**Supplementary Table 1:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Systematic review key terms.* | | | | | |
|  | **Concept 1** | | **AND** | | **Concept 2** |
| Theme | Condition | |  | | Treatment |
| Key words | Functional seizure\* OR hysterical seizure\* OR psychogenic non$epileptic seizure\* OR dissociative seizure\* OR pseudoseizure\* OR non$epileptic attack disorder OR non$epileptic seizure\* OR psychogenic seizure\* OR nonepileptic OR PNES OR NES OR NEAD | |  | | *Psychotherapy OR psychological therapy OR* *psychological treatment OR psychological intervention OR therapy* |
|  | |  | |  | |
|  | | **Inclusion** | | **Exclusion** | |
| Population | | Adults (≥16 years) with a diagnosis of FDS. | | Samples with a majority proportion of patients who are (i) under the age of 16; or (ii) have a mixed seizure disorder (FDS and epilepsy). | |
| Intervention | | Psychological treatment such as CBT, psychodynamic psychotherapy, psychoeducation, including behavioural interventions. Delivered on a 1:1 or group basis with patients; in person or remotely. | | Solely focusing on non-psychological treatment, which was not the aim of this study. | |
| Comparison | | Any comparison group | | - | |
| Outcome | | Assessing a seizure related outcome | | Non-seizure related outcome. | |
| Other | | Published after the year 1990. | | Case study, single-case experimental studies. Not published in English. | |

CBT = Cognitive behavioural therapy: FDS = Functional / dissociative seizures: NEAD = Nonepileptic attack disorder; NES = Nonepileptic seizures; PNES = Psychogenic nonepileptic seizures

**Supplementary Table 2:**

|  |  |
| --- | --- |
| *Treatment and study characteristics for data extraction and moderation analysis* | |
| Format | Treatments will be coded as (i) individual, (ii) group, or (iii) mixed. |
| Delivery | Treatments will be coded as (i) inpatient, (ii) outpatient, or (iii) tele-conferencing |
| Modality | Treatment type/modality code will be determined by author designation/description. We will not require any use of protocols or verification of techniques used. Treatment codes will be collapsed into the following domains: (i) behavioral, (ii) relational, (iii) cognitive-behavioural, (iv) psychoeducation, (v) body focused, (vi) eclectic/other, (vii) counselling unspecified. Samples that represented multiple treatments or eclectic treatments will also be coded as other. Ambiguous treatment codes will be reviewed by three study authors (CG, GR, NP). Univariate moderator analysis will exclude the *other* treatment domain. |
| Duration | Studies will be stratified into ‘short’ (0-6 session/hours), ‘medium’ (7-13) and ‘long’ treatments (14≥). |
| Risk of Bias | All studies will be coded as ‘low’, ‘unclear’, or ‘high’ risk of bias. |
| Age | Mean of sample |
| Gender | % of sample female |
|  |  |

**Supplementary Table 3:**

*GRADE ratings of the reliability of the three meta-analyses conducted.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Risk of bias  GRADE rating  Reason | Inconsistency of results  GRADE rating  Reason | Indirectness Rating  GRADE rating | Imprecision  GRADE rating  Reason | Publication bias  GRADE rating  Reason |
| Seizure freedom occurrence meta-analysis | Low reliability.  Lack of blinding and random allocation in cohort studies. | Low reliability.  Wide variation in point estimates.  Significant tests of heterogeneity (Q and I2). | No concerns.  All studies conducted on outpatient FND clinical population. | Low reliability.  Small samples sizes.  High imprecision of estimates given evidence of wide CIs around the point estimates. | No concerns.  Statistical tests non-significant and equal distribution in funnel plots. |
| Seizure improvement meta-analysis | Low reliability.  Lack of blinding and random allocation in cohort studies. | Low reliability.  Wide variation in point estimates.  Significant tests of heterogeneity (Q and I2). | No concerns.  All studies conducted on outpatient FND clinical population.  But, variation in the duration of follow-up. | Low reliability.  Small samples sizes.  High imprecision of estimates given evidence of wide CIs around the point estimates. | No concerns.  Statistical tests non-significant. Symmetry in post treatment funnel plot. But, asymmetry in the follow-up funnel plot. |
| Seizure frequency (means and medians) meta-analysis | Very low reliability.  Lack of blinding and random allocation in cohort studies. | Low reliability.  Wide variation in point estimates.  Significant tests of heterogeneity (Q and I2).  Leave one out analysis. | No concerns.  All studies conducted on outpatient FND clinical population. | Low reliability.  Small samples sizes.  High imprecision of estimates given evidence of wide CIs around the point estimates. | Not reported. |

