The Effects of Eye Movement Desensitisation and Reprocessing on Sleep in Adults with Post-Traumatic Stress Disorder: A Rapid Systematic Literature Review

Anastasia Stuart

32205095

University of Notre Dame Australia, Sydney Campus, School of Arts and Sciences

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Abstract

Sleep disturbance affects most adults with PTSD, however it is unclear if it is improved with eye movement desensitisation and reprocessing (EMDR), a recommended evidence-based treatment. This rapid systematic review synthesised evidence on sleep following EMDR treatment. Five databases were searched on 10 August 2026 for studies of standalone EMDR in adults with PTSD reporting sleep before and after treatment. Quality was assessed using JBI critical appraisal tools and findings were analysed using reflexive thematic analysis. Six reports of five studies (77 participants) were included. Subjective sleep improved after treatment however remained impaired following PTSD remission in two studies. Objective improvements in sleep were limited to sleep continuity. Sleep was not assessed at long-term follow-up. Confidence in findings was moderate to low due to small sample sizes and limitations of study designs. Psychologists treating this population should assess sleep separately from PTSD symptoms. The review was unfunded and not registered.

The Effects of Eye Movement Desensitisation and Reprocessing on Sleep in Adults with Post-Traumatic Stress Disorder: A Rapid Systematic Literature Review

Post-traumatic Stress Disorder (PTSD) is a psychiatric disorder that can arise following exposure to trauma. It is characterised by four symptom clusters of intrusion, stimuli avoidance, negative alterations in cognitions and mood, and alterations in arousal or reactivity (American Psychiatric Association [APA], 2022). PTSD is associated with impaired daily functioning, reduced quality of life, and elevated risk of suicidality (Giacco et al., 2013; Jellestad et al., 2021; Schlenger et al., 2015), with an estimated lifetime prevalence of 7.1% of Australians (Kroeger et al., 2026).

Approximately 70-92% of individuals with PTSD report clinically significant sleep disturbance, characterised by difficulty falling or staying asleep, or nightmares (Khazaie et al., 2016; Maker et al., 2006; Milanak et al., 2019). Sleep disturbance and PTSD are hypothesised to have a bidirectional relationship, with poor sleep increasing daytime PTSD symptoms, and PTSD symptom severity predicting worse sleep (Slavish et al., 2022). Poor sleep may therefore maintain PTSD and require direct treatment.

Eye movement desensitisation and reprocessing (EMDR) is a recommended first-line treatment for PTSD in Australian and international guidelines (Bisson et al., 2019; Phoenix Australia, 2021). However, these recommendations are based off PTSD symptom outcomes, and it is unclear if EMDR also improves sleep. Sleep is relevant to EMDR, which may work using sleep-related memory-processing mechanisms (Stickgold, 2002). Following trauma-focused therapy, sleep disturbance can persist leading to reduced long-term outcomes (Pruiksma et al., 2016). Psychologists delivering EMDR must therefore assess sleep, consider if adjunctive sleep-specific therapy is needed, and assess client readiness for termination based off symptom

improvement, consistent with the Psychology Board of Australia (PsyBA) Code of Conduct (Psychology Board of Australia, 2025). This rapid systematic literature review (rapid-SLR) will synthesise the available evidence on sleep outcome measures following EMDR treatment for individuals with PTSD to inform clinical decision-making.

Literature Review

Sleep

Sleep is a biological process essential for learning and memory (Walker, 2009). Polysomnography (PSG) is the gold standard for objective measurement, however, is expensive and has low ecological validity (Buysse et al., 2006). Subjective sleep measures, such as the Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989) and the Consensus Sleep Diary (CSD) (Carney et al., 2012) assess an individual's perceived sleep quality, and can be measured over time in a naturalistic environment (Fabbri et al., 2021). In clinical samples, self-reported sleep is often reported as significantly more impaired than objectively measured sleep, which may reflect psychological distress rather than inaccurate perception of sleep (Rezaie et al., 2018). Subjective and objective sleep are therefore related but distinct measures of a similar construct.

Sleep in PTSD

Sleep disturbance appears in two PTSD diagnostic symptom clusters, as trauma-related nightmares (intrusions), and difficulty initiating or maintaining sleep (arousal) (APA, 2022). Trauma-related nightmares occur in approximately 50-75% of individuals with PTSD (Isaac et al., 2023). In contrast to healthy adults who predominantly have nightmares during the rapid eye movement (REM) sleep stage, nightmares in PTSD occur during both REM and non-REM sleep stages and can include accurate trauma replays and non-replays (Phelps et al., 2018). REM sleep is involved in consolidating emotional memories without fear activation, and when fragmented

through nightmares or hyperarousal can lead to a failure of memory consolidation (Wassing et al., 2019). Stickgold (2002) proposes that in PTSD, elevated noradrenergic arousal leads to fragmented REM sleep, meaning traumatic memories are not integrated into autobiographical knowledge. Memories are then reexperienced with their original intensity when in nightmares or intrusions. However, this model is predominantly theoretical and PSG studies have only found reduced REM sleep in PTSD in younger samples (Zhang et al., 2019). Nocturnal hypervigilance and fear of nightmares can maintain sleep disturbance through avoidance (Pruiksma et al., 2016). Clinically, PTSD outcome measures such as the Clinician-Administered PTSD Scale for DSM-5 (CAPS-5) (Weathers et al., 2018) only use 1-2 items to assess sleep disturbance, which cannot capture sleep as a multidimensional construct or detect meaningful change (Yap et al., 2025).

