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Behavioral and psychological treatments for NREM parasomnias: A systematic review

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ABSTRACT

Background: Non-rapid eye movement (NREM) parasomnias are often benign and transient, requiring no formal treatment. However, parasomnias can also be chronic, disrupt sleep quality, and pose a significant risk of harm to the patient or others. Numerous behavioral strategies have been described for the management of NREM parasomnias, but there have been no published comprehensive reviews. This systematic review was conducted to summarize the range of behavioral and psychological interventions and their efficacy.

Methods: We conducted a systematic search of the literature to identify all reports of behavioral and psychological treatments for NREM parasomnias (confusional arousals, sexsomnia, sleepwalking, sleep terrors, sleep-related eating disorder, parasomnia overlap disorder). This review was conducted in line with PRISMA guidelines. The protocol was registered with PROSPERO (CRD42021230360). The search was conducted in the following databases (initially on March 10, 2021 and updated February 24, 2023): Ovid (MEDLINE), Cochrane Library databases (Wiley), CINAHL (EBSCO), PsycINFO (EBSCO), and Web of Science (Clarivate). Given a lack of standardized quantitative outcome measures, a narrative synthesis approach was used. Risk of bias assessment used tools from Joanna Briggs Institute.

Results: A total of 72 publications in four languages were included, most of which were case reports (68%) or case series (21%). Children were included in 32 publications and adults in 44. The most common treatment was hypnosis (33 publications) followed by various types of psychotherapy (31), sleep hygiene (19), education/reassurance (15), relaxation (10), scheduled awakenings (9), sleep extension/scheduled naps (9), and mindfulness (5). Study designs and inconsistent outcome measures limited the evidence for specific treatments, but some evidence supports multicomponent CBT, sleep hygiene, scheduled awakenings, and hypnosis.

Conclusions: This review highlights the wide breadth of behavioral and psychological interventions for managing NREM parasomnias. Evidence for the efficacy of these treatments is limited by the retrospective and uncontrolled nature of most research as well as the infrequent use of validated quantitative outcome measures. Behavioral and psychological treatments have been studied alone and in various combinations, and recent publications suggest a

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trend toward preference for multicomponent cognitive behavioral therapies designed to specifically target priming and precipitating factors of NREM parasomnias.

Abbreviations

CBT	Cognitive behavioral therapy
CBT-I	Cognitive behavioral therapy for insomnia
CBT-NREMP	Cognitive behavioral therapy for NREM parasomnias
CBTp	Cognitive behavioral therapy for parasomnias
CBT-p	Cognitive behavioral therapy for parasomnia
CBTs-a	Cognitive behavioral therapy for stress/anxiety
COMISA	Comorbid insomnia and sleep apnea
CPAP	Continuous positive airway pressure
DASS-21	Depression Anxiety Stress Scale
DOA	Disorders of arousal
EMDR	Eye movement desensitization and reprocessing
ESS	Epworth Sleepiness Scale
GERD	Gastroesophageal reflux disease
HADS	Hospital Anxiety and Depression Scale
ICSD-3	International Classification of Sleep Disorders Third Edition
IRT	Imagery rehearsal therapy
ISI	Insomnia Severity Index
MBSR	Mindfulness-based stress reduction
MFI	Multi-dimensional Fatigue Inventory
NREM	Non-rapid eye movement
PADSS	Paris Arousal Disorders Severity Scale
PLMD	Periodic limb movement disorder
PLMS	Periodic limb movements of sleep
POD	Parasomnia overlap disorder
PROMIS ACA	Patient Reported Outcomes Measurement Information System Applied Cognitive Abilities
RCT	Randomized controlled trial
RLS	Restless legs syndrome
SRED	Sleep-related eating disorder
STAI	State-trait anxiety inventory
WSAS	Work and Social Adjustment Scale

1. Introduction

Non-rapid eye movement (NREM) parasomnias, as defined in the International Classification of Sleep Disorders Third Edition (ICSD-3) [1], consist of the disorders of arousal—sleepwalking, sleep terrors, and confusional arousals—and sleep related eating disorder (SRED). NREM parasomnias also include sleep related abnormal sexual behaviors, also known as sexsomnia, which are typically considered a variant of confusional arousals, as these behaviors do not usually involve leaving the bed [2]. NREM parasomnias occur during a partial arousal from deep NREM sleep, typically in the first third of the night when N3 predominates. NREM parasomnias occur during the transition from N3 to wakefulness, though it has been postulated that sleep terrors may actually occur during transitions from N3 to REM [3]. During a parasomnia, individuals exhibit features of wakefulness including speaking or performing complex behaviors (walking, cooking, driving, etc.) despite having little or no conscious awareness and later recall of those behaviors. Sleepwalking, sleep terrors, and confusional arousals are most common in childhood and typically remit by adolescence [4]. In contrast, sexsomnia and SRED are more likely to have their onset in adulthood [5–8]. The estimated lifetime prevalence is 6.9% for sleepwalking, 10% for sleep terrors, 18.5% for confusional arousals, 7.1% for sexsomnia, and 4.5% for sleep related eating [9–11]. Compared to other sleep disorders, research on NREM parasomnias is scarce and clinical management is based largely on case reports and case series rather than formal treatment guidelines [2,8].

Although there are no formal practice guidelines for the treatment of these disorders, nonpharmacological strategies are generally preferred as an initial step, especially in pediatric parasomnias; there is little high-quality evidence for pharmacological treatment of NREM parasomnias. Furthermore, drugs are frequently not fully effective and have side effects, and patients should be informed that such medications are being used off-label. For many individuals—particularly in childhood when parasomnia episodes are generally mild and are likely to recede naturally with time—no treatment is required beyond reassurance and safety advice (according to one study [12], sleepwalking and sleep terrors remitted by age 13 for 75.9% and 93.3% of children, respectively). However, treatment is indicated when symptoms are severe, distressing, cause significant sleep disruption, or create a risk of harm to the patient or others. Recommendations which commonly appear in previously published non-systematic reviews include ensuring safety, providing reassurance of the time-limited and benign nature of symptoms, improving sleep hygiene, and addressing priming and precipitating factors [2,4,5,7,8,13–18]. Scheduled awakenings are recommended particularly for the treatment of pediatric NREM parasomnias [2,5,17–19]. Other important considerations include discontinuing medications that can provoke or aggravate NREM parasomnias (e.g., zolpidem) and treating comorbid sleep disorders (e.g., insomnia, RLS, PLMD, OSA) which could contribute to parasomnias [2,18,20]. However, no systematic reviews have been undertaken to synthesize the evidence for NREM parasomnia interventions. As a consequence, there is a gap in the literature regarding the use of behavioral and psychological techniques, including which types have been used, their efficacy, and the quality of evidence to support these techniques. To address this gap, we conducted a systematic review in order to identify the breadth and efficacy of behavioral and psychological interventions for NREM parasomnias. Specifically, this review aimed to (a) describe the range of behavioral and psychological interventions which have been used across the lifespan for NREM parasomnias, (b) examine the effect of these interventions on parasomnia frequency and severity, and (c) examine the quality of evidence to support behavioral and psychological interventions for NREM parasomnia. Results of this review will provide a summary of the evidence for behavioral and psychological treatments and identify opportunities for future research in the treatment of NREM parasomnias.

2. Methods

The protocol for this systematic review was prospectively registered with PROSPERO (CRD42021230360).

2.1. Eligibility criteria

Given the absence of any prior systematic reviews on this topic and the expected small number of randomized controlled trials (RCTs), inclusion criteria were intentionally broad in order to capture any published examples of behavioral and psychological interventions for NREM parasomnias: (1) study population diagnosed with one or more NREM parasomnia (disorders included in ICSD-3: sleepwalking, sleep terror,

confusional arousal [including sexsomnia], sleep related eating disorder) and/or with parasomnia overlap disorder (POD; co-occurring NREM parasomnia and REM behavior disorder), (2) participants received any behavioral or psychological intervention, either alone or in combination with medical intervention, (3) any type of research design including uncontrolled studies and case reports; (4) full text of publication available; and (5) for non-empiric publications (i.e., review articles and chapters), verification was obtained from author that case(s) were descriptions of real individuals rather than fictional or composite cases presented for purposes of illustration. Both behavioral and psychological interventions were included in order to capture the range of non-pharmacological and non-medical approaches that have been tested.

The following exclusion criteria were applied: (1) diagnosis of only REM parasomnia (nightmare disorder, REM behavior disorder, recurrent isolated sleep paralysis) or other parasomnia (exploding head syndrome, sleep enuresis, sleep related hallucinations, unspecified parasomnia) as classified by ICSD-3 (2) diagnosis of parasomnia due to a medical disorder or medication/substance; (3) medical intervention only; (4) abstracts; and (5) behavioral intervention limited to ensuring safety (e.g., locking windows, removing dangerous objects from house). Safety measures were excluded from designation as an intervention because they are not intended to treat or reduce parasomnia symptoms but only to prevent harm when parasomnias occur.

2.2. Search strategy and study selection

The review authors partnered with a research librarian to create a comprehensive search of the literature. The search was conducted on March 10, 2021 in the following databases: Ovid (MEDLINE), Cochrane Library databases (Wiley), CINAHL (EBSCO), PsycINFO (EBSCO), and Web of Science (Clarivate). The search was updated February 24, 2023. The search strategy (available in Appendix) included a combination of controlled vocabulary and keyword searching. All databases were searched from inception to present without the use of filters or limits. Records were downloaded and underwent multi-pass deduplication in a citation management software (EndNote) and unique records were uploaded to a screening platform (Rayyan [21]) for initial screening by two independent reviewers (JMM and KGB). This initial screening yielded 180 publications for full-text review. While reviewing those publications' citations, an additional 80 were identified for screening. Two authors (JMM and MDS) independently reviewed the full text of English publications, and a single author reviewed publications written in Dutch (MH), German (AF), or Persian (KK). Based on the full-text reviews, a total of 72 publications were included in the review (68 English, 2 Dutch, 1 German, 1 Persian). See Fig. 1 for a flow diagram summarizing the search and selection process.

2.3. Data extraction

For each of the 72 included publications, data for those in English were independently extracted by two reviewers (KGB and CW) and any discrepancies were resolved by a third reviewer (JMM). Data for publications in languages other than English were extracted by a single author (MH, AF, or KK). The following data were extracted and are summarized in Table 1: sample size, participant age range, NREM parasomnia diagnoses, behavioral and psychological treatments, other (pharmacological or medical) treatments delivered concurrently, length of follow up, and outcomes. Approaches to measuring and reporting outcomes were heterogeneous and included remittance rate, percentage improvement in symptoms, frequency of symptoms, qualitative descriptions of symptoms, and validated questionnaires. In Table 1 we report the latter when available. Otherwise, we have attempted to provide more uniformity to study outcomes by simplifying them (when possible) into categories of remission, partial remission, or no improvement.