**Supplementary Table 4:**

*Different reporting outcomes for seizure frequency for studies identified in the systematic search.*

|  | Raw | Mean | | Median | | Freedom | | | Improvement | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Raw Data | Mean | SD | Median | IQR | cases | | % | cases | % |
| Aamir (2011) |  | ✅ | ✅ |  |  |  | |  |  |  |
| Aboukasm (1998) |  |  |  |  |  | ✅ | | ✅ |  |  |
| Ataoglu (2003) |  |  |  |  |  |  | |  | ✅ | ✅ |
| Barrett-Naylor (2018) | ✅ | ✅ | ✅ | ✅ | ✅ | ✅ | | ✅ | ✅ | ✅ |
| Barry (2008) |  |  |  |  |  | ✅ | | ✅ | ✅ | ✅ |
| Baslet (2015) | ✅ | ✅ | ✅ | ✅ | ✅ | ✅ | | ✅ | ✅ | ✅ |
| Baslet (2020) |  |  |  | ✅ | ✅ | ✅ | | ✅ | ✅ | ✅ |
| Baslet (2022) |  |  |  | ✅ | ✅ |  | |  | ✅ | ✅ |
| Ben-Naim (2020) | **Plots** | ✅ | ✅ |  |  | ✅ | | ✅ | ✅ | ✅ |
| Bhattacharjee (2022) | ✅ | ✅ | ✅ | 🟡 | 🟡 | 🟡 | | 🟡 | 🟡 | 🟡 |
| Bullock (2015) |  |  |  |  |  | ✅ | | ✅ | ✅ | ✅ |
| Chen (2014) |  |  |  |  |  |  | |  |  |  |
| Conwill (2014) |  | ✅ | ✅ |  |  |  | |  |  |  |
| Cope (2017) |  |  |  |  |  | ✅ | | ✅ |  |  |
| DeLeuran (2019) |  |  |  | ✅ | ✅ | ✅ | | ✅ | ✅ | ✅ |
| Duncan (2016) |  |  |  |  |  | ✅ | | ✅ |  |  |
| Goldstein (2004) |  | ✅ | ✅ | ✅ | **Range** |  | |  |  |  |
| Goldstein (2010) |  |  |  | ✅ | ✅ | 🟡 | | 🟡 |  |  |
| Goldstein (2020) |  |  |  | ✅ | ✅ |  | |  | ✅ | ✅ |
| Khattak (2006) |  |  |  |  |  |  | |  |  |  |
| Korman (2019) |  |  |  |  |  | ✅ | | ✅ |  |  |
| Kuyk (2008) |  | ✅ | ✅ | ✅ | **Range** | ✅ | | ✅ | ✅ | ✅ |
| LaFrance (2009) |  | ✅ | ✅ | ✅ |  | ✅ | | ✅ | ✅ | ✅ |
| LaFrance (2014) |  |  |  |  |  | ✅ | | ✅ | ✅ | ✅ |
| LaFrance (2020) |  |  |  |  |  |  | |  | ✅ | ✅ |
| Labuda (2020) |  |  |  |  |  | ✅ | | ✅ |  |  |
| Mayor (2010) |  |  |  |  |  | ✅ | | ✅ |  |  |
| Mayor (2013) |  |  |  | ✅ | ✅ | ✅ | | ✅ | ✅ | ✅ |
| McDade (1992) |  |  |  | ✅ |  | ✅ | | ✅ |  |  |
| Metin (2013) |  |  |  | ✅ | **Range** |  | |  |  |  |
| Myers (2017) | ✅ | ✅ | ✅ | ✅ | ✅ | ✅ | | ✅ | ✅ | ✅ |
| Rusch (2001) |  |  |  |  |  | ✅ | | ✅ | ✅ | ✅ |
| SantiagoTrevino (2017) | **Digitized** | ✅ | ✅ |  |  |  |  | |  |  | |
| Santos (2014) |  |  |  |  |  | ✅ | ✅ | | ✅ | ✅ | |
| Sarudiansky (2020) |  |  |  |  |  |  |  | |  |  | |
| Streltzov (2022) | ✅ | ✅ | ✅ |  |  | ✅ | ✅ | | ✅ | ✅ | |
| Thompson (2012) |  |  |  |  |  |  |  | |  |  | |
| Tilahun (2021) |  |  |  | ✅ | ✅ |  |  | |  |  | |
| Tolchin (2019) |  |  |  |  |  | ✅ | ✅ | | ✅ | ✅ | |
| Wiseman (2016) |  |  |  | ✅ | ✅ | ✅ | ✅ | | ✅ | ✅ | |
| Zaroff (2004) |  |  |  |  |  | ✅ | ✅ | | ✅ | ✅ | |