EMDR

EMDR is a structured, eight-phase trauma-focused psychotherapy for PTSD aimed at reducing the vividness and emotional intensity of traumatic memories through allowing memories to be reintegrated into semantic content (Shapiro, 2018). Following history taking and preparation, individuals recall a target traumatic memory and its associated beliefs, emotions, and bodily sensations (de Jongh et al., 2024). The memory is desensitised using bilateral stimulation, often eye movements, until distress subsides. A positive cognition is then installed alongside the target memory using bilateral stimulation, and progress is reviewed. EMDR has shown effectiveness in diverse populations (Acarturk et al., 2015; Molero-Zafra et al., 2024; Zhao et al., 2023), however mechanisms of action are unclear. Stickgold (2002) proposes EMDR induces a REM-sleep-like state during wakefulness, allows memory integration that fails during disturbed sleep. However, this model is built using animal models and indirect evidence and has not been directly tested. Pagani et al. (2017) additionally proposes that EMDR may engage slow-

wave sleep like processes which are also important for memory. In contrast, the working memory hypothesis proposes taxing working memory during recall reduced the vividness and emotionality of the memory (van den Hout & Engelhard, 2012), supported by evidence that greater working-memory taxation produces greater reductions in memory vividness and emotionality (Littel & van Schie, 2019; Wadji et al., 2022). Sleep-based theoretical models predict that EMDR directly affects sleep, while the working memory hypothesis suggests sleep will improve because of PTSD symptom improvement. Therefore, sleep outcomes following EMDR can inform both clinical practice and scientific theory.

Clinical relevance

EMDR is a first-line recommended treatment for individuals with PTSD, meaning it is delivered to clients experiencing clinically significant sleep disturbances (Milanak et al., 2019). However, sleep is not directly targeted in EMDR treatment, meaning clients may have residual sleep impairment following PTSD symptom remission which predicts smaller treatment gains (López et al., 2017) and facilitates fear reinstatement, increasing risk of relapse (Zuj et al., 2018). However, this evidence comes from cognitive treatments and may not be applicable to EMDR which is theorised to work through sleep-like processes (Stickgold, 2002).

The Research Gap

Currently, while there is strong evidence for the effectiveness of EMDR on PTSD symptoms (Phelps et al., 2022), the effects on sleep have not been systematically reviewed. Rousseau et al. (2021) identified one previous PSG study. Psychologists lack synthesised evidence on whether standalone EMDR improves sleep, if these changes are maintained long-term, and if they are associated with PTSD symptom improvement. This gap leads to unclear

recommendations for assessment, treatment, and discharge for individuals with sleep disturbance and PTSD.

Aims:

The rapid-SLR aims to synthesise evidence on how EMDR affects sleep in adults with clinically significant PTSD symptoms, to inform evidence-based recommendations for assessment, monitoring, and treating sleep disturbance in this population.

Primary Research Question:

What is the evidence for how EMDR affects sleep in adults with PTSD?

Secondary Research Questions:

1. How are sleep changes maintained at follow up?
2. Are improvements in sleep associated with the magnitude of PTSD symptom reduction?

Methods

Study Design

This rapid-SLR used thematic synthesis, selected as it can integrate findings across heterogeneous designs where meta-analysis is not possible (Thomas & Harden, 2008). It followed PRISMA 2020 guidelines (Page et al., 2021) and was streamlined using Cochrane rapid review guidance to enhance feasibility (Garritty et al., 2024), using one reviewer, five databases and English peer-reviewed publications, without grey literature. Subgroup analysis, meta-analysis, and sensitivity analysis of results were not conducted due to feasibility and heterogeneity of data.

Eligibility Criteria

Eligibility was defined a priori using an adapted version of the population, interventions, comparator, outcomes (PICO) framework including criteria for setting, studies and timeframe

(Schardt et al., 2007) (Appendix A). Eligible studies included adults with a primary PTSD diagnosis established by clinical interview or validated measure, and standalone EMDR as adjunct therapies may confound outcomes. Studies including medication-only comparators were excluded due to heterogeneous effects of medication on sleep architecture (Hutka et al., 2021). Studies required a validated sleep measure taken pre- and post-treatment. Studies published from 2002 were eligible, aligning with EMDR protocol standardisation (Shapiro & Maxfield, 2002). As the research questions assessed change in sleep following intervention, only randomised controlled trials and quasi-experimental designs with pre-post measurements were eligible.

Search Strategy and Study Selection

PsycInfo, PubMed, Embase, MEDLINE, and ProQuest were searched on 10 August 2026, combining subject headings and keywords for PTSD, EMDR, and sleep (Appendix B). Identified articles were screened by the author at a title-abstract level, then full-text level using a screening decision tree with include, exclude, and unclear outcomes, with unclear records progressing to full-text review (Figure 1). Decisions and exclusion reasons were recorded in Excel. A peer conducted a fidelity check of 5% (n = 11) of records at the title-abstract level with 100% concordance.

Figure 1

Screening Decision Tree

	Inclusion	Exclusion
Publication eligibility	1. Does the study meet the predefined publication eligibility criteria? English-language, peer-reviewed journal article published on or after 1 January 2002. **↓ Yes / Unclear**	Non-English, non-peer reviewed including conference abstracts and theses. Published prior to 1 January 2002. **↓ No, exclude from further screening**
Study design	Randomised controlled trial, controlled clinical trial, or quasi-experimental design including single-arm pre–post, uncontrolled cohort and feasibility studies, reporting primary original data. **↓ Yes / Unclear**	Observational study, case study, study protocol registration, secondary evidence synthesis including meta-analysis or systematic review. **↓ No, exclude from further screening**
Population	Adults (≥18 years) with a primary PTSD diagnosis by clinician interview under any edition of the DSM or ICD, or a clinically significant score on a validated PTSD measure. **↓ Yes / Unclear**	Participants aged < 18, primary diagnosis other than PTSD, subthreshold or non-clinical sample, mixed sample where PTSD data cannot be separated from other groups. **↓ No, exclude from further screening**
Intervention	Standalone EMDR following Shapiro's protocol, in any delivery format. **↓ Yes / Unclear**	EMDR with an adjunct or concurrent therapy, or within a multicomponent programme. EMDR-derived therapies (e.g. accelerated resolution therapy). **↓ No, exclude from further screening**
Comparator	Waitlist, no-treatment or healthy control, treatment as usual, active psychological comparator, or single-arm pre–post design. **↓ Yes / Unclear**	Medication-only comparator. **↓ No, exclude from further screening**
Outcome	Validated subjective or objective sleep measure (e.g. PSQI, sleep diary, actigraphy, PSG) reported at baseline and post-intervention. **↓ Yes / Unclear**	No validated sleep measure. Sleep not reported at both baseline and post-intervention. **↓ No, exclude from further screening**
Setting	Any clinical or research setting in any country. **↓ Yes / Unclear**	No setting restrictions.
Decision	**INCLUDE:** proceed to full-text review (title and abstract stage) or include in the review (full-text stage).	**EXCLUDE:** record the reason for exclusion in the screening log and do not include in analysis.

