	Clinical features and prognosis of nonepileptic seizures in a	https://doi.org/10.1046/j.1528-1157.2001.45299.x	1	0.5	0.5	0.5	0.5	0.5	1	1	1	0.5	1	0.5	0.5	1	10

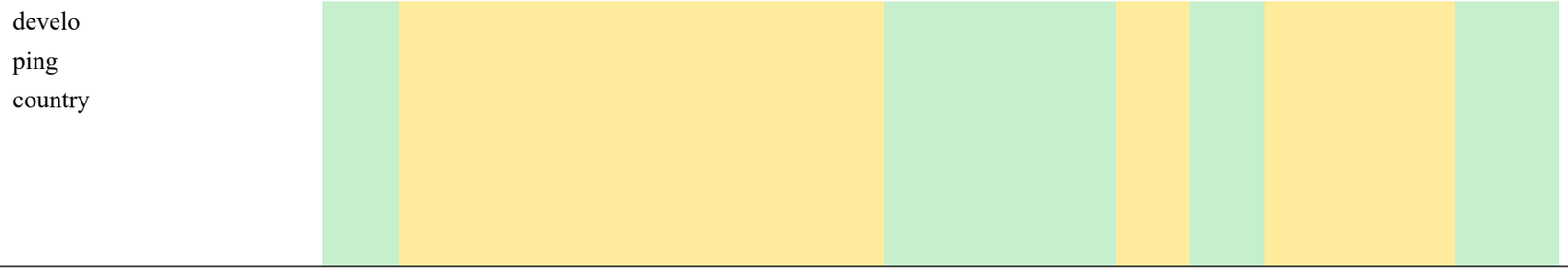


Table S6d. Qualitative studies

Author	Paper title	Web link	Was there a clear statement of the aims of the research?	Is a qualitative methodology appropriate?	Was the research design appropriate to address the aims of the research?	Was the recruitment strategy appropriate to the aims of the research?	Was the data collected in a way that addressed the research issue?	Has the relationship between researcher and participants been adequately considered?	Have ethical issues been taken into consideration?	Was the data analysis sufficiently rigorous?	Is there a clear statement of findings?	How valuable is the research?	SUMMARY

Cardena E, et al. (2020)	Differentiating psychogenic nonepileptic from epileptic seizures: A mixed-methods, content analysis study	https://doi.org/10.1016/j.yebeh.2020.107121	1	1	1	0.5	1	0	1	0.5	1	1	8
Dickinson et al. (2011)	Patients diagnosed with nonepileptic seizures: their perspectives and experiences	https://doi.org/10.1016/j.yebeh.2010.12.034	1	1	1	0	1	0	1	1	1	1	8

Green A, et al. (2004)	Illness representations among people with non-epileptic seizures attending a neuropsychiatry clinic: A qualitative study based on the self-regulation model	https://doi.org/10.1016/j.seizure.2003.09.001	1	1	1	0.5	1	0	1	1	1	1	8.5
Pick et al. (2016)	Emotion and dissociative seizures: A phenomenological analysis of patients' perspectives	https://doi.org/10.1016/j.yebeh.2015.12.010	1	1	1	1	1	0	1	1	1	1	9
Plug L, et al. (2009)	Seizure metaphors differ in patients' accounts of	https://doi.org/10.1111/j.1528-1167.2008.01798.x	1	1	1	0.5	1	0.5	1	1	1	1	9

	epileptic and psychogenic nonepileptic seizures.												
Rawlings GH, et al. (2017)	Written accounts of living with psychogenic nonepileptic seizures: A thematic analysis	https://doi.org/10.1016/j.seizure.2017.06.006	1	1	1	0.5	1	0.5	1	1	1	1	9
Rawlings GH, et al. (2018)	Written Accounts of Living With Epilepsy or Psychogenic Nonepileptic Seizures: A Thematic Comparison	https://doi.org/10.1177/1049732317748897	1	1	1	0.5	1	0.5	1	1	1	1	9

Walsh G, et al. (2024)	"This is real", "this is hard" and "I'm not making it up": Experience of diagnosis and living with non-epileptic attack disorder	https://doi.org/10.1016/j.yebeh.2024.109753	1	1	1	0.5	1	0.5	1	1	1	1	9
Xue Q, et al. (2025)	Qualitative analysis of written accounts of functional/dissociative seizures	https://doi.org/10.1016/j.yebeh.2025.110436	1	1	1	0.5	1	0.5	1	1	1	1	9