**Supplementary Table 5:**

*Summary of how seizure-related measures have been investigated across studies.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Study | Seizure frequency | Seizure severity, intensity or bothersomeness | Seizure clusters | Seizure duration |
| Aamir (2011) | Primary care givers were asked to keep the record of number of seizures per day per week from first day session until last session after 4 weeks | N/A | N/A | N/A |
| Aboukasm (1998) | Not reported | N/A | N/A | N/A |
| Ataoglu (2003) | All patients assessed by a psychiatrist. The frequency (number of seizures within the past week) of the conversive attacks were noted for each patient. | N/A | N/A | N/A |
| Baird (2017) | N/A | N/A | Cluster event was identified when three or more seizures for a given day statistically exceeded the number of expected seizures. Expected seizure rates were subjective average seizure occurrence at trial entry and observed seizure rate for the previous seven days of the day in question. | N/A |
| Barrett-Naylor (2018) | Self-reported seizure frequency | N/A | N/A | N/A |
| Barry (2008) | On study entre, weekly seizure logs were completed by participants documenting number of seizures. Participants encouraged to complete logs on a daily basis. | N/A | N/A | N/A |
| Baslet (2015) | Not reported | N/A | N/A | N/A |
| Baslet (2020) | Frequency of seizures was obtained from a weekly patient completed episode log. | Intensity of seizures was self-rated in a 0-to-10 Likert scale (with 0 representing “PNES are not intense or bothersome at all” and 10 representing “PNES are at their highest intensity of severity”). | N/A | Duration of seizure was averaged from self-report of episode duration in a patient weekly episode log. |
| Baslet (2022) | Seizure weekly frequency obtained via episode logs | Self-rated seizure intensity | N/A | N/A |
| Ben-Naim (2020) | Patients self-reported their seizure frequency upon admission and during therapy via weekly standardised seizure diaries collected and verified by their therapist. | N/A | N/A | N/A |
| Bhattacharjee (2022) | Not reported | Used the PNES scale and while this measures severity, it combines this with motor phenomena. | N/A | N/A |
| Bullock (2015) | Participants completed weekly seizure logs tracking FDS events. | N/A | N/A | N/A |
| Chen (2014) | One self-report question using a five-item Likert scale asking whether the amounts of their attacks are “much worse” to “Much better” | One self-report question using a five-item Likert scale asking whether the intensity or severity of my attack is “much worse” to “Much better” | N/A | N/A |
| Conwill (2014) | Monthly seizure frequency was recorded alongside a measure of Clinical Global Impressions scale. | N/A | N/A | N/A |
| Cope (2017) | Patients asked to give the frequency of their FDS over the past four previous weeks. | Patients asked to rate the intensity of their DFS ranging from “Extremely mild” to “Extremely severe” | N/A | N/A |
| DeLeuran (2019) | Monthly seizure frequency for the last three months prior to psychotherapy was obtained during the first session, and at the end of psychotherapy, monthly seizure frequency for the past three months was registered. | N/A | N/A | N/A |
| Duncan (2016) | Seizure outcomes collected by face to face interview with neurologist. Patients also sent out a short questionnaire asking whether they consider themselves seizure free. | N/A | N/A | N/A |
| Goldstein (2004) | Seizure frequency diary. Seizure frequency was recorded per month. | N/A | N/A | N/A |
| Goldstein (2010) | Patients were encouraged to keep seizure diaries and their seizure frequency was recorded at appointments. | N/A | N/A | N/A |
| Goldstein (2020) | Monthly seizure frequency in the previous four weeks. Seizure diaries were used, which were recorded in a database as weekly counts. Participants also asked about seizure frequency as part of a selection of self-report questions. | Seizure severity measured using the one item from the Seizure Severity Scale. Seizure bothersomeness measured using the one item from the Seizure Severity Scale. | N/A | N/A |
| Khattak (2006) | Not reported. | N/A | N/A | N/A |