Data Extraction and Management

Articles were stored in EndNote with duplicates manually removed. Study characteristics and verbatim extracts related to each research question were extracted into Excel by the author. No requests for additional data were made to study investigators. Outcomes were extracted as reported by studies and no effect measures were calculated. Unreported data was recorded as not reported. Extracted data is available from the author upon request.

Quality Appraisal

Study quality was assessed by the author using the JBI Critical Appraisal Tools for randomised controlled trials (Barker et al., 2023) or quasi-experimental studies (Barker et al., 2024) to allow assessment for bias with a measurement appropriate for the study design. No studies were excluded for low quality to ensure a comprehensive synthesis of available evidence. Reporting of this review was self-appraised against the PRISMA 2020 checklist (Appendix E).

Data Analysis and Synthesis Approach

Braun and Clarke's (2006, 2019) model of thematic analysis was used to inductively analyse themes. Verbatim extracts were organised by research question and coded, then grouped into sub-themes and themes. Themes were then defined, named, mapped to research questions, and interpreted. Confidence in each theme was judged by triangulating across study designs, outcome measures, populations and theoretical approaches (Carter, 2014). Confidence was rated high when findings agreed across three or more sources without conflict, moderate when across two or conflicting information was explained, and low otherwise (Farmer et al., 2006). Reflexive practice was recorded throughout to consider the centrality of researcher subjectivity. Data were presented graphically using Canva and Word software.

Positionality Statement

The author is a provisional psychologist and sleep researcher. This risks overemphasing the risks of residual sleep impairment and recommending direct treatment of sleep. To address this, a non-directional primary research question was created, and reflexive notes were reviewed prior to thematic analysis.