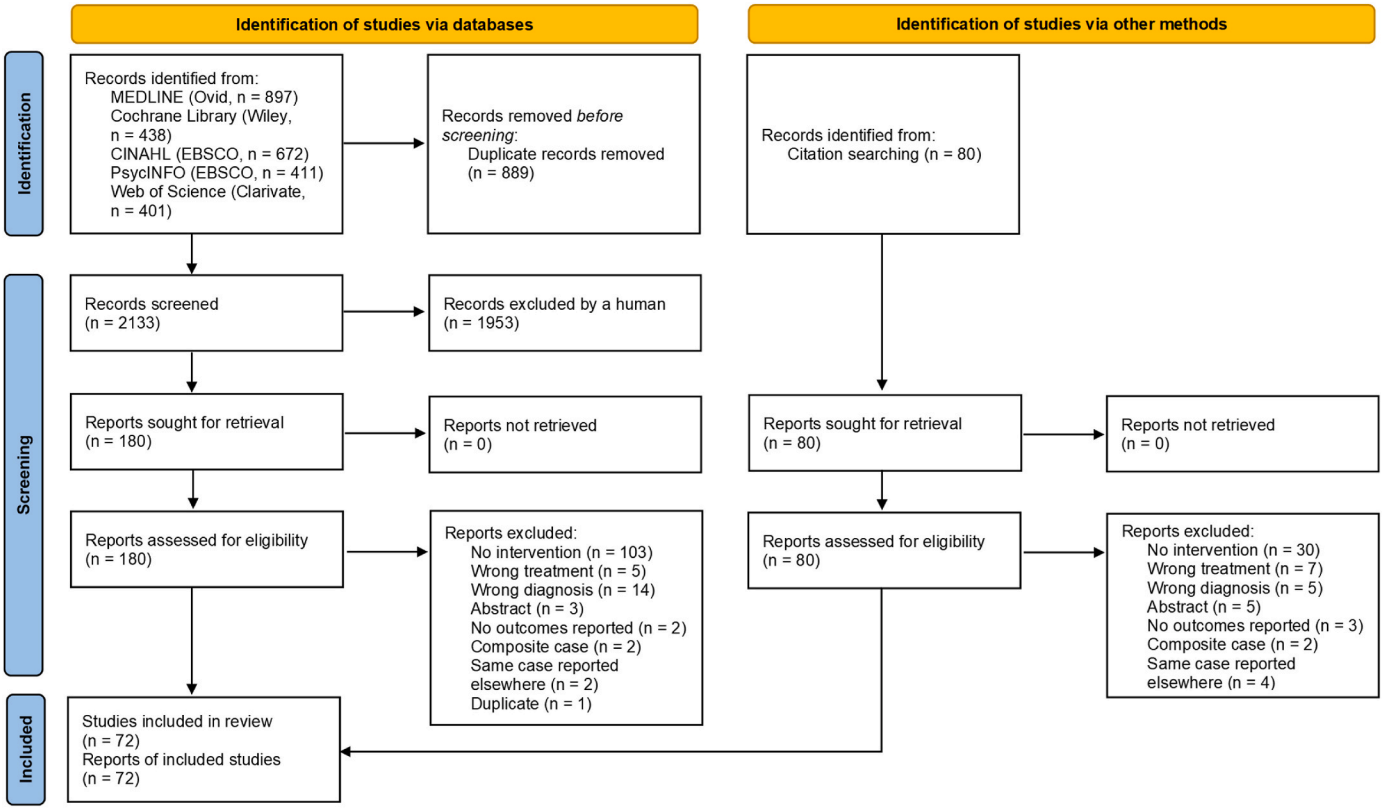

Fig. 1. Flow diagram of identification and selection process for reports included in review.

Table 1
Summary of studies included in systematic review.

Author Year	N	Age range	Diagnosis (n)	Behavioral and psychological treatments	Length of follow-up	Outcome (n/N)	Notes
Ahluwalia 2018	1	8	Sleep terrors (1)	Psychotherapy for stress Relaxation Scheduled awakenings Parent management Art Play therapy	1 yr	Partial remission (1/1)	
Ariño 2014	1[a]	28	Confusional arousals/ sexsomnia (1)	Sleep hygiene	Not reported	Partial remission (1/1)	Also received clonazepam 0.5 mg
Attarian 2013	6[a]	19–74[b]	Confusional arousals (9)[b] Sleepwalking (39)[b] Sleep terrors (28)[b] Mixed (27)[b]	Sleep hygiene CBT (relaxation, hypnosis, cognitive therapy)	6 mo-5 yr[b]	"Successfully treated" (6/6)	
Baran 2003	1	29	Confusional arousals/sleep terrors (1)	Sleep hygiene Sleep extension	Not reported	Remission (1/1)	Also received temazepam 15 mg
Brown 1997	1[a]	10	Sleep terrors (1)	Relaxation Hypnosis	Not reported	Remission (1/1)	
Clement 1970	1	7	Sleepwalking (1)	Psychotherapy Play therapy Awakening from episodes	58 weeks	Remission (1/1)	
Contreras 2019	1	16	Sexsomnia (1)	Psychotherapy Hypnosis	1 yr	Partial remission (1/1)	Prior to behavioral treatment, started CPAP ("modest reduction" in sexsomnia) and clonazepam (not tolerated)
Conway 2011	2	33–39	Sleepwalking (2)	Education Psychotherapy EMDR therapy	Post-treatment	Partial remission (2/2)	n = 1 also received clonazepam 0.3 mg for part the treatment period
Cuisinier 1991	1	34	Sleepwalking/ sleep terrors (1)	Hypnosis Stress management	Post-treatment	No improvement (1/1)	
Dahl 1993	3	6–8.5	Sleepwalking (1) Sleep terrors (1) DOA, not specified (1)	Education Sleep extension Parental support at bedtime to reduce anxiety	2 yr (n = 2) Not reported (n = 1)	Remission (2/3) Partial remission (1/3)	n = 1 also received clonazepam, carbamazepine
del Busto 2017	1	38	Sexsomnia/ sleepwalking (1)	Sleep hygiene	1 mo	Remission (1/1)	Also received melatonin 3 mg and CPAP, discontinued zolpidem
DelRosso 2018	1	5	Confusional arousals/ sleepwalking/ sleep terrors (1)	Sleep extension	Not reported	Partial remission (1/1)	Also received melatonin 3 mg
Dillahunt 1971	1	Not reported	Sleepwalking (1)	Hypnosis	5 yr	Remission (1/1)	
Drakatos 2019	512	19–88	Confusional arousals (39) Sexsomnia (15) Sleepwalking (206) Sleep terrors (72) SRED (7) Mixed (122) POD (51)	Sleep hygiene CBT-I CBTs-a MBSR	≥6 mo	Sleep hygiene only Successfully treated (68/512) Sleep hygiene + CBT or MBSR Successfully treated (32/40)	Successful treatment defined as patient reported "total resolution or satisfactory control" of symptoms. Of those who received CBT or MBSR, 15/40 had first failed another treatment (treatments not specified in manuscript).
Durand 1999	3	5–9	Sleep terrors (1) Sleepwalking/ sleep terrors (2)	Education Scheduled awakenings	1 yr	Remission (3/3)	
Durand 2002	3	3–7.5	Sleep terrors (2) Sleepwalking/ sleep terrors (1)	Education Scheduled awakenings	1 yr	Remission (3/3)	
Edmonds 1967	1	21	Sleepwalking (1)	Aversion therapy Discontinue naps	6 mo	No improvement (1/1)	
Ekambaram 2017	1	15	Sleepwalking (1)	Sleep extension	3 mo	Remission (1/1)	Also stopped taking montelukast inhibitor
Eliseo 1975	1	19	Sleepwalking (1)	Hypnosis Assertiveness training	2 yr	Remission (1/1)	
Frank 1997	3	6–12	Sleepwalking (3)	Scheduled awakenings	6 mo	Remission (2/3) Partial remission (1/3)	
Gafner 2004	1	Not reported	Sleepwalking (1)	Hypnosis	Not reported	Remission (1/1)	
Guilleminault 1987	21	Children	DOA, not specified (21)	Psychotherapy Hypnosis	≥1 yr	Psychotherapy Remission or partial remission (18/18)	Ages not reported. Psychotherapy recipients were "children and

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Table 1 (*continued*)