| Korman (2019) | Patients were contacted via phone and asked whether their FDS have changed (yes, no or NA) and how (less frequent, more frequent, and unchanged). | Patients were contacted via phone and asked whether their FDS have changed in terms of severity (less intense, more intense, unchanged, NA). | N/A | N/A |
| Kuyk (2008) | Seizure frequency at T1 and T2 counted by nursing staff, and T3 self-reported. | N/A | N/A | N/A |
| Labuda (2020) | Assessed using self-made questionnaire. Frequency assessed using five-point Likert scale (decreased much, decreased slightly, unchanged, increased slightly, increased much). at T2, patient’s self-report was checked against nurses’ seizure documentation in the patient chart). At T3, patients also asked when their last seizure occurred. | N/A | N/A | N/A |
| LaFrance (2009) | Patients recorded their seizures prospectively using a daily seizure calendar capturing 1-week intervals. Collateral information from family informants was allowed and encouraged. | N/A | N/A | N/A |
| LaFrance (2014) | Seizure frequency was assessed daily using weekly seizure calendars, with family assisting participants in logging seizure frequency | N/A | N/A | N/A |
| LaFrance (2020) | Patients prospectively kept a daily seizure log on a 1-week diary sheet to record details of each seizure. | N/A | N/A | N/A |
| Mayor (2010) | Patients were asked the seizure frequency, as well as checking their seizure diaries when available and carers. | N/A | N/A | N/A |
| Mayor (2013) | Patients were asked how many seizures they had experienced in the last month. Patients used diaries when available or estimated seizure frequency at baseline. They were asked to keep seizure diaries during the study to base their report of seizure frequency at follow up on the diaries. | N/A | N/A | N/A |
| McDade (1992) | Not reported | N/A | N/A | N/A |
| Metin (2013) | Charters to record weekly FDS were handed out. Each week at the beginning of the sessions, patients were asked how many seizures they had in the previous week. Families were informed about these charters and were responsible for checking the accuracy of seizure frequency. | N/A | N/A | N/A |
| Myers (2017) | Change in seizure frequency (seizures per day). Frequency was noted in each session by examining the patient’s seizure logs. | N/A | N/A | N/A |
| Rusch (2001) | Not reported | N/A | N/A | N/A |
| Santiago-Trevino (2017) | Not reported | N/A | N/A | N/A |
| Santos (2014) | Initial interview script asking about seizure frequency | N/A | N/A | N/A |
| Sarudiansky (2020) | Self-report seizure frequency in the past two weeks. | N/A | N/A | N/A |
| Senf‐Beckenbach (2022) | One question asking about seizure frequency in the past year. | Measured using the Liverpool Seizure Severity Scale, which is a 20-item measure. | N/A | N/A |
| Streltzov (2022) | Assessed by self-reported seizure frequency (number of seizures in past thirty days and past seven days). | Seizure severity was subjectively rated on a 1-10 scale, with 1 being least severe and 10 being most severe, how often seizures in past thirty days and past seven days have interfered with usual routines on a 1-5 scale with 1 indicating not at all and 5 indicating every day | N/A | N/A |
| Thompson (2013) | Self-report number and intensity of seizures since discharge via blinded telephone interview. | Self-report number and intensity of seizures since discharge via blinded telephone interview. | N/A | N/A |
| Tilhaun (2021) | Participants completed seizure diaries at home and discussed them during their in-office sessions. Patients completed measures monthly in clinic before their visit or at home prior to their appointments. | N/A | N/A | N/A |
| Tolchin (2019) | At baseline, weekly FDS frequency was collected via semi-structured neuropsychiatric interview. Patients were asked to complete daily seizure diaries. At follow up, patients contacted by blinded interviewer to assess weekly FDS frequency and four-week seizure freedom. | N/A | N/A | N/A |
| Wiseman (2016) | Patients were asked to self-report their FDS frequency over the month preceding the intervention on the basis of diaries, if available, or to estimate their FDS frequency in the past month if not. | N/A | N/A | N/A |
| Zaroff (2004) | Five-item questionnaire designed for the purpose of determining seizure frequency. | N/A | N/A | N/A |