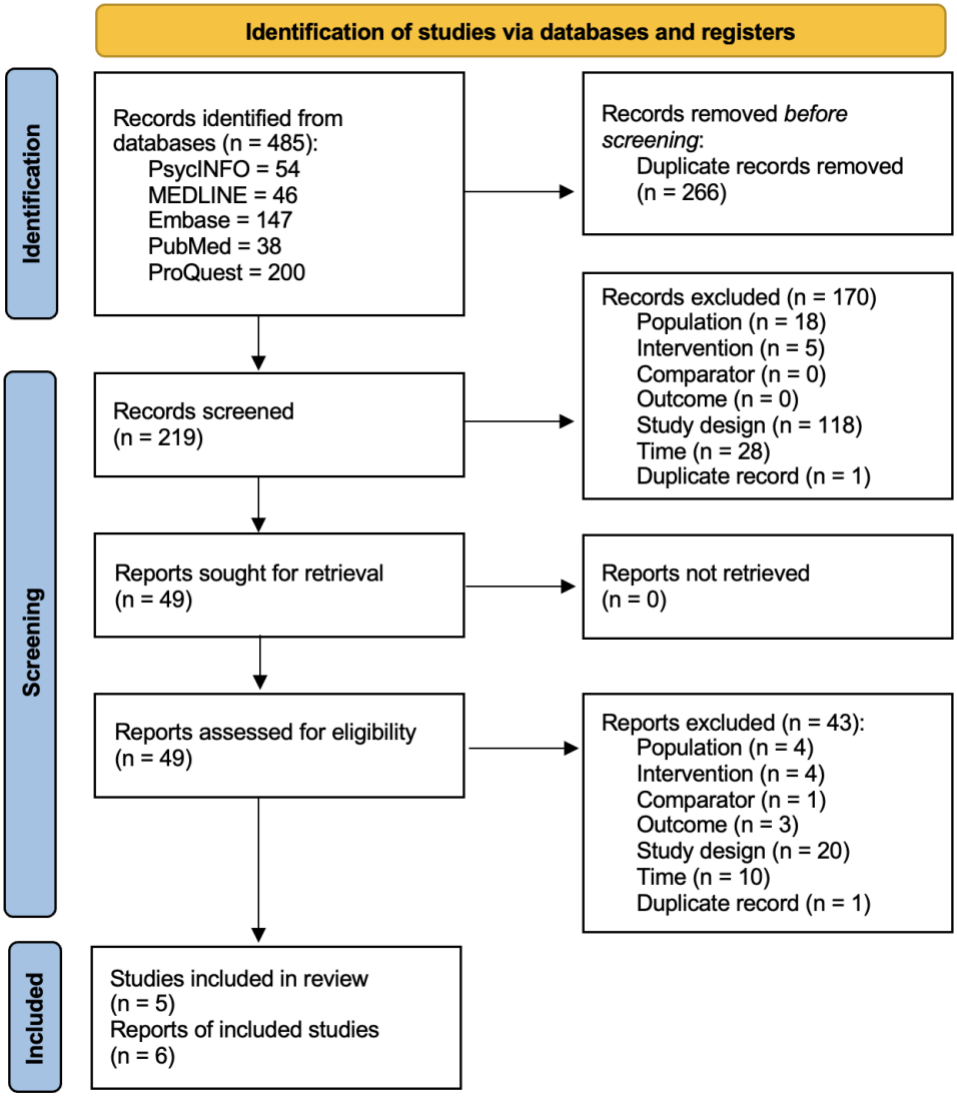
Results

Search Results

Search results identified 485 records, with 266 duplicates which were removed. 219 were title-abstract screened, and 49 full-text, with 43 excluded (Figure 2). Six reports of five studies were included in the rapid-SLR, as two reports used the same cohort and were therefore synthesised as one study (Raboni et al., 2006, 2014). Three studies of accelerated resolution therapy and one study of EMDR delivered with adjunct therapies were near-eligible studies that were excluded due to differing from Shapiro and Maxfield's (2002) EMDR protocol.

Figure 2

PRISMA (2020) Flow Diagram



Study Characteristics

Studies were published between 2006 and 2024 and conducted in Brazil, Iran, France and the Netherlands. Six reports of five studies included two randomised controlled trials, two controlled pre-post studies, and two single-arm studies, including 77 EMDR-treated adults with PTSD. Treatment sessions ranged from one session to weekly treatment over 9 months. Two samples were exclusively male military personnel, and one sample included older adults. Subjective sleep was measured with the Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989) in three studies, the Consensus Sleep Diary (Carney et al., 2012) in one, the Recovery-

Stress Questionnaire (RESTQ-48) in the Raboni et al. cohort (Kellmann & Kallus, 2001), and a single Clinician-Administered PTSD Scale for DSM-5 (CAPS-5) (Weathers et al., 2018) item in one. Objective sleep was measured using PSG before and after treatment in two studies and after EMDR in an additional study. See Appendix C for the characteristics of included studies table.

Risk of Bias

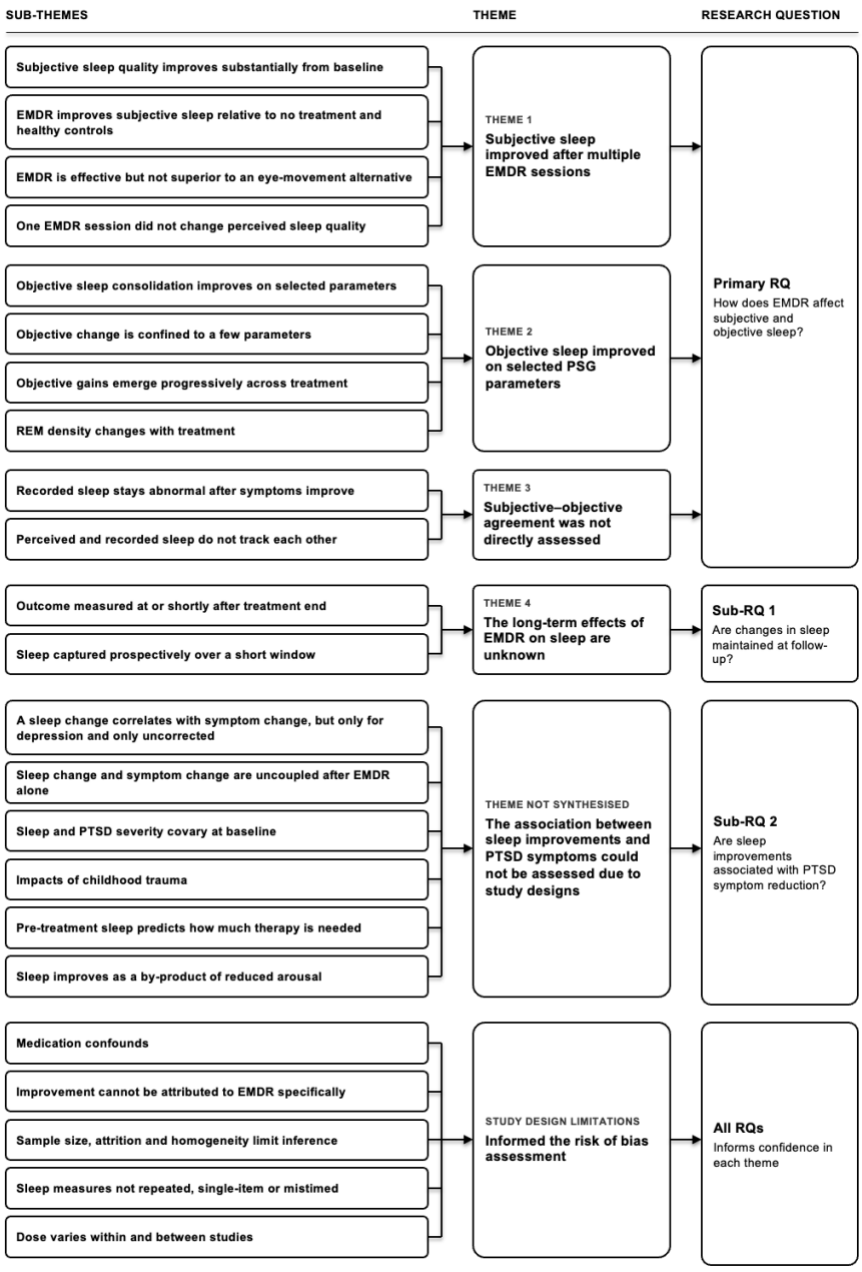
Quality percentages were 78% (Raboni et al., 2014), 77% (van der Heijden et al., 2024), 67% (Rousseau et al., 2021), 44% (Gielkens et al., 2024), 33% (Raboni et al., 2006) and 15% (Ahmadi et al., 2015). Four studies did not have an untreated PTSD control group, three included participants with medication confounds, and two analysed completers only despite 46% exclusion after enrolment (Raboni et al., 2014) and 31% attrition (Ahmadi et al., 2015). Selective reporting in three studies *(*Ahmadi et al., 2015*;* Gielkens et al., 2024*;* Raboni et al., 2006) indicated a risk of reporting bias. See Appendix D for the summary of appraisal results. The two highest-quality reports (Raboni et al., 2014; van der Heijden et al., 2024) contributed to Themes 1 and 3, while the only comparison with untreated controls came from the lowest-quality study (Ahmadi et al., 2015).