Author Year	N	Age range	Diagnosis (n)	Behavioral and psychological treatments	Length of follow-up	Outcome (n/N)	Notes
						Hypnosis Remission (1/3) Partial remission (1/3) No improvement (1/3)	adolescents", hypnosis recipients were "adolescents."
Guilleminault 1995	34[a]	12–63[b]	Sleepwalking (34)	Psychotherapy Hypnosis	2 mo-10 yr[b]	Remission (36/41)[b] Partial remission (5/41)[b]	n = 4 had comorbid SDB treated with CPAP or surgery. n = 34[b] also received medication (sodium phenytoin or carbamazepine)
Guilleminault 2002	6[a]	18–33	Sexsomnia (6)	Psychotherapy Supportive therapy Stress management	1–5 yr	Remission (5/6) No improvement (1/6)	n = 3 also received clonazepam n = 1 also received sertraline, lorazepam n = 1 also received clonazepam, "other benzodiazepines", zolpidem, "antidepressants", carbamazepine, valproic acid, gabapentin n = 1 also received CPAP
Guilleminault 2003	33	2–11[b]	Sleep terrors with or without sleepwalking (33)	Sleep hygiene Family therapy	6 mo	Family therapy Remission (3/6) Partial remission (1/6) No improvement (2/6)	
Guilleminault 2005	50	18–42	Sleepwalking (50)	Sleep hygiene Psychotherapy Stress management	1 yr	No improvement (8/8)	n = 5 also received medication for depression or anxiety ("SSRIs, anxiolytics, or trazodone")
Harris-Carlson 1992	20	2–10	Sleepwalking (1) Sleepwalking/ sleep terrors (9) Sleep terrors (10)	Control group Education/reassurance Treatment group Education/reassurance Scheduled awakenings Regular sleep/meal schedule	1 mo	Reduction in parasomnia frequency for both groups, no group differences	
Hartmann 1983	2	27–50	Sleepwalking/ sleep terrors (2)	Alcohol cessation Psychotherapy	1–2 yr	Partial remission (2/2)	n = 1 also received flurazepam (not tolerated) and diazepam.
Hauri 2007	19[a]	6–71[b]	Sleepwalking (11) Sleep terrors (6) SRED (2)	Hypnosis	5 yr	Sleepwalking Remission or partial remission (2/3) Sleep terrors Remission or partial remission (1/4) SRED outcomes not reported	
Hirscher 2011	1	28	Sleepwalking/ sleep terrors (1)	Education Sleep hygiene Worry time Relaxation Hypnosis Mindfulness Scheduled naps	1 yr	Partial remission (1/1)	Also received imagery rehearsal therapy for comorbid nightmares
Holka-Pokorska 2021	1	36	Sexsomnia (1)	Couples therapy Sleep extension	Post-treatment	Partial remission (1/1)	Also received trazodone for insomnia
Hoogduin 2000	3	26–37	Sleep terrors (3)	Education Hypnosis Stress management	0–1 yr	Remission (3/3)	
Hurwitz 1991	27	18–51	Sleepwalking (8) Sleep terrors (4) Sleepwalking/ sleep terrors (15)	Hypnosis	6–63 mo	Partial remission (20/27) No improvement (7/27)	
Irfan 2017	1[a]	5	Sleep terrors (1)	Reassurance Sleep extension	1 yr	Remission (1/1)	
Kales 1982	3	22–27	Sleep terrors (3)	Psychotherapy	1 yr	Remission (1/3) Partial remission (1/3) No improvement (1/3)	
Kellerman 1979	1	3	Sleep terrors (1)	Psychotherapy for anxiety Positive reinforcement	Post-treatment	Remission (1/1)	
Kennedy 2002	2[a]	30–33	Sleepwalking (1) Sleep terrors (1)	Hypnosis	5–6 mo	Partial remission (2/2)	
Khorramdel 2022	1	60	Sleepwalking (1)	Sleep hygiene Biofeedback	Post-treatment	Partial remission (1/1)	Also received CPAP and medication (aripiprazole, biperiden, doxepin, fluticasone/salmeterol spray, montelukast; all taken together before bed)
Kirkner 1956	1	26	Sleep walking (1)	Hypnosis	Not reported	Remission (1/1)	
Koe 1989	1	16	Sleep terrors (1)	Hypnosis	3 mo	Remission (1/1)	

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Table 1 (*continued*)

Author Year	N	Age range	Diagnosis (n)	Behavioral and psychological treatments	Length of follow-up	Outcome (n/N)	Notes
Kohen 1992	11	2–16	Sleep terrors (11)	Reassurance Education Hypnosis	6 mo-4 yr	Remission (11/11)	n = 4 also received imipramine 20–60 mg which was discontinued after learning hypnosis
Kohler 2015	1	16	POD (1)	Hypnosis	Post-treatment	Partial remission (1/1)	Also received clonazepam (0.5–1 mg) for 2 yr, then zolpidem for insomnia for 2 yr
Kohler 2017	4	12–77	Sleepwalking (3) Sleepwalking/ SRED (1)	Hypnosis Sleep hygiene	2 mo-6 yr	Remission (3/4) Partial remission (1/4)	n = 1 also received pramipexole and iron for PLMS
Kraft 1986	1	22	Sleep terrors (1)	Hypnosis Psychotherapy	6 mo	Remission (1/1)	
Kramer 1989	1	10	Sleep terrors (1)	Hypnosis	2 yr	Remission (1/1)	
Lask 1988	19	5–13	Sleep terrors (19)	Scheduled awakenings	1 yr	Remission (19/19)	
Limbekar 2022	110[a]	Adults	Sleepwalking (38)[b] Sleep terrors (15)[b] SRED (6)[b] Other (51)[b]	Sleep hygiene	Post-treatment	Effective (2/7) Ineffective (5/7)	38 received sleep hygiene alone but 31 were lost to follow-up.
Mazarakis 2014	1	58	Sleep terrors (1)	Sleep education	Post-treatment	Partial remission (1/1) Reduction in PSQI and STAI	Also received paroxetine 20 mg
Meyer 1975	1	24	Sleepwalking (1)	Relaxation Aversion therapy Exposure therapy for test anxiety	1 yr	Partial remission (1/1)	
Mundt 2021	3	27–30	Confusional arousals/ sleepwalking (1) Confusional arousals/sleep terrors (1) SRED (1)	Education Sleep hygiene Cognitive therapy Hypnosis Stress management Sleep extension	Post-treatment	SRED Remission (1/1) Mixed DOA Partial remission (2/2)	
Nichols 2013	1	3.5	Confusional arousals/sleep terrors (1)	Sleep hygiene Regular nap time	Post-treatment	Partial remission (1/1)	Parasomnias partially remitted after adenotonsillectomy for comorbid OSA, then further improved after changing nap time
Nugent 1984	1	20	Sleepwalking (1)	Hypnosis	9 mo	Remission (1/1)	
O'Regan 2021	46	19–73	Confusional arousals (4) Sexsomnia (2) Sleepwalking (26) Sleep terrors (24) SRED (1)	CBT-NREMP (education, reassurance, sleep hygiene, stimulus control, sleep restriction therapy, relaxation, mindfulness)	Post-treatment (n = 38) 6 mo (n = 8)	Post-treatment: significant ($p < .05$) reduction in PADSS, ISI, and HADS 6 mo: significant ($p < .05$) reduction in PADSS, ISI	
Reid 1975	6	17–21	Sleepwalking (6)	Hypnosis	Post-treatment	Remission (4/6) No improvement (2/6)	
Reid 1981	11	20–52	Sleepwalking (11)	Hypnosis	1 year	Treatment group Remission (5/7) Partial remission (2/7) Control group Remission (2/4) Partial remission (1/4) No improvement (1/4)	Both groups received hypnosis though techniques differed between groups
Richardson 1909	1	45	Sleepwalking (1)	Hypnosis	Post-treatment	Remission (1/1)	
Rocha 2020	1	37	Sleepwalking/ sleep terrors (1)	Hypnosis	Post-treatment	"Successfully treated" (1/1)	Also received carbamazepine 200 mg
Sadigh 1995	1	17	Sleep terrors (1)	Autogenic training	37 weeks	Remission (1/1)	
Schenck 1989	22[a]	18–68[c]	Sleepwalking/ sleep terrors (22)	Hypnosis	Not reported	"Substantial benefit" (14/22) No improvement (8/22)	
Schenck 1993	38[a]	18–65[b]	SRED (38)	Hypnosis Biofeedback Relaxation Phobic-stimulus therapy Psychotherapy Punishment	Not reported	Hypnosis No improvement (6/6) Biofeedback/relaxation No improvement (4/4) Phobic-stimulus therapy No improvement (2/2) Psychotherapy	

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Table 1 (*continued*)

Author Year	N	Age range	Diagnosis (n)	Behavioral and psychological treatments	Length of follow-up	Outcome (n/N)	Notes
						No improvement (n not reported) Punishment Temporary remission then relapse (1/1)	
Schenck 1995	2	17–46	Sleepwalking/ sleep terrors (2)	Hypnosis	9 mo-2.5yr	Partial remission (2/2)	n = 1 also received clonazepam 0.25 mg
Schenck 1997	1[a]	5	POD (1)	Hypnosis	6 mo-9 yr[b]	"Full/substantial control" (1/1)	
Sexton-Radek 2018	1	43	Sleep terrors (1)	"CBT focused" including education, stress management, mindfulness	3 mo	Partial remission (1/1)	Also received zolpidem 5 mg
Sexton-Radek 2021	1	33	Confusional arousals (1)	CBT-I + strategies targeting parasomnias (sleep hygiene, stress management, mindfulness, cognitive therapy)	Post-treatment	Remission (1/1)	
Sodan Turan 2015	1[a]	58	Sleep terrors (1)	Sleep hygiene	Post-treatment	No improvement (1/1)	
Taboada 1974	1	7	Sleep terrors (1)	Hypnosis	1.5 yr	Remission (1/1)	
Teplitz 1958	7	4-"young adult"	Sleepwalking (7)	Psychotherapy	"Several years"	Remission (1/7) No outcomes reported (6/7)	
Tobin 1993	1	8	Sleepwalking (1)	Scheduled awakening	1 yr	Remission (1)	
van Mierlo 2022	45[a]	18–78[b]	Confusional arousals (11)[b] Sleepwalking (32)[b] Sleep terrors (17)[b] Sleepwalking/ sleep terrors (5)[b] Parasomnia due to a medical condition (2)[b] Unspecified parasomnia (1)[b]	Sleep hygiene CBT-p (education, sleep hygiene, safety, relaxation, cognitive therapy, problem solving therapy)	2 mo	PADSS improved significantly Sleep hygiene only (n = 8, p = .042) CBT-p (n = 21, p < .001) CBT-p plus medication (n = 5, p = .047)	Two CBT-p recipients also received CPAP. Medications were gabapentin or clonazepam.
Vincent 2022	14[a]	Adults	Sleepwalking (4) Sleep terrors (10) POD (2)[d]	CBTp (education, sleep hygiene, relaxation, hypnosis, imagery rehearsal therapy, scheduled awakenings, lucid dreaming, association splitting, cognitive therapy)	2 mo	Treatment group improved (significant group × time interaction) on parasomnia frequency, parasomnia distress, actigraphy-derived nocturnal activity and sleep efficiency. Non-significant group × time interaction for sleep diary variables, fatigue (MFI), sleepiness (ESS), insomnia (ISI), work and social adjustment (WSAS), cognitive function (PROMIS ACA), depression and anxiety (DASS-21)	Ages not reported. n = 5 out of the total study sample (N = 19, including some individuals with only REM parasomnia) were also taking medication. Manuscript does not indicate how many participants with NREM parasomnias or POD were taking medication
Walton 1961	1	35	Sleepwalking (1)	Assertiveness training	21 mo	Remission (1)	
Wile 1934	3[a]	6–14[b]	Sleepwalking (3)	Auto-suggestion	3 mo-5 yr[b]	Remission (3/3)	Nightmares were the primary treatment target for the study (N = 25) and a subset (n = 3) had co-occurring sleepwalking

CBT = cognitive behavioral therapy. CBT-I = CBT for insomnia. CBT-NREMP = CBT for non-rapid eye movement parasomnias. CBTp = CBT for parasomnias. CBT-p = CBT for parasomnia. CBTs-a = CBT for stress/anxiety. CPAP = continuous positive airway pressure. DASS-21 = Depression Anxiety Stress Scale. DOA = disorders of arousal. EMDR = eye movement desensitization and reprocessing. ESS = Epworth Sleepiness Scale. HADS = Hospital Anxiety and Depression Scale. ISI = Insomnia Severity Index. MBSR = mindfulness-based stress reduction. MFI = Multi-dimensional Fatigue Inventory. PADSS = Paris Arousal Disorders Severity Scale. PLMS = periodic limb movements of sleep. POD = parasomnia overlap disorder. PROMIS ACA = Patient Reported Outcomes Measurement Information System Applied Cognitive Abilities. PSQI = Pittsburgh Sleep Quality Index. SDB = sleep disordered breathing. SRED = sleep related eating disorder. STAI = State-Trait Anxiety Inventory. WSAS = Work and Social Adjustment Scale.