**Supplementary Table 6:**

*Clinical outcomes for seizure severity measures. Pre and post-treatment data are expressed in terms of the mean and standard deviation of the number of seizures experienced. The unit of temporal measurement (i.e., weeks, months) differs per study. Comparison time if not specified in the manuscript is approximated based on available information.*

|  | | Comparison | Pre | | | Post | | | p |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| N | Mean | SD | N | Mean | SD |  |
| Baslet (2020) | Start of treatment to post-intervention  (3 months) | | 26 | 5.6 | 2.1 | 26 | 3.7 | 2.7 | < 0.012 |
| Baslet (2022) | Start of treatment to follow-up  (3-6 months post-intervention/  6–9-month post-treatment starting) | | 26 | 6.0 | 2.0 | 14 | 2.9 | 2.8 | < 0.001 |
| Bhattacharjee (2022) | Baseline to post-intervention  (4 weeks) | | 16 | 22.1 | - | 16 | 9.1 | - | <0.001 |
| Bhattacharjee (2022) | Baseline to follow-up  (6 months post-intervention/  7-month post-intervention starting) | | 16 | 22.1 | - | 16 | 4.0 | - | <0.001 |
| Chen (2014) | Baseline to follow-up  (3 months and 6 months post-intervention) | | - | - | - | - | - | - | - |
| Cope (2017) | Start of treatment to post intervention (3 weeks) | | - | - | - | - | - | - | - |
| Goldstein (2020) | Start of treatment to end of treatment (approx. 6 months) | | 182 | 4.7 | 1.6 | 125 | 3.9 | 1.9 | - |
| Goldstein (2020) | Start of treatment to follow up  (12-months) | | 182 | 4.7 | 1.6 | 129 | 3.8 | 1.8 | - |
| Korman (2008) | Start of treatment to follow up  (not clear) | | - | - | - | - | - | - | - |
| Senf-Beckenbach (2022) | Baseline to end of treatment (approx. 12 weeks) | | 20 | 51.6 | 4.5 | 20 | 49.5 | 7.0 | - |
| Senf-Beckenbach (2022) | Baseline to end of treatment (approx. 12 weeks) | | 22 | 48.1 | 6.7 | 22 | 46.6 | 7.4 | - |
| Senf-Beckenbach (2022) | Baseline to follow-up  (approx. 6.5 months) | | 22 | 48.1 | 6.7 | 13 | 40.3 | 8.0 | - |
| Senf-Beckenbach (2022) | Baseline to follow-up  (approx. 6.5 months) | | 20 | 51.6 | 4.5 | 12 | 48.8 | 6.6 | - |
| Streltzov (2022) | Start of treatment to follow up (approx. 3 months) | | 6 | 4.7 | 1.5 | 6 | 1.9 | 1.4 | - |
| Thompson (2013) | Start of treatment to 6 week post discharge (not clear) | | - | - | - | - | - | - | - |
|  |  | |  |  |  |  |  |  |  |