Thematic Synthesis

Thematic analysis of 45 verbatim data extracts generated 112 initial codes, 23 subthemes, and four themes (Figure 3). Eighteen extracts addressed the primary research question, four sub-research question 1, six sub-research question 2, and 17 informing risk of bias.

Figure 3

Thematic Map



Primary Research Question. What is the evidence for how EMDR affects sleep in adults with PTSD?

Theme 1. Subjective sleep improved in comparison to baseline in multi-session studies (Gielkens et al., 2024; Raboni et al., 2006, 2014; Rousseau et al., 2021). PSQI scores showed a large, significant pre-post improvement in one study (Rousseau et al., 2021) and improved more

than untreated controls in another that did not report dose (Ahmadi et al., 2015). Self-rated sleep quality (Raboni et al., 2006, 2014) and subjective hours of sleep in older adults (Gielkens et al., 2024) increased from baseline. However, Van der Heijden et al. (2024) found no significant changes in a sleep diary in the week following a single session of EMDR. Improvement was incomplete, with PSQI scores after remission remaining above the clinically significant threshold in both an unmedicated civilian sample and a medicated military sample (Raboni et al., 2014; Rousseau et al., 2021). Findings agreed across designs, measures and populations, with the only result reporting no improvement being explained by dose, and confidence in this finding is moderate.

Theme 2. Objective sleep improved on selected PSG paramaters. Raboni et al. (2014) found wake after sleep onset decreased and sleep efficiency increased. Rousseau et al. (2021) found significant improvements in total sleep time and a statistically non-significant but clinically significant improvement in sleep efficiency. Findings partially agreed across two studies using one measure type, so confidence in this finding is low.

Theme 3. Subjective-objective agreement was not directly assessed. Subjective sleep quality improved significantly in Rousseau et al. (2021) while objective sleep improved marginally, while subjective and objective sleep improved in the Raboni et al. (2006, 2014) cohort. Van der Heijden et al. (2024) recorded subjective data from the night of PSG recording, however did not report it separately. Triangulating measures within studies therefore gave no consistent pattern, leading to low confidence in this theme.

Research Sub-Question 1. How are sleep changes maintained at follow up?

Theme 4. The long-term effects on sleep following EMDR are unknown. No studies assessed sleep beyond one week after termination, and one study (Ahmadi et al., 2015) not

reporting assessment timing. This absence was consistent across all studies and measures, so confidence was not rated.

Research Sub-Question 2. Are improvements in sleep associated with the magnitude of PTSD symptom reduction?

No theme was developed, as study designs prevented this question being answered. Three studies continued EMDR until PTSD symptom remission (Gielkens et al., 2024; Raboni et al., 2006, 2014; Rousseau et al., 2021), meaning all participants finished treatment with low PTSD scores. Rousseau et al. (2021) found an association between sleep fragmentation at baseline and treatment duration required for remission and found no association between change in sleep and change in PTSD symptoms, but did not assess sleep during treatment.

Discussion

This rapid-SLR synthesised evidence for how EMDR influences sleep in adults with PTSD, identifying four themes using data from six reports of five studies. Thematic synthesis found that in studies involving multiple sessions of EMDR, subjective and objective measures of sleep improved, however long-term follow up was not measured and improvements in sleep could not be assessed separately from PTSD symptom remission. To the author's knowledge, it is the first review of sleep outcomes following EMDR, and confidence in the findings are moderate to low.

The primary research question assessed the evidence for how EMDR affects sleep in adults with PTSD, finding that EMDR was associated with improvements in subjective and objective sleep, however clinically significant impairment could remain. In two studies, PSQI scores improved but remained in the clinically significant range (Raboni et al., 2014; Rousseau et al., 2021), meaning clients not meeting PTSD criteria may still experience residual sleep

disturbance. This aligns with findings from other trauma-focused therapies, after which sleep improves but often remains clinically significantly impaired (Pruiksma et al., 2016; Woodward et al., 2017). There is therefore no evidence for a sleep-related advantage for EMDR, despite theorised links to sleep memory consolidation processes (Stickgold, 2002), although no studies directly compared sleep in EMDR to other trauma-focused therapies.

Objective improvements in sleep continuity were observed in two studies (Raboni et al., 2014; Rousseau et al., 2021). Improvements may reflect sleep consolidating as cortical hyperarousal decreases with reduced emotional reactivity to traumatic memories (Riemann et al., 2010). Residual impairments may reflect pre-sleep arousal, which is not directly targeted in treatment (Woodward et al., 2017). However, as sleep could not be assessed independently from PTSD symptom remission, these findings cannot support or reject the hypothesis that EMDR works using a sleep-dependent pathway. Improvements may also be attributable to time, regression to the mean, or first-night effects, which can make baseline measures appear worse (Byun et al., 2019). Additionally, changes in subjective and objective sleep did not consistently correlate, consistent with evidence impaired subjective sleep may reflect psychological distress rather than disrupted sleep (Harvey & Tang, 2012). A direct effect of EMDR on objective sleep is therefore possible, but untested.

Sub-research question 1 could not be answered as no studies assessed sleep beyond one week after treatment termination or symptom remission. This gap is clinically relevant, as residual sleep disturbance can predict smaller gains from trauma-focused therapy, facilitate fear reinstatement, and increase the risk of relapse (López et al., 2017; Zuj et al., 2018). As such, clinicians cannot assume sleep gains at termination will be preserved.