Table S7 Themes, subthemes and illustrative symptoms

Themes	Number of studies	Subthemes	Number of studies	Example Symptoms
Sensory symptoms/pain	28	Pain/Headache	24	*Headache*
		Non-pain somatosensory symptoms	17	*Paraesthesias*
		Other sensory symptoms	15	*Metallic taste*
		Dizziness-related sensations	15	*Dizziness, vertigo, lightheaded*
Arousal symptoms	24	Hyperarousal	18	*Heart palpitations, shortness of breath*
		Hypo-arousal	9	*Fatigue*
		Mixed arousal	4	*Fast breathing and weakness*
Emotional symptoms	24	Panic/Anxiety	23	*Feel frightened*
		Other emotions	8	*Anger*
Consciousness	20	Awareness	14	*Feel unaware*
		Unresponsiveness	10	*Can't respond*
		Dissociation	11	*Disconnected to the body*
		Loss of control	7	*Not in control*
Cognitive symptoms	15	Confusion	8	*Feeling disoriented*
		Memory gaps	7	*Amnesia*
		Flashbacks	4	*Flashing into mind*
Motor symptoms	14	Vocalisation or problems with speech production	7	*Slurring, stuttering*
		Falling and other negative motor features	6	*Fall to the floor*
		Positive motor features	8	*Shake*

Table S8 Study representation in themes

No.	Author	Sensory/pain	arousal	emotion	consciousness	cognition	motor
1	Ali F, et al. (2010) [45]				✓		
2	Asadi-Pooya AA, et al. (2016) [46]	✓					
3	Asadi-Pooya AA, et al. (2019) [47]				✓		
4	Asadi-Pooya AA, et al. (2019) [48]	✓	✓	✓			✓
5	Asadi-Pooya AA, et al. (2019) [49]		✓				
6	Asadi-Pooya AA, et al. (2020) [50]	✓	✓				
7	Asadi-Pooya AA, et al. (2021) [51]	✓					
8	Bianchi E, et al. (2019) [62]	✓	✓			✓	✓
9	Cardena E, et al. (2020) [22]	✓	✓	✓	✓	✓	✓
10	Deli A, et al. (2021) [29]	✓	✓				
11	Dickinson P, et al. (2011) [67]	✓		✓	✓		✓
12	Erba G, et al. (2017) [63]	✓	✓				
13	Galimberti CA, et al. (2003) [52]		✓				
14	Goldstein LH and Mellers JD (2006) [36]	✓	✓	✓			
15	Green A, et al. (2004) [68]	✓	✓	✓	✓	✓	✓
16	Hendrickson R, et al. (2014) [34]	✓	✓	✓	✓		✓
17	Hendrickson R, et al. (2015) [39]			✓	✓	✓	
18	Ho R, et al. (2019) [13]						
19	Hubsch C, et al. (2011) [44]	✓		✓			
20	Kerr WT, et al. (2019) [53]	✓	✓				
21	Kerr WT, et al. (2021) [54]	✓					
22	Korucuk M, et al. (2018) [14]						
23	Lancman ME, et al. (1993) [65]	✓				✓	

24	Patidar Y, et al. (2013) [55]	✓					
25	Pick S, et al. (2016) [21]		✓	✓	✓		✓
26	Plug L, et al. (2009) [69]				✓	✓	
27	Rather MA, et al. (2020) [56]	✓			✓		
28	Rawlings GH, et al. (2017) [70]	✓		✓	✓	✓	✓
29	Rawlings GH, et al. (2018) [32]		✓	✓	✓		
30	Rawlings GH, et al. (2017) [20]			✓			
31	Reuber M, et al. (2016) [40]	✓	✓	✓	✓	✓	✓
32	Reuber M, et al. (2011) [23]	✓	✓	✓	✓	✓	✓
33	Rosso BI, et al. (2021) [57]	✓					
34	Sawchuk T, et al. (2020) [15]						
35	Selkirk M, et al. (2008) [41]					✓	
36	Silva W, et al. (2001) [66]		✓	✓			
37	Stone J and Carson AJ (2013) [12]	✓	✓	✓	✓	✓	✓
38	Vein AM, et al. (1994) [37]			✓			
39	Vilyte G, et al. (2024) [58]	✓	✓	✓	✓	✓	✓
40	Walsh G, et al. (2024) [33]		✓	✓	✓	✓	✓
41	Wang CY, et al. (2023) [59]	✓	✓	✓	✓		
42	Wardrope A, et al. (2025) [35]	✓	✓	✓	✓	✓	
43	Wardrope A, et al. (2025) [64]		✓	✓			
44	Watson NF, et al. (2002) [60]	✓					
45	Whitfield A, et al. (2023) [16]						
46	Witgert ME, et al. (2005) [61]			✓			
47	Xue Q, et al. (2025) [4]	✓	✓	✓	✓	✓	✓