**Supplementary Table 7:**

*Moderator analyses for categorical (subgroups) and continuous (meta-regression) moderators of seizure freedom rates. A reference level (denoted by ‘ref’) is allocated as the intercept for each moderator analysis.*

|  | **k** | **n** | **es (%)** | **p-value** | **95% CI** | **prediction interval** |
| --- | --- | --- | --- | --- | --- | --- |
| **Treatment Delivery Format:**  QM(df 2) = 1.4, p-val = 0.50 , I2 = 70.4% , τ2 = 0.03 | | | | | | |
| Individual (ref) | 21 | 512 | 40 |  | 0.31-0.49 | 0.1-0.73 |
| Group | 4 | 58 | 50 | 0.41 | 0.28-0.71 | 0.13-0.86 |
| Individual + Group | 3 | 103 | 30 | 0.46 | 0.11-0.54 | 0.02-0.71 |
| **Treatment Setting:**  QM(df 2) = 6.7, p-val = 0.04 , I2= 65.5 % , τ2 = 0.02 | | | | | | |
| Outpatient (ref) | 23 | 537 | 44 |  | 0.36-0.52 | 0.16-0.74 |
| Inpatient | 3 | 114 | 29 | 0.19 | 0.12-0.49 | 0.03-0.65 |
| Tele-therapy | 2 | 22 | 10 | 0.02 | 0-0.36 | 0-0.48 |
| **Overall Risk of Bias:**  QM(df 2) = 1.2, p-val = 0.34 , I2= 70.0 % , τ2= 0.02 | | | | | | |
| Low | 4 | 72 | 28 | 0.16 | 0.11-0.49 | 0.02-0.67 |
| Medium (ref) | 8 | 165 | 46 |  | 0.32-0.61 | 0.14-0.8 |
| High | 16 | 436 | 39 | 0.46 | 0.3-0.5 | 0.1-0.73 |
| **Treatment Duration:**  QM(df 2) = 0.4, p-val = 0.80 , I2= 71.5 % , τ2= 0.03 | | | | | | |
| Short (ref) | 8 | 201 | 40 |  | 0.25-0.55 | 0.07-0.78 |
| Medium | 12 | 228 | 38 | 0.58 | 0.18-0.6 | 0.05-0.79 |
| Long | 4 | 83 | 45 | 0.92 | 0.33-0.58 | 0.11-0.82 |
| **Treatment Modality:**  QM(df 3) = 3.5, p-val = 0.31, I2= 70.1%, τ2 = 0.03 | | | | | | |
| Cognitive Behavioural (ref) | 13 | 303 | 35 |  | 0.25-0.45 | 0.1-0.65 |
| Eclectic or Various | 4 | 147 | 56 | 0.04 | 0.39-0.72 | 0.24-0.86 |
| Psychoeducation | 5 | 75 | 33 | 0.86 | 0.17-0.5 | 0.06-0.66 |
| Relational | 3 | 91 | 32 | 0.82 | 0.14-0.53 | 0.05-0.67 |
| **Age (k = 25):**  QM(df 1) = 87.2, p-val = 0.940, I2= 73.43%, τ2= 0.03 | | | | | | |
| **Gender (k = 23):**  QM(df 1) = 56.5, p-val = 0.683­, I2= 60.99%, τ2= 0.02 | | | | | | |

**Supplementary Figure 1:**

*Forest plot of subgroup moderators included in the meta-analysis (black dashed line denotes the pooled average across all samples i.e., 40%).*

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**Supplementary Figure 2:**

*Funnel plot of seizure freedom rates at the end of treatment (pre- versus post-treatment)*

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**Supplementary Figure 3:**

*Funnel plot of seizure freedom rates at the end of treatment (follow-up)*

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**Supplementary Figure 4:**

*Funnel plot of seizure improvement rates at the end of treatment (acute treatment phase)*

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**Supplementary Figure 5**

*Funnel plot of seizure improvement rates at follow up.*

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**Supplementary Figure 6**

*Funnel plot of seizure frequency improvement based on standardised mean difference.*

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