Sub-research question 2 could not be answered, as studies only measured sleep at baseline and post-intervention, and treated participants to remission. Woodward et al. (2017) found that in adults with PTSD treated with cognitive therapy, changes in sleep quality and PTSD symptom severity were correlated and independently predicted change in the other. Therefore, while it is possible a similar relationship exists following treatment with EMDR, there is not yet sufficient evidence to test the connection or direction of this relationship.

Recommendations

Recommendations for Psychology Practice. As sleep impairment can remain following PTSD symptom remission (Theme 1), psychologists delivering EMDR should assess sleep separately from PTSD symptoms throughout treatment. Clients should be informed that sleep disturbance may remain despite improvements in PTSD symptoms, so residual sleep impairments are not perceived as residual PTSD symptoms. Psychologists should consider an adjunctive evidence-based treatment treating sleep in clients with PTSD and sleep disturbance, such as cognitive behavioural therapy for insomnia (CBT-i), which can improve sleep and PTSD symptoms (Ho et al., 2016).

Policy Recommendations. Australian guidelines strongly recommend EMDR for PTSD, however do not include recommendations for the assessment or treatment of comorbid sleep disturbance (Phoenix Australia, 2021). As sleep disturbance can remain following treatment (Theme 1), guidelines should therefore recommend assessing sleep before, during, and after trauma-focused therapy, enabling improved outcomes for patients.

Future Research. Future research should use randomised controlled trial designs with a waitlist or active comparator arm (Rousseau et al., 2021). Validated measures of subjective and objective sleep, and PTSD symptoms, should be measured at baseline, throughout treatment,

immediate follow-up, and long-term follow up, using fixed-dose EMDR protocols. Samples should include diverse populations, including culturally diverse samples and trauma types, to assess if findings generalise. This will lead to increase confidence in the evidence that treatment using EMDR can improve sleep outcomes for individuals with PTSD.

Limitations

This rapid-SLR is limited by a small, heterogeneous and low-quality evidence base. Evidence was assessed by a single reviewer increasing the risk of eligible studies being misjudged, however a peer fidelity check showed full agreement. Case studies were excluded to enhance feasibility of the review within a short time frame which resulted in qualitative information not being captured. Included studies ranged significantly in risk of bias, and results were not consistently reported in interpretable ways, leading to low certainty in the findings of thematic analysis. Transparent PRISMA-guided methods and triangulation support the findings and identify what has not been studies while identifying implications for future research and clinical practice.

Ethical and Professional Issues. This paper risks overstating findings from weak evidence and low-quality studies, which has been addressed through transparent reporting of the findings and confidence ratings. However, failure to examine this research question risks psychologists assuming sleep disturbance will be sufficiently treated with standalone EMDR, contrary to the PsyBA (2025) Code of Conduct requirement to provide safe and effective services to clients.

Safe and Sustainable Research Practice. Research was conducted as part of a full-time course load alongside clinical placement and work responsibilities. Workload was managed using a Gantt chart revised after the proposal stage, with built-in contingency buffers to assist

with time management and facilitate proactive communication with lecturers. Scheduled breaks were taken when needed, consistent with the Code of Conduct requirement to manage practitioner wellbeing (PsyBA, 2025). Supervision and consultation was provided by the PSYC5006 course convenor and course peers. Findings will be presented at the 2026 Sleep DownUnder conference and prepared for journal submission, with all outputs reporting the limited confidence of findings.

Conclusion

This rapid-SLR found EMDR treatment until PTSD symptom remission was associated with improved subjective sleep, however clinically significant impairment can remain after remission. Objective improvements in sleep were limited to sleep continuity, and the long-term effects on sleep and association with PTSD symptom reduction could not be assessed. Confidence in findings was moderate to low. As this is the first known synthesis of sleep outcomes in PTSD following treatment with EMDR, this review found no evidence supporting EMDR's hypothesised sleep-related mechanisms producing a sleep-specific benefit. Additionally, remission from PTSD symptoms can leave residual sleep impairments. Psychologists should therefore assess sleep using a validated measure before, during, and after treatment, and offer adjunctive sleep-focused interventions where disturbance persists. Psychological guidelines should recommend measurement of sleep using a validated measure alongside assessment of PTSD symptoms, and randomised controlled trials using fixed-dose protocols, continuous assessment, and long-term follow-up are needed to understand if and how EMDR affects sleep.

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Appendix A

PICOSST Framework

PICOSST Element	Inclusion Criteria	Exclusion Criteria
Population	Adults (≥18) with a primary diagnosis of PTSD (DSM-5, DSM-IV, or ICD) established using clinician interview or clinically significant scores on a validated self-report measure (e.g. PCL-5).	Individuals under 18; clinical samples with primary diagnoses other than PTSD; non-clinical samples; mixed diagnostic samples where PTSD-specific data cannot be extracted.
Intervention	EMDR delivered as a standalone intervention using Shapiro's (Shapiro & Maxfield, 2002) protocol in any delivery format.	EMDR delivered with an adjunct therapy as this would confound the outcome variables; EMDR-derived therapies that vary from the standard protocol as these may not reflect results from the standardised protocol.
Comparator	Waitlist, treatment-as-usual, active psychological comparator, healthy controls, active psychological comparator, or single-arm pre-post studies. Trials in which all arms receive EMDR are eligible where an EMDR-alone arm reports sleep before and after treatment.	Medication-only comparators will be excluded given heterogeneous medication effects on sleep architecture (Hutka et al., 2021)
Outcome	Studies reporting any validated subjective or objective measure of sleep quality (e.g. PSQI, ISI, actigraphy, polysomnography) at baseline and post-intervention.	No validated sleep measure at baseline and post-intervention.
Study Design	Randomised controlled trials, controlled clinical trials and quasi-experimental designs, including single-arm pre–post, uncontrolled cohort and feasibility studies, reporting primary data.	Single patient case studies and case series are excluded for feasibility. Observational and cross-sectional studies are excluded as they cannot estimate treatment-related change. Secondary evidence syntheses including systematic reviews and meta-analyses are excluded as they do not report primary data.
Setting	Studies can take place in an inpatient or outpatient setting in any country.	N/A
Time	Studies published after 2002, the development of Shapiro's EMDR protocol.	Studies published prior to 2002.