[a] Number of participants in the study who met inclusion criteria for this review, if different from total sample size.

[b] Data represent the entire study sample rather than just the subset who received behavioral intervention; publication did not disaggregate data by treatment type.

[c] Data represent the entire subset of the sample with sleepwalking/sleep terrors (n = 54), some of whom did not receive behavioral treatment; publication did not disaggregate data by treatment type.

[d] These individuals would be included in the above 14 with either sleepwalking or sleep terrors but manuscript did not specify which NREM parasomnia diagnosis was given to the 2 participants with POD.

2.4. Risk of bias

Risk of bias was assessed by three reviewers (JRD, CW, MDS). Each reference was rated by two reviewers using the appropriate Joanna Briggs Institute Critical Appraisal Checklist depending on study design (i.e., Case Report, Case Series, Quasi-Experimental, or Randomized Controlled Trials) [22]. The scales ranged from 8 to 13 items, and each item was rated as "yes," "unclear," "no," or "not applicable; " each "yes" answer was scored as a 1, and all other answers were scored as 0. Decisions about scoring system and cut-off points were chosen a priori. Studies were classified as having overall Low (i.e., minimum 70% scored "yes"), Moderate (i.e., <70–50% scored "yes"), or High risk of bias (i.e., <50% scored "yes").

3. Results

The most common NREM parasomnias diagnoses reported were sleepwalking (49 publications) and sleep terrors (46 publications), while only 11 included confusional arousals, seven included sexsomnia, seven included SRED, and four included POD. Children were included in 32 publications and adults were included in 44. The majority of publications included small numbers of participants, with 38 (53%) reporting on a single case. Across the 34 publications with N > 1, the number of participants had a mean of 30.9, median of 7.5, and mode of 3. There have been only 3 RCTs to date and these have investigated hypnosis (N = 11) [23], scheduled awakenings (N = 20) [24], and a transdiagnostic cognitive behavioral therapy (CBT) for parasomnias (N = 14) [25]. As shown in Table 1, the types of interventions used to treat NREM parasomnias varied widely across the 72 publications, and some studies used a single intervention while others combined multiple interventions. The most frequently reported treatment approaches have been hypnosis followed by psychotherapy (see Fig. 2). Because a lack of standardized outcomes precluded a meta-analysis, the sections below provide a narrative synthesis of data for each type of intervention reported in the literature, including how the intervention was implemented across studies, populations with which it was used, and outcomes.

3.1. Education and reassurance

Education and reassurance are commonly provided to patients (or caregivers of children with parasomnias) for the purpose of alleviating worry about symptoms which are benign and/or transitory and to dispel misconceptions that parasomnias indicate the presence of a lurking psychopathology [26]. Among publications included in this review, 15 used education and/or reassurance as an intervention for NREM parasomnias [24,25,27–39]. Six were with pediatric patients [24,28–30,33,34] and nine were with adult patients (defined for the purpose of this review as age 18 or older) [25,27,31,32,35–39]. The most common diagnoses were sleepwalking and sleep terrors, though a handful of studies [25,36–38] included patients with confusional arousals, sexsomnia, SRED, or POD. Study types included case reports, case series, uncontrolled trials, and two RCTs [24,25]. In pediatric studies, education/reassurance was supplemented with sleep extension [28,33], scheduled awakenings [24,29,30], or hypnosis [34]. In adult studies, education was typically included in multicomponent interventions and was coupled with various combinations of sleep hygiene, hypnosis, stress management, relaxation training, cognitive therapy, mindfulness, and sleep extension.

Studies of adults generally described providing education rather than reassurance, which was mentioned in only one study [37]. In their description of a group psychotherapy (CBT for NREM parasomnias; CBT-NREMP), O'Regan and colleagues provided the most detailed explanation of the educational content provided to participants [37]. In CBT-NREMP, education comprised the majority of the first session and included information about sleep, sleep architecture, NREM parasomnia etiology, NREM parasomnia trajectories, daytime consequences, risks, and the therapeutic rationale for CBT-NREMP.

3.1.1. Outcomes

In one trial, 20 children with sleepwalking were randomized to receive parental education/reassurance alone (control group) or parental education/reassurance plus scheduled awakenings and regular sleep/meal times [24]. Both groups improved and no significant differences were found, leading the author to speculate that education/reassurance served as an active treatment rather than a control. In other studies, education/reassurance was offered in conjunction with other interventions, and it is therefore impossible to draw any conclusions about the efficacy of education/reassurance alone.

3.2. Sleep hygiene

Nineteen studies described the use of sleep hygiene, either alone or in combination with other interventions, to reduce NREM parasomnias [14,25,26,31,36–38,40–51]. These studies included disorders of arousal, SRED, and POD. With the exception of a retrospective case series and two case reports [14,42,45], the literature focused on treatment of adults. While about half of these publications did not provide details of the specific instructions given to patients, those that did emphasized consistent sleep schedules, obtaining an adequate amount of sleep, avoidance of substances (alcohol, caffeine, nicotine) and heavy meals that could interfere with sleep, avoiding exercise close to bedtime, and creating a suitable bedroom environment. Several studies (including the largest NREM parasomnia cohort studied to date, N = 512 [26]) described sleep hygiene as a standard intervention provided to all patients before initiating any other treatment [26,42,43,48]. Sleep hygiene was also a standard part of several multicomponent CBTs [25,37,38].

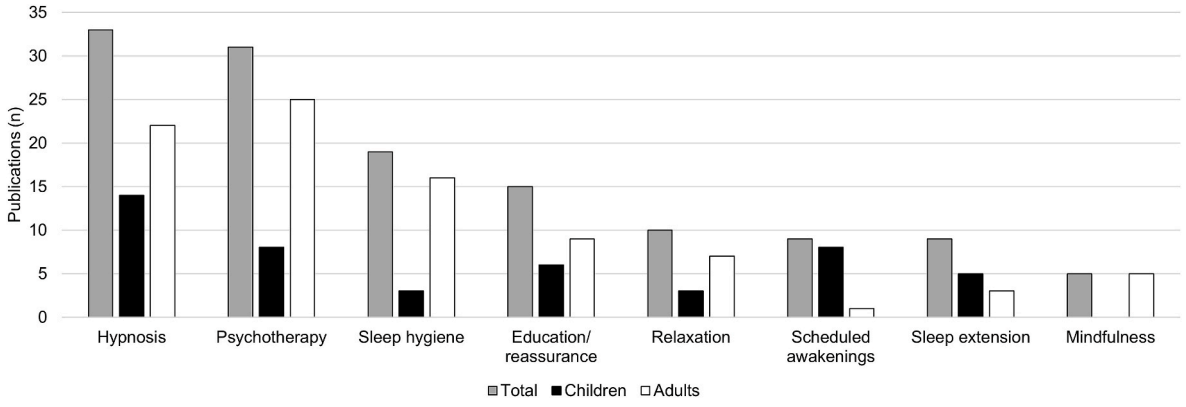

Fig. 2. Frequency of behavioral and psychological treatments in studies of NREM parasomnias.

3.2.1. Outcomes

Sleep hygiene was most commonly delivered as one of several treatment components, but several studies provided data on outcomes with sleep hygiene as a standalone intervention. In a large retrospective case series [26], partial or full remission was achieved with sleep hygiene alone for 68 of 512 individuals (13.2%). This represented 25.6% of those with confusional arousals, 17.9% of those with sleepwalking, 15.2% of those with sleep terrors, 6.5% of those with mixed parasomnias, and 3.9% of those with POD. No participants with sexsomnia or SRED improved with sleep hygiene alone. Limbekar and colleagues [48] reported that sleep hygiene alone was effective for two out of seven (28.6%) who completed follow-up in their retrospective case series (an additional 31 received only sleep hygiene but were lost to follow-up). In a trial by van Mierlo and colleagues [38], eight adults who received only sleep hygiene advice experienced a significant improvement ($p = .042$) on the Paris Arousal Disorders Severity Scale (PADSS-month). Finally, in a case report of an adult with sleep terrors, sleep hygiene alone did not improve symptoms [46].

3.3. Sleep extension

Eight publications reported on the use of sleep extension (either via naps [14,31,33] or increasing nighttime sleep [13,28,36,49,52]) as an intervention to reduce disorders of arousal. In all publications, sleep extension was implemented with a single individual. Most reports on this strategy are of children though sleep extension was also used with several adults [31,36,49].

3.3.1. Naps

Recommendations for naps were described in both adult and pediatric case reports. In the case of a 28-year-old man, 20–30 min naps were implemented along with additional behavioral strategies in order to treat comorbid sleepwalking and sleep terrors [31]. To treat a child's sleep terrors that only partially remitted after an adenotonsillectomy (for comorbid OSA), Nichols [14] recommended a regular nap schedule which coincided with their daycare schedule. Finally, Irfan described treatment for sleep terrors in a 5-year-old as consisting of providing parents with reassurance and instructions for longer naps [33].

3.3.2. Nighttime sleep

Extension of nighttime sleep was implemented in three pediatric [13,28,52] and three adult cases [36,49,53], each of whom received additional behavioral and/or pharmacological intervention. In some publications, treatment details regarding sleep extension were sparse, such as stating only that "sleep extension" [52] or "total sleep time augmentation" [49] had been implemented. Dahl [28] instructed parents to increase their child's sleep by 15 min each night, while Ekambaram [13] advised parents to ensure the child slept 8–10 h. Both also emphasized the importance of the regularity of sleep. In the treatment of confusional arousals and sleep terrors in a 30-year-old woman, Mundt recommended extending nighttime sleep by 30–60 min [36]. For sexsomnia in a 36-year-old man, Holka-Pokorska reported that the patient was instructed to increase his time in bed to 8 h [53].

3.3.3. Outcomes

Symptoms for all of the above cases fully or partly remitted with treatment. However, it is difficult to ascertain the extent to which sleep extension contributed to the improvement given that all individuals received additional behavioral and/or pharmacological interventions simultaneously. In some cases, the timeline of symptom improvement with successive interventions provides evidence for the efficacy of sleep extension. In the case described by Nichols [14], parasomnias were reduced following adenotonsillectomy and further reduced in frequency after a regular nap schedule was implemented. Irfan described a child for whom sleep terrors had begun after her naps were shortened due to beginning kindergarten and subsequently remitted after lengthening the naps [33].

