Article:
Aboaja, Anne, Dewa, Lindsay, Perry, Amanda Elizabeth orcid.org/0000-0002-0279-1884 et al. (7 more authors) (2024) Sleep interventions for adults admitted to psychiatric inpatient settings:a systematic scoping review. Sleep Medicine Reviews. 101950. ISSN 1087-0792

https://doi.org/10.1016/j.smrv.2024.101950

Sleep Medicine Reviews 76 (2024) 101950

Contents lists available at ScienceDirect

Sleep Medicine Reviews

journal homepage: www.elsevier.com/locate/smrv

Sleep interventions for adults admitted to psychiatric inpatient settings: A systematic scoping review

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ARTICLE INFO

Handling Editor: M Vitiello

Keywords:
Psychiatric inpatients
Intervention
Sleep
Mental health
CBT for insomnia
Hospital

ABSTRACT

Sleep disturbances are common, affecting over half of adults with a mental disorder. For those admitted to a psychiatric ward, difficulties with sleep, particularly insomnia, are compounded by factors relating to the inpatient setting. We conducted a scoping review of sleep intervention studies involving adults admitted to psychiatric settings. We categorised the different types of sleep interventions and identified the effects on sleep and other mental and physical health outcomes. Instruments used to measure sleep were also examined. The search strategy yielded 4780 studies, of which 28 met the inclusion criteria. There was evidence of more non-pharmacological than pharmacological interventions having been tested in inpatient settings. Results indicated that non-pharmacological interventions based on cognitive behaviour therapy for insomnia improve sleep and may improve mental and physical health. Several distinct sleep measures were used in the studies. Gaps in the literature were identified, highlighting the importance of research into a wider range of sleep interventions tested against robust controls, using validated measures of sleep with evaluation of additional mental and physical health outcomes among a large sample size of adults in the psychiatric inpatient settings.

1. Introduction

Good sleep is essential for our mental health, social functioning and quality of life. There is a complex bidirectional relationship between sleep and psychiatric disorders [1], many of which are associated with sleep continuity disturbances [2]. Sleep problems commonly occur across mental disorders [3] and are risk factors for the onset [4] and prognosis of mental disorders [5]. Sleep disturbances are present in up to 80% of people with psychosis [3,6,7] and up to 90% of people with depression [3,7]. Compared to people without a mental disorder, adults with schizophrenia have a shorter total sleep time [8], whilst those with bipolar disorder have a longer sleep duration [9]. In addition, individuals with active symptoms of borderline personality disorder experience prolonged sleep onset latency [10]. The relationship between sleep and mental disorders is further complicated by a third factor, physical health comorbidity, which is linked to both sleep and mental disorders. Compared to the general population, people with mental disorders have an increased risk of obesity, diabetes and cardiovascular disease [11], all of which are associated with sleep disturbances [12]. In addition, the side effects of medication used to treat mental disorders not only directly affect sleep, but are also associated with an increased risk of developing these physical health conditions [13]. However, targeting sleep disturbances directly through pharmacological and non-pharmacological interventions can improve sleep, and subsequently reduce these risks.

Maintaining a good sleep environment can also improve sleep. The psychiatric hospital is an inpatient setting which should be a therapeutic environment whereby improving mental and physical wellbeing is the goal. However, the reality is that, often, the environment is not

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https://doi.org/10.1016/j.smrv.2024.101950
Received 15 December 2022; Received in revised form 26 April 2024; Accepted 30 April 2024
Available online 9 May 2024

Abbreviations

CBT-i	Cognitive behavioural therapy for insomnia
dCBT-i	Digital cognitive behavioural therapy for insomnia
GRIPP2	Guidance for reporting involvement of patients and the public version 2
ISI	Insomnia severity index
JBI	Joanna Briggs institute
LMICs	Low- and middle- income countries
MMAT	Mixed methods appraisal tool
PSQI	Pittsburgh sleep quality index
PRISMA	Preferred reporting items for systematic reviews and meta-analyses
PRISMA-ScR	Preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews
RCT	Randomised controlled trial

conducive to good sleep quality. Features of the hospital environment can further disrupt sleep-wake regulation and further compound sleep disturbances [14], for example, through inadequate daytime light exposure, noise at night [15], lack of autonomy [16,17] and the ward regime [17], for example, using light to check on a patient's wellbeing every hour during the night. When compared to sleep at home, sleep in any hospital setting is significantly shorter in duration and poorer in quality [14]. However, inpatient sleep quality is significantly poorer on psychiatric wards than non-psychiatric wards [18]. Whilst adults with a wide range of mental disorders admitted to a psychiatric hospital experience a range of sleep problems [19], the present study focuses on insomnia, rather than other conditions such as sleep apnoea and restless legs syndrome.