Note. PICOSST criteria was amended following feedback from assessment milestones.

Appendix B

Search Strategy

(sleep *OR insomnia* OR "sleep qualit*″ OR "sleep disturb*" OR "sleep difficult*″ OR "sleep efficiency" OR "sleep onset" OR nightmare* OR "PSQI" OR "Pittsburgh Sleep Quality Index" OR "Insomnia Severity Index" OR polysomnograph *OR actigraph*)
AND
("EMDR" OR "eye movement desensitisation and reprocessing" OR "eye movement desensitization and reprocessing" OR ("eye movement*″ ADJ3 reprocess*))
AND
("PTSD" OR "post-traumatic stress" OR "post traumatic stress" OR "combat stress" OR "traumatic stress disorder*" OR "PCL-5" OR "CAPS-5")

Appendix C

Characteristics of Included Studies

Study (country)	Design and comparator	Sample	EMDR dose	Outcome measures	Outcome timing	Key sleep findings
Ahmadi et al. (2015), Iran	Randomised controlled trial, three arms: EMDR, REM desensitisation and no-therapy control. REM desensitisation arm not synthesised.	11 of 16 randomised to EMDR analysed (33 of 48 overall). Male military personnel aged 25–50 with combat-related PTSD. Diagnosed using the SCID for DSM-III-R and Mississippi Scale score >107. All taking SSRIs or second-generation antipsychotics.	Not reported	Sleep: PSQI Other: Mississippi Scale	Post-intervention (timing not reported)	PSQI global score improved more than in the no-therapy control ($p < .001$). Means and dose not reported.
Gielkens et al. (2024), Netherlands	Single-arm pre–post. No comparator.	22 outpatients aged 60–84. Diagnosed using the CAPS-5.	Weekly sessions until remission or 9 months ($M = 15.32$, $SD = 7.27$)	Sleep: CAPS-5 item E6 (hours of sleep) Other: CAPS-5, cognitive measures	End of treatment (remission or 9 months)	Self-reported hours of sleep increased, $t(21) = 2.36$, $p = .028$. Pre–post means not reported.
Raboni et al. (2006), Brazil	Single-arm pre–post. No comparator.	7 adults (2 men, 5 women) aged 24–36 with PTSD after assault or kidnapping. Diagnosed using the SCID for DSM-IV. Probable overlap with Raboni et al. (2014).	Weekly 30–90 min sessions until remission ($M = 5$)	Sleep: PSG (SE, WASO), RESTQ-48 sleep quality	Baseline, after the third session and the week after discharge	SE increased (85.8% to 91.9%) and WASO decreased (62.9 to 32.9 min), both $p < .05$. Self-rated sleep quality improved, $p = .003$.
Raboni et al. (2014), Brazil	Controlled before–after. Healthy controls ($n = 11$) also received three EMDR sessions.	13 adults with PTSD after assault or kidnapping (24 enrolled). Diagnosed using the SCID-I for DSM-IV. No psychotropic medication.	Weekly 90 min sessions, 3–10, until remission ($M = 5$)	Sleep: PSG (sleep architecture, WASO, SE, REM density), PSQI, RESTQ-48 Other: IES, mood and anxiety measures	Baseline (two PSG nights) and the night after the final session	WASO decreased and SE increased ($p < .03$). Self-rated sleep improved ($p < .002$). PSQI no longer differed from controls but remained above 5 (figure only).
Rousseau et al. (2021), France	Controlled before–after. Historical healthy military controls ($n = 20$).	15 male active-duty soldiers with war-related PTSD (17 enrolled), mean age 36.8 years. Diagnosed by psychiatrist interview (DSM-IV-TR). Five taking SSRIs.	Every 7–15 days until remission ($M = 4.41$, $SD = 2.09$)	Sleep: PSG, PSQI, PSQI-A Other: PCLS, CAPS, BDI	One week before EMDR and one week after remission	PSQI improved (12.0 to 5.6, $p < .001$) but remained above 5. TST and SE increased, but change was not tested within the EMDR group. Baseline awakening density predicted sessions to remission ($r = .78$).
van der Heijden et al. (2024), Netherlands	Randomised controlled trial of EMDR with TMR vs EMDR with sham TMR. Sham arm synthesised as uncontrolled pre–post EMDR.	16 adults with PTSD in the sham arm. Diagnosed using the CAPS-5. Stable psychotropic medication permitted.	Single evening session	Sleep: adapted CSD (SOL, awakenings, SE, sleep quality, nightmares), PSQI at baseline only, PSG on intervention night only Other: CAPS-5, PCL-5	Diary averaged over three nights before and seven nights after the session	No change in diary sleep quality, SOL, SE or nightmares. Awakenings decreased across both arms (pooled).