3.4. Scheduled awakenings

Nine publications reported the use of scheduled awakenings for the treatment of sleep terrors or sleepwalking [24,25,29,30,54–58]. These consisted of case reports [54,55,58], case series [57], quasi-experimental studies [29,30,56], and RCTs [24,25]. A trial by Vincent and colleagues [25] was a notable exception to overall trends; their study included adult participants, while all other reports were on the treatment of children. Additionally, scheduled awakenings comprised one technique out of many taught in the CBT for parasomnias (CBTp) described by Vincent, but in pediatric studies, this intervention was more likely to be offered alone or in conjunction with only education/reassurance.

3.4.1. Variations in technique

In the earliest account of using awakenings to reduce parasomnias, published in 1970, Clement instructed the parent to wake the child at the first sign that a sleepwalking episode was beginning [55]. Eighteen years later, Lask was the first to describe a method of pre-emptive awakenings that has become the standard in subsequent research [57]. In his and all subsequent studies, the average timing of the parasomnia episodes was identified and parents were asked to intervene by waking their child before such an episode occurred. Parents were instructed to wake their children 10–15 min before the usual time of an episode [57], 15 min before [24,54], 15–30 min before [56], or 30 min before [29,30,58]. Additionally, the amount of time the child was to remain awake varied, with some protocols requiring a brief awakening only long enough to verify the child was awake [24,29,30,56], and others instructing parents to keep the child awake for around 5 min [57,58] or at least 15 min [54].

The length of treatment varied across articles, ranging from "a few times" [54] to 18 weeks [55]. Several studies tapered or increased treatment according to frequency of parasomnia episodes. For instance Durand [29,30] repeated scheduled awakenings each night until the children had seven symptom-free nights. Parents were then instructed to skip one night the first week, two nights the following week, and so on. However, nightly awakenings resumed if the child had a parasomnia. Harris-Carlson [24] similarly followed a symptom-dependent treatment course for four weeks, moving the time of the scheduled awakening 15 min later as long as parasomnia events did not occur or 15 min earlier when episodes persisted. In contrast, Lask [57] implemented seven nights of initial treatment and seven more nights in response to relapse.

3.4.2. Outcomes

Across studies with scheduled awakenings as the sole intervention, all participants improved, with 22 achieving remission of parasomnias and one achieving partial remission [56–58]. In two studies which combined education with scheduled awakenings, parasomnias remitted for all six participants [29,30]. Harris-Carlson's RCT demonstrated reduced symptom severity for both the treatment group that received scheduled awakenings and the control group, with no significant difference between groups (the treatment group also received instructions for consistent sleep/meal schedules, and both groups received education/reassurance) [24].

3.5. Relaxation

Ten studies included relaxation as an intervention for NREM parasomnias [6,25,31,37,38,41,54,59], [–] [61] typically in conjunction with other strategies, though it was used as a standalone intervention for one case report [61]. Relaxation was included in multicomponent CBT in three trials targeting adult parasomnias [25,37,38]. In other reports, relaxation training was supplemented with hypnosis and other interventions including scheduled awakenings, psychotherapy, and sleep

hygiene [6,31,41,54,59,60]. All recipients of relaxation training were adults aside from three children who were the subject of case reports [54,59,61]. Most patients were diagnosed with disorders of arousal though there were small numbers diagnosed with SRED [6,37] and POD [25]. Relaxation techniques varied in content and emphasis across studies. Some manuscripts did not provide details, but those that did described the use of progressive muscle relaxation [25,31,37,59], imagery [25,54,59], breathing exercises [25,54,59], or autogenic training [61].

3.5.1. Outcomes

In the only report of relaxation as an independent intervention, sleep terrors remitted with 8 sessions of autogenic training [61]. In a case of sleep terrors, initial treatment with relaxation was "somewhat effective" and the symptoms subsequently remitted with the addition of hypnosis [59]. Aside from those cases, limited conclusions can be drawn regarding the efficacy of relaxation. In four SRED cases, symptoms did not improve though it is unclear how many of the four received relaxation and if any received relaxation alone, as it was only noted that they received "biofeedback, acupuncture, and/or relaxation therapy" (p. 463) [6]. In individuals who received relaxation combined with other interventions, symptoms were described as "successfully treated" [41], partially remitted [31,54,60], or demonstrated significant group-level improvement in parasomnias as measured by symptom diaries [25] or the PADSS [37,38].

3.6. Hypnosis

Thirty-three studies included in this review described the use of hypnosis, including the earliest report of behavioral treatment of a NREM parasomnia published in 1909 [62]. Of these manuscripts, 14 included children [34,45,59,63–73], 22 included adults [6,23,25,31,32,36,41,45,62,65,66,70,71,74–82][6,23,25,31,32,36,41,45,62,65,66,70,71,74–82], and two case reports did not describe the age of participants [83,84]. The full range of diagnoses were represented including many studies of disorders of arousal (though for sexsomnia, only one case report) [63] and smaller numbers of studies reporting on hypnosis for SRED [6,36,45,66] and POD [25,68,72]. In the majority of studies (n = 19), hypnosis was the sole behavioral intervention, though in several of those studies participants also received medication. In the remaining studies, hypnosis was delivered in conjunction with at least one other intervention such as education/reassurance, sleep hygiene, psychotherapy, relaxation, or stress management.

3.6.1. Hypnotic techniques

Most studies provided at least a brief description of the hypnotic procedures employed, and several approaches recurred in the literature. Numerous studies [23,45,68,70,75,77,84] used a method first described in a 1971 case report by Dillahunt [83] who described teaching an arousal cue (the feeling of the feet touching the floor) that terminated the trance state and by extension, would terminate sleepwalking. Other studies focused on providing hypnotic and post-hypnotic suggestions relevant to sleep and parasomnias, for example, that the individual would not fall too quickly into a deep sleep [69,77], that the individual could control the parasomnias [62,75], that the parasomnias were no longer needed and could be abandoned [23,66], or that there would be glue holding the individual in bed until they were ready to awaken [59]. Hypnotic suggestions related to sleeping calmly through the night were common, and some studies paired this with imagery of watching a movie of oneself sleeping calmly without parasomnias [66,71,72,76]. An approach described in two studies involved eliciting parasomnias during hypnosis. Koe [67] discovered that a noise could precipitate the patient's sleep terrors, and the patient was subsequently provided with hypnotic suggestions that he would become less aware of sounds and sensations during sleep. In the approach described by Hoogduin and Hagenaars [32], sleep terrors were evoked during hypnosis as a form of exposure therapy followed by rescripting the parasomnia with hypnotic suggestions. Two case reports used hypnosis that was not specifically focused on sleep-related imagery or suggestions [73,79].

3.6.2. Outcomes

Positive or mixed results were found in most studies which included hypnosis. Eight case reports with hypnosis as the sole intervention reported full remission of parasomnia symptoms in children and adults [62,67,69,73,78,80,83,84]. Partial remission was reported in five additional cases [68,71,77], though two of those cases also received medication [68,71]. Positive though somewhat ambiguous results were also achieved for an adult with sleepwalking and sleep terrors [81] ("successfully treated") and a child with POD [72] ("full/substantial control"). In a study of adults with sleepwalking and sleep terrors [82], 14 participants reported "substantial benefit" from hypnosis and eight reported no improvement.

Mixed results were found in several other trials, including a retrospective study of patients with sleepwalking and/or sleep terrors for whom outcome data were available up to 63 months [76]. In that study, 20 individuals achieved partial remission and seven did not improve. In a longitudinal study by Hauri and colleagues [66], four participants with sleepwalking or sleep terrors were "symptom free or much improved" 18 months after treatment, compared to seven who reported "little or no improvement." Seven participants completed an additional follow-up at five years, at which time three reported being "symptom free or much improved" and four endorsed "little or no improvement." Reid's initial study reported that hypnosis for sleepwalking produced remission in four participants and no improvement in two [70]. Reid's subsequent study [23] was the only hypnosis trial with a control condition, though both the treatment and control groups received some form of hypnosis targeted to NREM parasomnias. In the active group, remission (n = 5) or partial remission (n = 2) was achieved for all. In the control group, remission (n = 2) or partial remission (n = 1) was achieved for most, while one participant did not improve.

3.7. Mindfulness

Five studies included mindfulness as an intervention with adult patients [26,31,37,39,51]. Two of the studies involved a retrospective examination of patients treated for a variety of NREM parasomnias [26,37] and three were case reports of patients with disorders of arousal [31,39,51]. In Drakatos [26], patients received a combination of sleep hygiene followed by mindfulness-based stress reduction (MBSR), whereas mindfulness was taught as one component of a larger course of treatment for the patients described in Hirscher [31], O'Regan [37], and Sexton-Radek [39,51]. The latter studies included multiple other strategies such as education/reassurance, sleep hygiene, relaxation, stress management, and CBT for insomnia (CBT-I).

3.7.1. Outcomes

As reported by Drakatos [26], MBSR successfully treated parasomnia symptoms for seven patients ("total resolution or satisfactory control" based on patient self-report) who had previously failed sleep hygiene. However, because the published data for MBSR and CBT were collapsed, it is unclear how many patients received MBSR but did not improve. Parasomnia symptoms improved for patients who received mindfulness in conjunction with other cognitive and behavioral strategies [31,37], though the effect of mindfulness per se cannot be isolated.

3.8. Psychotherapies

There were 31 articles that reported on the use of various psychotherapies. Fourteen articles were N = 1 case reports [31,39,51,53–55,60,63,74,75,85–88], nine articles were case reports or case series with two to eight patients [27,32,36,41,43,44,89–91], and eight articles presented prospective cohorts or retrospective chart reviews of patient

samples up to 512 participants [2,6,25,37,38,42,64,65] (however, in the latter studies not all participants received psychotherapy). Only one of the studies was randomized [25]. The majority of studies (n = 23) focused on treatment of adults, while six articles examined treatment of children [42,54,55,63,64,85] and two articles enrolled mixed samples of adults and children [65,91]. Diagnoses of patients who were treated with psychotherapy included nine studies of sleepwalking [27,43,55,60,65,75,87,88,91], six studies of sleep terrors [32,39,54,85,86,90], three studies of sexsomnia [53,63,89], one study of confusional arousals [51], one study of SRED [6], and 11 studies that included patients from multiple diagnostic categories [25,26,31,36–38,41,42,44,64,74]

3.8.1. Therapy types

The types of therapy used were varied. The earliest articles reported using insight-oriented therapies, consistent with the predominant therapy models at the time [44,86,90,91]. In these articles, parasomnias were thought to emerge from unresolved conflicts. Two early studies described teaching assertiveness in their treatments [75,87] while other early studies used reinforcement [85] and punishment techniques such as applying an electric current to the arm or blowing a whistle in response to the patient sleepwalking [60,88]. Psychotherapy targeting stress and anxiety was a theme present in both early and later studies [26,32,36,41,43,54,55,74,85,89]. One study utilized eye movement desensitization and reprocessing [27]. Two studies conducted among children utilized play therapy [54,55] and one study utilized family therapy [42]. Parents were also involved in the therapy and reinforcement techniques in other studies [54,85]. Couples therapy was used for a case of sexsomnia [53].

The majority of later studies utilized CBT [6,25,26,31,36–39,41,51]. CBT was used in different adaptations based on the presenting symptoms. For example, Drakatos [26] reported CBT-I was used for participants with insomnia symptoms. A number of publications have described using multicomponent CBT-based approaches to target parasomnias, including a case report by Hirscher [31], case reports by Sexton-Radek [39,51], and case reports by Mundt and Baron [36]. Additionally, O'Regan [37], van Mierlo [38], and Vincent [25] all described CBT protocols that incorporated education and behavioral skills specifically targeting parasomnias (note: for van Mierlo, additional details beyond those provided in the manuscript were obtained via personal communication with the authors). The details of psychotherapy were not described in several articles [43,64,89].

3.8.2. Outcomes

The majority of studies reported full or partial remission of parasomnias with psychotherapy. Successful treatment or remission was reported for most participants for 10 studies [26,32,41,51,55,64,65,75,85–87,89]. For example, in retrospective case reviews, Drakatos [26] reported 80% had remission or partial remission of parasomnia with CBT or MBSR treatment (results were combined for these treatments) in a mixed diagnosis adult sample, and Guilleminault [65] reported 97% had either remission or improvement in sleepwalking with psychotherapy. Eleven articles report partial remission or mixed finding in their participants [27,31,36,39,42,44,53,54,60,63,90]. Four studies reported no improvement with psychotherapy [6,43,74,88].

Two studies used validated measures to assess outcomes and reported statistically significant improvement in the PADSS [38,92] with CBT adapted for parasomnias (CBT-NREMP [37] and CBT-p[38]) among adults with mixed parasomnia diagnoses. In an RCT of another CBT for parasomnias (CBTp) [25], symptom severity and frequency (measured with sleep diaries) improved significantly for the treatment group.

3.9. Other treatments

Wile described the treatment of nightmares with "suggestion therapy" (which involved the suggestion to replace an unwanted dream with a new story) in 25 children, three of whom had comorbid sleepwalking [93]. For the group containing the three children with sleepwalking, median time to improvement occurred at a median of five months, however the manuscript did not explicitly state whether this improvement included symptoms of sleepwalking. Vincent's transdiagnostic parasomnia treatment (CBTp) included several unique elements such as imagery rehearsal therapy (IRT), lucid dreaming, and association splitting ("practicing with associating parasomnia content with a neutral or positive word") [25]. The study included a mixed sample of REM and NREM parasomnias, and participants were taught they could use IRT to rehearse a relaxing ending for both nightmares and NREM parasomnias. Details on whether and which participants implemented these particular techniques was not provided, but as described above, the group randomized to receive multicomponent CBTp demonstrated a significant improvement in parasomnia severity/frequency. Ahluwalia reported incorporating art into psychotherapy with a child with sleep terrors [54]. The treatment course also included elements of stress management, relaxation training, play therapy, and scheduled awakenings, and the child was reported to have achieved partial remission in symptoms. Schenck reported that biofeedback was unsuccessful in treating SRED [6]. Details and the exact number of participants who received biofeedback were not provided. The manuscript stated only that four patients received "biofeedback, acupuncture and/or relaxation therapy, without benefit" (p. 463). Biofeedback, in combination with sleep hygiene, CPAP, and medication, was partially successful in treating sleepwalking in a case report by Khorramdel [50].

3.10. Risk of bias

A graphical summary of risk of bias is presented in Fig. 3, generated using the *robvis* tool [94]. Most studies had a low (n = 29; 42%) or medium (n = 26; 38%) overall risk of bias. However, overall generalizability of findings was deemed low given the predominant study designs and overall methodological flaws. Three included studies (all case reports) went unrated for risk of bias because they were not presented in English, and a translation allowing review of risk of bias was unavailable. The majority of the literature used a case report (n = 49) or case series (n = 15) design, with n = 5 quasi-experimental studies and n = 3 randomized controlled trials. Primary methodological flaws for case reports and case series included limited reporting of demographic information for participants and study sites (case series only). The primary methodological weaknesses for quasi-experimental studies was lack of control group, and for randomized controlled trials was lack of masking of participants, interventionists, and/or assessors.

4. Discussion

Overall, results of our review demonstrated a large number of studies on behavioral and psychological treatments for NREM parasomnias, but results were limited by small sample sizes and lack of randomized designs. The most common NREM parasomnias studied were sleepwalking and sleep terrors, while relatively fewer publications focused on confusional arousals, sexsomnia, SRED, and POD. In the first 50 years of research included in this review (1909–1959), there were only four reports, and since 1960, an average of one publication has been added to the literature each year. The majority of publications have included small numbers of participants, with over half of the studies being case reports. The most frequently reported treatment approaches have been hypnosis and psychotherapy. The psychotherapy approaches followed historical trends, in the earlier years favoring techniques such as psychoanalysis and aversion therapy, then moving to cognitive therapy and multicomponent approaches.

Our results also demonstrated a greater number of publications including adult samples, especially among the more recent publications; all publications between 2020 and 2022 have included only adults. This focus on adults may seem surprising given the childhood preponderance of NREM parasomnias, but the substantial number of reports on adults

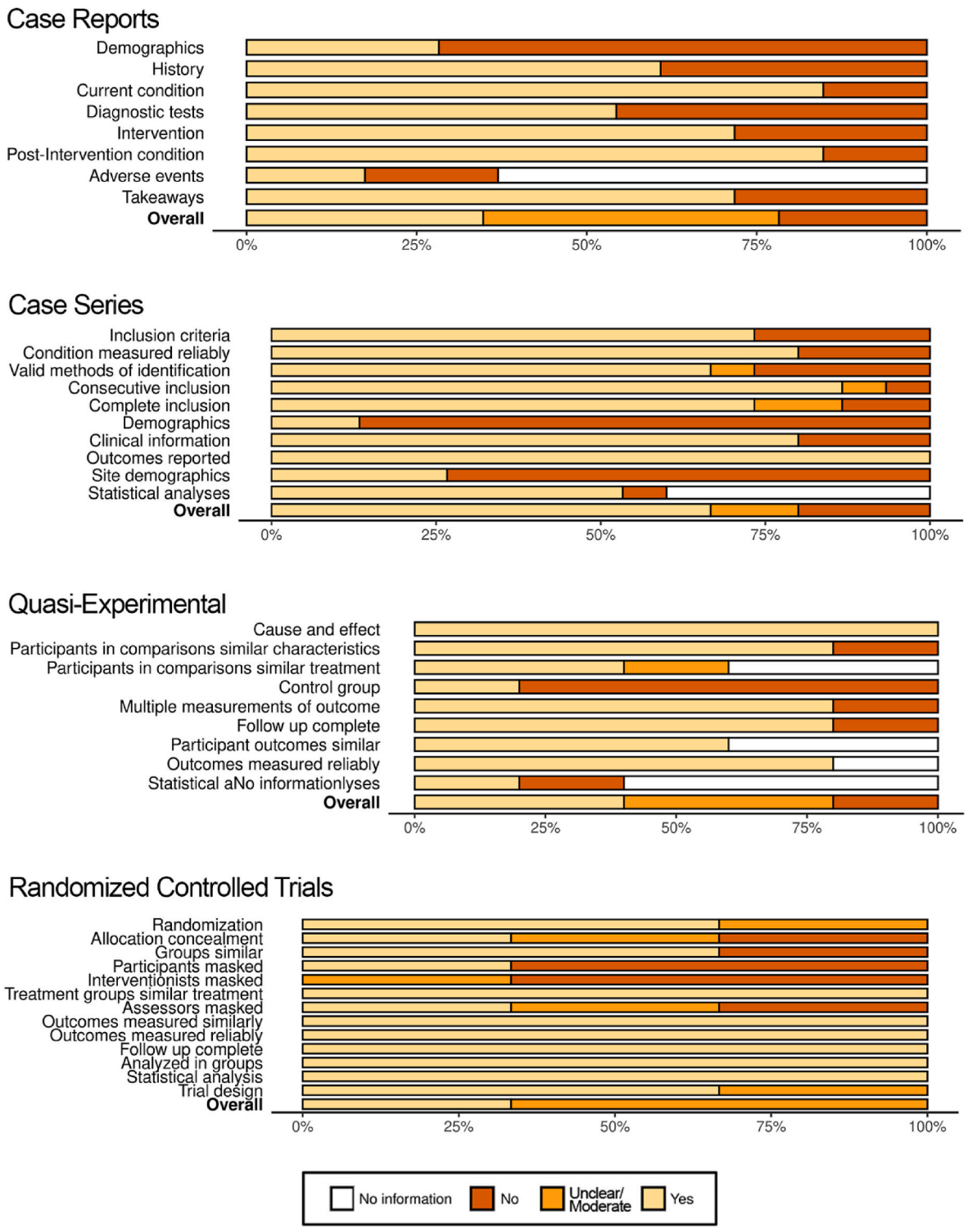

Fig. 3. Risk of bias ratings.

may reflect the fact that childhood symptoms are typically benign and outgrown with time, whereas chronic symptoms persisting into adulthood are by their very nature likely to be of greater clinical concern and more likely to necessitate treatment. Although nearly all publications reported the age and gender of participants, there was a notable lack of data on other demographic factors such as race and ethnicity. This may have been due to the retrospective nature of most reports and also reflects lack of awareness of potential disparities in prevalence or identification of parasomnias among diverse populations.