Note. Raboni et al. (2006) and Raboni et al. (2014) report one cohort and were synthesised as one study. BDI = Beck Depression Inventory; CAPS(-5) = Clinician-Administered PTSD Scale (for DSM-5); CSD = Consensus Sleep Diary; DSM = Diagnostic and Statistical Manual of Mental Disorders; EMDR = eye movement desensitisation and reprocessing; IES = Impact of Event Scale; PCL-5 = PTSD Checklist for DSM-5; PCLS = Posttraumatic Stress Checklist Scale; PSG = polysomnography; PSQI(-A) = Pittsburgh Sleep Quality Index (PTSD Addendum); REM = rapid eye movement; RESTQ-48 = Recovery-Stress Questionnaire; SCID = Structured Clinical Interview for DSM; SE = sleep efficiency; SOL = sleep-onset latency; SSRIs = selective serotonin reuptake inhibitors; TMR = targeted memory reactivation; TST = total sleep time; WASO = wake after sleep onset.

Appendix D

Summary of Quality Appraisal Results

Study	Study type	Appraisal tool	Quality %	Overall appraisal	Major strengths and limitations
Ahmadi et al. (2015)	Randomised controlled trial (3 arms)	JBI Critical Appraisal Tool for RCTs	15 (2/13)	Include	**Limitations:** Randomisation and allocation concealment not described; no blinding; 31% attrition with completers-only analysis; EMDR dose and assessment timing not reported; internally inconsistent PSQI statistics **Strengths:** Randomised design with a no-treatment control; validated PSQI
van der Heijden et al. (2024)	Randomised controlled trial (2 arms)	JBI Critical Appraisal Tool for RCTs	77 (10/13)	Include	**Limitations:** Randomisation is to TMR vs sham, not EMDR, so the EMDR–sleep effect is an uncontrolled pre–post change; single EMDR session; 7-day follow-up; no baseline PSG **Strengths:** Participants and outcome assessors blinded; no attrition; identical procedures across arms; validated sleep diary
Raboni et al. (2006)	Quasi-experimental (single-group pre–post)	JBI Critical Appraisal Tool for Quasi-Experimental Studies	33 (3/9)	Include	**Limitations:** Very small sample (n = 7); no control group; only significant PSG results reported; scoring procedure not described; probable sample overlap with Raboni et al. (2014) **Strengths:** Objective PSG at three time points, including mid-treatment; validated sleep questionnaire (RESTQ-48)
Raboni et al. (2014)	Quasi-experimental (controlled before–after)	JBI Critical Appraisal Tool for Quasi-Experimental Studies	78 (7/9)	Include	**Limitations:** 46% of PTSD participants excluded after enrolment, with completers-only analysis; healthy controls also received EMDR (no PTSD control); single pre and post-measurement **Strengths:** PSG with an adaptation night and blinded scoring; validated sleep questionnaires (PSQI; RESTQ-48, Kellmann & Kallus, 2001); groups matched on age, sex and education; no psychotropic medication
Rousseau et al. (2021)	Quasi-experimental (controlled before–after)	JBI Critical Appraisal Tool for Quasi-Experimental Studies	67 (6/9)	Include	**Limitations:** Historical healthy controls who differ in age, setting and recording equipment; no adaptation night; some participants on SSRIs; many sleep parameters tested without correction **Strengths:** Validated automated PSG scoring applied consistently pre and post; low attrition; age-adjusted sensitivity analysis; homogeneous military sample
Gielkens et al. (2024)	Quasi-experimental (single-group pre–post)	JBI Critical Appraisal Tool for Quasi-Experimental Studies	44 (4/9)	Include	**Limitations:** No control group; sleep measured by a single CAPS-5 item, with pre–post means not reported; 29% attrition with dropouts systematically older **Strengths:** Stable co-interventions; independent trained assessors; clinician-diagnosed PTSD; only included study of older adults

Note. Quality % = number of items rated "Yes" ÷ number of applicable items × 100, following the proportion-of-"Yes" to "No" and "Unclear" results on the JBI Critical Appraisal Tool. For outcome-level items (RCT tool Q7–Q12; quasi-experimental tool Q5–Q9), an item scored only if it was rated "Yes" for every sleep outcome appraised. Quality % is descriptive only and was not used to exclude studies. PSG = polysomnography; PSQI = Pittsburgh Sleep Quality Index; RESTQ-48 = Recovery-Stress Questionnaire; TMR = targeted memory reactivation. CAPS-5 = Clinician-Administered PTSD Scale for DSM-5; EMDR = eye movement desensitisation and reprocessing; RCT = randomised controlled trial; SSRIs = selective serotonin reuptake inhibitors.

Appendix E

Prisma Checklist (Page et al., 2021)

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Title
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Abstract
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Introduction and literature review
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Aims
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Eligibility criteria, Figure 1, Appendix A
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Study design, Search strategy and study selection
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Search strategy and study selection, Appendix B
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Search strategy and study selection, Figure 1
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Data extraction and management
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Data analysis and synthesis approach
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Data extraction and management
Study risk of bias	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how	Quality appraisal,

Section and Topic	Item #	Checklist item	Location where item is reported
assessment		many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Appendix D
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Data extraction and management
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Data analysis and synthesis approach
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Data extraction and management
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Data analysis and synthesis approach
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Study design, Data analysis and synthesis approach
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Study design
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Study design
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Quality appraisal
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Data analysis and synthesis approach
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Search results. Figure 2.
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Search results
Study characteristics	17	Cite each included study and present its characteristics.	Study characteristics, Appendix C
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Risk of bias, appendix D
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Appendix C
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Risk of bias, Theme 1-4
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary	Theme 1-4

Section and Topic	Item #	Checklist item	Location where item is reported
		estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Risk of bias
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Theme 1-4
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Discussion
	23b	Discuss any limitations of the evidence included in the review.	Limitations
	23c	Discuss any limitations of the review processes used.	Limitations
	23d	Discuss implications of the results for practice, policy, and future research.	Recommendations for psychology practice, policy recommendations, future research
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Abstract
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	The review protocol was prepared and submitted as Milestone 1
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Appendix A note
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Abstract
Competing interests	26	Declare any competing interests of review authors.	Positionality statement
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Data extraction and management

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