4.1. Efficacy of behavioral and psychological treatments

Despite methodological limitations, this review provides some evidence for the efficacy of various behavioral and psychological interventions, in particular multicomponent CBT, sleep hygiene, scheduled awakenings, and hypnosis. Most notably, a recent RCT of CBTp demonstrated significant improvement (compared to a control group) in parasomnia frequency and severity [25]. Similarly, CBT-NREMP [37] and CBT-p[38] were both associated with significant

improvement on the PADSS, however they were not compared to control groups. Based on a large retrospective study, there is evidence that sleep hygiene alone may be an effective treatment for some individuals with NREM parasomnias [26]. In that study, 13.2% of patients achieved partial or full remission of symptoms with sleep hygiene. Scheduled awakenings had a high rate of success in pediatric samples, though as noted above these data come primarily from uncontrolled case reports/case series and in the sole RCT [24], scheduled awakenings were not more effective than education/reassurance. Finally, there is evidence from numerous case reports and uncontrolled trials to support the use of hypnosis in treating children and adults, including some evidence for the long-term durability of improvement. The only RCT of hypnosis compared two variations of hypnotic techniques, and across groups all but one of the participants improved [23]. For other treatments (education/reassurance, sleep extension, relaxation, mindfulness), evidence for their efficacy as standalone interventions is either very limited or absent.

4.2. Multicomponent cognitive behavioral therapies

While the earliest studies tended to focus on a single intervention strategy, there has been a trend toward increasing complexity and comprehensiveness in the approach to treating parasomnias. Early examples of multidimensional CBT for parasomnias include Hirscher and Riemann's 2011 case report [31] and Attarian and Zhu's 2013 case series [41]. Most publications from the two years prior to this review (2021–2022) have described cognitive behavioral approaches with multiple components designed to specifically target priming and precipitating factors of NREM parasomnias. These include case reports, case series, and an RCT that merged behavioral and psychological methods [25,36–38,51]. Notably, all of these have included only adult patients. For a case report of confusional arousals, Sexton-Radek reported combining CBT-I with strategies to target parasomnias (including sleep hygiene, stress management, mindfulness, and cognitive therapy) [51]. In their collection of three case reports, Mundt and Baron [36] described a case-conceptualization approach to treating NREM parasomnias by integrating various behavioral strategies (such as education, sleep hygiene, relaxation, hypnosis, stress management, cognitive therapy, and sleep extension), taking into account the conceptualization, patient preferences, and skills of the provider. Studies by O'Regan [37], van Mierlo [38], and Vincent [25] described using a similar multifaceted approach but with standardized protocols (referred to as CBT-NREMP, CBT-p, and CBTp, respectively) rather than an individual case-conceptualization approach. There is substantial overlap in the components of each of these approaches, such as the inclusion of education, sleep hygiene, cognitive skills, and relaxation in all protocols.

This nascent convergence toward a multicomponent CBT specifically targeting NREM parasomnias echoes the trajectory of the development of behavioral treatments for other sleep disorders. For example, before CBT-I was a standardized treatment package, its components existed as individual approaches to addressing insomnia. Likewise, numerous variations of IRT (some including exposure to the nightmare, some including relaxation, etc.) have been studied for the treatment of nightmares, and experts in the field are currently developing a consensus CBT for nightmares (CBT-N) protocol (K. Pruiksma, personal communication, November 14, 2022.). In a more expansive transdiagnostic approach described by Harvey and Buysse [95] (Transdiagnostic Sleep and Circadian Intervention, TranS-C), CBT-I strategies are combined with approaches for treating circadian disorders and elements of interpersonal and social rhythm therapy. Based on this review, it would appear that treatment for NREM parasomnias is moving in the same direction toward favoring a treatment package (CBT) that combines multiple strategies.

4.3. Potential mechanisms of behavioral and psychological treatments

A useful model for conceptualizing the treatment of NREM parasomnias is the 3P model which describes the contribution of predisposing, priming, and precipitating factors [8,96]. Table 2 summarizes how the treatments discussed in this review might target specific factors in the 3P model (note that Table 2 does not contain an exhaustive list of factors and further elaboration of factors implicated in NREM parasomnias can be found in several recent reviews) [3,8,97]. Predisposing factors such as age and genetics operate at the trait level, and priming factors such as stress and insufficient sleep occur during the preceding day(s). Precipitating factors include things that disrupt sleep (external stimuli such as sounds, internal stimuli such as PLMS), thus triggering a partial arousal which sets the parasomnia in motion. Factors which contribute to increased or prolonged confusion during arousals are also designated as precipitating factors (hypoxemia, alcohol, cannabis, and certain medications) [8]. If priming and precipitating factors are not adequately treated, then those factors could then become perpetuating factors that promote NREM parasomnia chronicity.

The behavioral and psychological treatments represented in this review tend to primarily address the priming and precipitating factors of NREM parasomnias. However, even for unmodifiable predisposing factors such as age or family history, a behavioral intervention of education/reassurance can serve an important role in helping patients and their families to understand parasomnias and feel less anxious about the

Table 2
Behavioral and psychological treatments and their relationship to the 3P model of NREM parasomnias (predisposing, priming, and precipitating factors).

NREM parasomnia factors	Behavioral and psychological treatments
Predisposing factors	
Young age	Education/reassurance
Family history	Education/reassurance
Genes	Education/reassurance
Priming factors	
Stress	Education/reassurance
	Psychotherapy for stress/anxiety
	Relaxation
	Mindfulness
	Hypnosis
	Biofeedback
Insufficient sleep	Regular sleep schedule
	Sleep extension
	Scheduled naps
	CBT-I
	Scheduled awakenings
Alcohol	Sleep hygiene
Caffeine	Sleep hygiene
Medications	Education/reassurance
Fever	Education/reassurance
Precipitating factors	
External stimuli that trigger arousals (e.g., noise, changes in light, bed movement, physical contact)	Hypnosis Sleep hygiene (sleep environment alterations including eye mask, window coverings, ear plugs, white noise machine, not sleeping with TV or other sources of sound/light on, avoiding physical contact with bed partner or pets)
Internal stimuli that trigger arousals	
GERD	Sleep hygiene (meal timing/composition)
Apneas/hypopneas	CBT-I (for those with COMISA)
RLS/PLMS	Sleep hygiene
	Sleep extension
Increased confusion during arousals	
Alcohol	Sleep hygiene
Cannabis	Sleep hygiene
Medications	Education/reassurance

CBT-I = cognitive behavioral therapy for insomnia. COMISA = comorbid insomnia and sleep apnea. GERD = gastroesophageal reflux disease. PLMS = periodic limb movements of sleep. RLS = restless legs syndrome.

symptoms. As shown in Table 2, stress and insufficient sleep—two common priming factors—can potentially be addressed by numerous behavioral interventions. For example, studies in this review targeted stress with psychotherapy (e.g., CBT for stress/anxiety, stress management), relaxation training, mindfulness training, hypnosis, and biofeedback. Education/reassurance was also commonly provided in order to alleviate stress related to the parasomnias themselves. Studies in this review addressed insufficient sleep with scheduled naps, regularizing the sleep scheduling, extending time in bed, and CBT-I. Scheduled awakenings may also fall into the category of interventions that address insufficient sleep; the mechanism of scheduled awakenings is unknown but there is evidence that sleep duration increases when this technique is implemented [17].

Sleep hygiene recommendations target multiple priming and precipitating factors, including substances and the sleep environment. Sleep hygiene also has a potential role in reducing some comorbid conditions that can precipitate arousals. For example, avoiding eating before bed can reduce symptoms of GERD. Other sleep disorders, particularly sleep apnea and RLS/PLMD, are recognized as possible precipitating factors for NREM parasomnias [2,20]. Although no studies in this review described the use of behavioral treatment to target comorbid sleep apnea or RLS/PLMD, suggestions based on the broader sleep literature have been included in Table 2. CBT-I is recommended for individuals with comorbid insomnia and sleep apnea (COMISA) based on emerging evidence that CBT-I reduces the apnea-hypopnea index in individuals with COMISA [98]. To reduce RLS/PLMS, behavioral strategies that have been recommended include exercise, eliminating caffeine and alcohol, and obtaining sufficient sleep [99,100]. Sleep hygiene and sleep extension have therefore been included in Table 2 as potential behavioral treatments to reduce these sleep related movement disorders.

Behavioral and psychological treatments for which mechanisms remains to be clarified include hypnosis and IRT, the former being quite common in this literature and the latter having been included in only one study [25] which included patients with both REM and NREM parasomnias. As noted earlier, a 1934 study primarily targeting nightmares (but including several patients with comorbid sleepwalking) also described techniques resembling IRT [93]. Hypnosis might have efficacy for NREM parasomnias through several mechanisms, including reducing stress, altering sleep architecture, reducing awakenings, and reducing perception of environmental stimuli that would normally trigger an arousal [67,101–103]. IRT arguably is quite similar to some common hypnotic techniques in the NREM parasomnia literature. In IRT for nightmares (the usual target for this treatment), patients rescript a recurring nightmare so that it no longer contains the distressing elements, and the revised story is mentally rehearsed daily. In applying this to NREM parasomnias, the story of a parasomnia episode (which may involve little or no recall of dream content) would be rewritten so that the parasomnia does not happen or resolves satisfactorily. Many accounts of hypnosis in this review used strategies of rehearsing imagery of a new version of the parasomnia (waking if one's feet touch the floor, returning to sleep quickly, etc.) or of sleeping peacefully without parasomnias. Similar to IRT procedures, participants were often instructed to practice self-hypnosis at home. Based on these parallels, we suggest that hypnosis (when used in the way described above) and IRT are quite similar, the key difference being that in hypnosis the imagery rehearsal takes place while in a trance state.

4.4. Limitations

This literature, while providing a wealth of information about potential approaches for managing NREM parasomnias, provides only limited evidence for the efficacy of specific treatments due to a number of factors: (1) lack of RCTs, (2) lack of standardized and validated outcome measures, (3) heterogeneity within samples (e.g., participants received different treatment combinations or had different follow-up periods), (4) incomplete reporting of study or sample details (e.g., not disaggregating outcomes for specific diagnoses or treatments), and (5) use of combined behavioral/medical treatment. Furthermore, given that childhood symptoms typically remit with time, it is unclear in the pediatric literature whether any improvement observed in uncontrolled studies may have been due to spontaneous remission. In addition, some categories of NREM parasomnia had fewer studies (e.g., SRED, sexsomnia) relative to more common types of parasomnia such as sleepwalking.

In addition, lack of standardization of outcome measures is a limitation which precluded our ability to conduct a meta-analysis (however, even when validated measures are used, assessment of NREM parasomnias is limited by lack of recall given that patients are frequently amnestic for events and parents or bed partners may not notice minor events). Many studies relied on retrospective approaches such as chart reviews. The only validated parasomnia measure used in this literature (in two studies) [37,38], the PADSS [92], was developed in 2014. A 1-month version of the PADSS—useful for measuring changes in symptoms before and after treatment, as the reference timeframe for the original measure was 1 year—was not validated and published until 2022 [38]. Although symptoms other than parasomnia frequency and severity were not the focus of this review, two recent trials of CBT for parasomnias included validated measures to assess changes in other symptoms such as insomnia, daytime sleepiness, fatigue, depression, and anxiety [25,37].

5. Conclusions

NREM parasomnias can persist throughout the lifespan and may have serious consequences including poor sleep quality and bodily harm to the patient or others. Treatment development and testing for NREM parasomnias has been neglected compared to most sleep disorders [2,8], perhaps due to a relatively low base rate, limited memory for the events, and potentially stigmatizing nature of the phenomena. Thus, treatments have not been tested with the methods necessary to create formal treatment guidelines such as those that exist for most other sleep disorders, including other types of parasomnias [104,105]. In order to establish clinical practice guidelines, RCTs are needed to determine the efficacy of both behavioral and pharmacological treatments, as well as their comparative efficacy.

This review demonstrates that although large psychological and behavioral RCTs have been lacking, there have nonetheless been many published attempts to treat these disorders with an incredible array of approaches. Treatments most commonly represented in the literature have included (in order of most to least common): hypnosis, psychotherapies, sleep hygiene, education/reassurance, relaxation, scheduled awakenings, sleep extension, and mindfulness. For each of these treatments, numerous variations in implementation have been described in the literature. Evidence to date is most supportive of CBT, sleep hygiene, scheduled awakenings, and hypnosis.

The literature summarized in this review may provide guidance to future researchers attempting to design and test psychological and behavioral treatments. Based on what is known about the multiple etiological factors that combine to produce NREM parasomnias, it is likely that a multifaceted treatment approach—such as the various cognitive behavioral approaches described recently [25,36–38]—will prove most useful in addressing NREM parasomnias. Recent advances in the treatment of these disorders mirrors the historical development of other psychological and behavioral sleep treatments (e.g., CBT-I) which similarly over time united disparate techniques into a cohesive, conceptualization-based, multicomponent treatment approach.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

APPENDIX

Database searched (3/10/21 and 2/24/23)	Results
Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations, Daily and Versions	**897**
Cochrane Database of Systematic Reviews	**7**
Cochrane Central Register of Controlled Trials	**431**
CINAHL (Ebsco)	**672**
PsycINFO (Ebsco)	**411**
Web of Science Core Collection	**401**
Original Total	**2411**
Update Total	**3023**
Original After de-duplication	**1704**
Update After de-duplication	**2134**

MEDLINE (Ovid)

Number	Search	Results
1	exp Parasomnias/	8848
2	((non-rem or nonrem or nrem or non-rapid-eye-movement) adj3 (parasomni* or disorder*)).ti,ab.	231
3	(sleep* adj2 (eat* or walk* or wander* or terror* or sex*)).ti,ab.	2481
4	(confusional-arousal* or elpenor-syndrome or nocturnal-wander* or night-terror* or parasomnia-overlap or pavor-nocturnus or sexsomni* or sleep-arousal-disorder* or somnambulis*).ti,ab.	793
5	1 or 2 or 3 or 4	11415
6	exp Behavior Therapy/	87837
7	exp Complementary Therapies/	243168
8	exp Sleep Hygiene/	1749
9	((alternative or complementary or behavioral or cognitive or relaxation) adj2 (modification* or intervention* or remediation* or therap* or treatment*)).ti,ab.	118230
10	(CBT or counseling or education or guided-imagery or hypnos* or hypnotherap* or meditat* or mindfulness or nonpharmacological or non-pharmacological or non-medical or nonmedical or non-medication or nonmedication or psychoeducation or reassurance or scheduled-awakening* or sleep-extension or sleep-hygiene or stress-management).ti,ab.	695474
11	6 or 7 or 8 or 9 or 10	1045990
12	5 and 11	**897**

Cochrane Library

Number	Search	Result
#1	MeSH descriptor: [Parasomnias] explode all trees	1018
#2	(non-rem or nonrem or nrem or non-rapid-eye-movement) near/3 (parasomni* or disorder*):ti,ab,kw	15
#3	((sleep*) near/2 (eat* or walk* or wander* or terror* or sex*)):ti,ab,kw	806
#4	(confusional-arousal* or elpenor-syndrome or nocturnal-wander* or night-terror* or parasomnia-overlap or pavor-nocturnus or sexsomni* or sleep-arousal-disorder* or somnambulis*):ti,ab,kw	48
#5	#1 or #2 or #3 or #4	1844
#6	MeSH descriptor: [Behavior Therapy] explode all trees	21393
#7	MeSH descriptor: [Complementary Therapies] explode all trees	25157
#8	MeSH descriptor: [Sleep Hygiene] explode all trees	209
#9	(alternative or complementary or behavioral or cognitive or relaxation) near/2 (modification* or intervention* or remediation* or therap* or treatment*):ti,ab,kw	52143
#10	(CBT or counseling or education or guided-imagery or hypnos* or hypnotherap* or meditat* or mindfulness or nonpharmacological or non-pharmacological or non-medical or nonmedical or non-medication or nonmedication or psychoeducation or reassurance or scheduled-awakening* or sleep-extension or sleep-hygiene or stress-management):ti,ab,kw	131607
#11	#6 or #7 or #8 or #9 or #10	186765
#12	#5 AND #11	**438**

CINAHL

Number	Search	Result
S1	(MH "Parasomnias+")	3975
S2	TI ((non-rem or nonrem or nrem or non-rapid-eye-movement) N3 (parasomni* or disorder*)) OR AB ((non-rem or nonrem or nrem or non-rapid-eye-movement) N3 (parasomni* or disorder*))	88
S3	TI (((sleep*) N2 (eat* or walk* or wander* or terror* or sex*))) OR AB (((sleep*) N2 (eat* or walk* or wander* or terror* or sex*)))	1481
S4	TI ((confusional-arousal* or elpenor-syndrome or nocturnal-wander* or night-terror* or parasomnia-overlap or pavor-nocturnus or sexsomni* or sleep-arousal-disorder* or somnambulis*)) OR AB ((confusional-arousal* or elpenor-syndrome or nocturnal-wander* or night-terror* or parasomnia-overlap or pavor-nocturnus or sexsomni* or sleep-arousal-disorder* or somnambulis*))	193
S5	S1 OR S2 OR S3 OR S4	5456
S6	(MH "Behavior Therapy+")	41472
S7	(MH "Alternative Therapies+")	272939
S8	(MH "Sleep Hygiene")	995
S9	TI ((alternative or complementary or behavioral or cognitive or relaxation) N2 (modification* or intervention* or remediation* or therap* or treatment*)) OR AB ((alternative or complementary or behavioral or cognitive or relaxation) N2 (modification* or intervention* or remediation* or therap* or treatment*))	59122
S10	TI ((CBT or counseling or education or guided-imagery or hypnos* or hypnotherap* or meditat* or mindfulness or nonpharmacological or non-pharmacological or non-medical or nonmedical or non-medication or nonmedication or psychoeducation or reassurance or scheduled-awakening* or sleep-extension or sleep-hygiene or stress-management)) OR AB	403246

(*continued on next page*)

(*continued*)

CINAHL		
	((CBT or counseling or education or guided-imagery or hypnos* or hypnotherap* or meditat* or mindfulness or nonpharmacological or non-pharmacological or non-medical or nonmedical or non-medication or nonmedication or psychoeducation or reassurance or scheduled-awakening* or sleep-extension or sleep-hygiene or stress-management))	
S11	S6 OR S7 OR S8 OR S9 OR S10	712039
S12	S5 AND S11	**672**

PsycINFO		
Number	Search	Result
S1	DE "Parasomnias" OR DE "Sleepwalking"	926
S2	TI ((non-rem or nonrem or nrem or non-rapid-eye-movement) N3 (parasomni* or disorder*)) OR AB ((non-rem or nonrem or nrem or non-rapid-eye-movement) N3 (parasomni* or disorder*))	152
S3	TI (((sleep*) N2 (eat* or walk* or wander* or terror* or sex*))) OR AB (((sleep*) N2 (eat* or walk* or wander* or terror* or sex*)))	2325
S4	TI ((confusional-arousal* or elpenor-syndrome or nocturnal-wander* or night-terror* or parasomnia-overlap or pavor-nocturnus or sexsomni* or sleep-arousal-disorder* or somnambulis*)) OR AB ((confusional-arousal* or elpenor-syndrome or nocturnal-wander* or night-terror* or parasomnia-overlap or pavor-nocturnus or sexsomni* or sleep-arousal-disorder* or somnambulis*))	895
S5	S1 OR S2 OR S3 OR S4	3538
S6	DE "Behavior Therapy"	27350
S7	TI ((alternative or complementary or behavioral or cognitive or relaxation) N2 (modification* or intervention* or remediation* or therap* or treatment*)) OR AB ((alternative or complementary or behavioral or cognitive or relaxation) N2 (modification* or intervention* or remediation* or therap* or treatment*))	87810
S8	TI ((CBT or counseling or education or guided-imagery or hypnos* or hypnotherap* or meditat* or mindfulness or nonpharmacological or non-pharmacological or non-medical or nonmedical or non-medication or nonmedication or psychoeducation or reassurance or scheduled-awakening* or sleep-extension or sleep-hygiene or stress-management)) OR AB ((CBT or counseling or education or guided-imagery or hypnos* or hypnotherap* or meditat* or mindfulness or nonpharmacological or non-pharmacological or non-medical or nonmedical or non-medication or nonmedication or psychoeducation or reassurance or scheduled-awakening* or sleep-extension or sleep-hygiene or stress-management))	520532
S9	S6 OR S7 OR S8	597927
S10	S5 AND S9	**459**

Web of Science Core Collection		
Number	Search	Result
#1	TS=((non-rem or nonrem or nrem or non-rapid-eye-movement) NEAR/3 (parasomni* or disorder*))	319
#2	TS=((sleep*) NEAR/2 (eat* or walk* or wander* or terror* or sex*))	4026
#4	TS=(confusional-arousal* or elpenor-syndrome or nocturnal-wander* or night-terror* or parasomnia-overlap or pavor-nocturnus or sexsomni* or sleep-arousal-disorder* or somnambulis*)	1177
#4	#1 OR #2 OR #3	5038
#5	TS=((alternative or complementary or behavioral or cognitive or relaxation) NEAR/2 (modification* or intervention* or remediation* or therap* or treatment*))	197334
#6	TS=(CBT or counseling or education or guided-imagery or hypnos* or hypnotherap* or meditat* or mindfulness or nonpharmacological or non-pharmacological or non-medical or nonmedical or non-medication or nonmedication or psychoeducation or reassurance or scheduled-awakening* or sleep-extension or sleep-hygiene or stress-management)	1689161
#7	#5 OR #6	1850717
#8	#4 AND #8	**557**

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