Inadequate sleep negatively affects several areas of health including mood, cognition and behaviour [20,21]. Among people with mental disorders, sleep disturbances are associated with elevated levels of depression and irritability, as well as deficits in memory, concentration and decision-making [22]. In the psychiatric inpatient setting, poor sleep is linked to increased suicidality [23,24] and sleep disturbances have been associated with increased impulsivity [25] and aggression [26]. The potential costs of untreated poor sleep among patients in a psychiatric hospital are significant. Patients who are unable to sleep during the night are more likely to sleep during the day and miss psychological therapies [27]. Those with disturbed sleep who attend psychological therapies are more likely to experience impaired learning due to poor attention [20] and memory [28,29] and may be required to repeat inpatient therapies prior to discharge. Increased symptoms of mental disorder linked to poor sleep may result in a longer admission [30] and higher doses of psychotropic medication which has implications for physical health [31]. Those with increased suicidality and aggression carry a heightened risk of harm to their own lives and the lives of others and are likely to require a longer admission. Therefore, sleep improvement in the inpatient psychiatric setting is an opportunity to improve health outcomes and achieve financial benefits through the reductions in length of stay, decreased psychotropic prescribing, and reduced missed or repeated psychological therapies.

Despite a growing body of literature on the use of sleep interventions in hospitals, the evidence specifically in psychiatric hospitals, where frequent patient observations are undertaken during the night [27], remains limited. Reviews have either excluded inpatients with a mental disorder [32], combined psychiatric populations with prison populations [33] or included inpatients with a mental disorder without separately examining their specific responses to sleep interventions [34,35]. Given the known associations between sleep, mental health and physical health, there is value in a review that systematically identifies studies of both pharmacological and non-pharmacological sleep interventions used among people with a mental disorder in psychiatric inpatient settings.

Focusing on insomnia, the aims of this scoping review were to (i) collate studies examining the effects of pharmacological and non-pharmacological sleep interventions specifically within the adult psychiatric inpatient setting, (ii) understand how sleep outcomes are measured in these studies and whether there are any barriers to measuring sleep and (iii) identify the effects these sleep interventions have on sleep and other mental and physical health outcomes.

2. Method

The protocol for this review was published before the review was undertaken [36]. The review was undertaken in accordance with the Joanna Briggs Institute (JBI) scoping review methodological framework [37]. We followed the Preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidance to summarise the search results [38] and used the PRISMA extension for scoping reviews (PRISMA-ScR) to report other findings [39]. The stages of JBI methodology included: (i) identification of research questions (ii) inclusion criteria (iii) search strategy (iv) study selection, (v) data extraction, (vi) presentation of results.

2.1. Research questions

Review questions were.

1. How is sleep measured in sleep intervention studies undertaken in the adult psychiatric inpatient setting?
2. What barriers to measuring sleep are reported in sleep intervention studies performed in adult psychiatric inpatient settings?
3. Which sleep interventions used in adult psychiatric inpatient settings have an effect on sleep and other health outcomes?

2.2. Inclusion criteria

Quantitative studies were included if they examined the effectiveness of an intervention on sleep; a sleep parameter was a primary outcome; participants were adults aged 18 years and over; they were conducted in an inpatient psychiatric setting; and they were published in English. Study designs included randomised controlled trials, quasi-randomised trials and non-randomised/quasi-experimental studies. Mixed child and adult samples were excluded unless authors applied appropriate stratification by age in the data analysis, and therefore adults could be separated. Consistent with previous reviews [17,26,32,34], studies that focused solely on parasomnias, sleep apnoea, and sleep-related movement disorders were excluded. Case studies, theses, and conference proceedings were also excluded.

2.3. Search strategy

Four databases were searched: CINAHL, MEDLINE, PsycInfo and Web of Science. We identified studies using variations on the following concepts: "sleep" AND "mental" AND "hospital". The detailed search strategy is outlined in the Supplement 1. Additional studies were identified through the first 1000 results on Google Scholar (AA1, FW). No lower date limit was used. We conducted the search on 20 September 2019 and updated our search on 18 June 2020 and 19 April 2023. We also scanned the reference lists of included studies.

2.4. Study selection

Identified articles were uploaded into EndNote version X9 [40] and duplicates were removed. One reviewer (AA1) conducted title and abstract screening. Two reviewers (AA2, GA) independently screened full text articles and where disagreement could not be resolved by

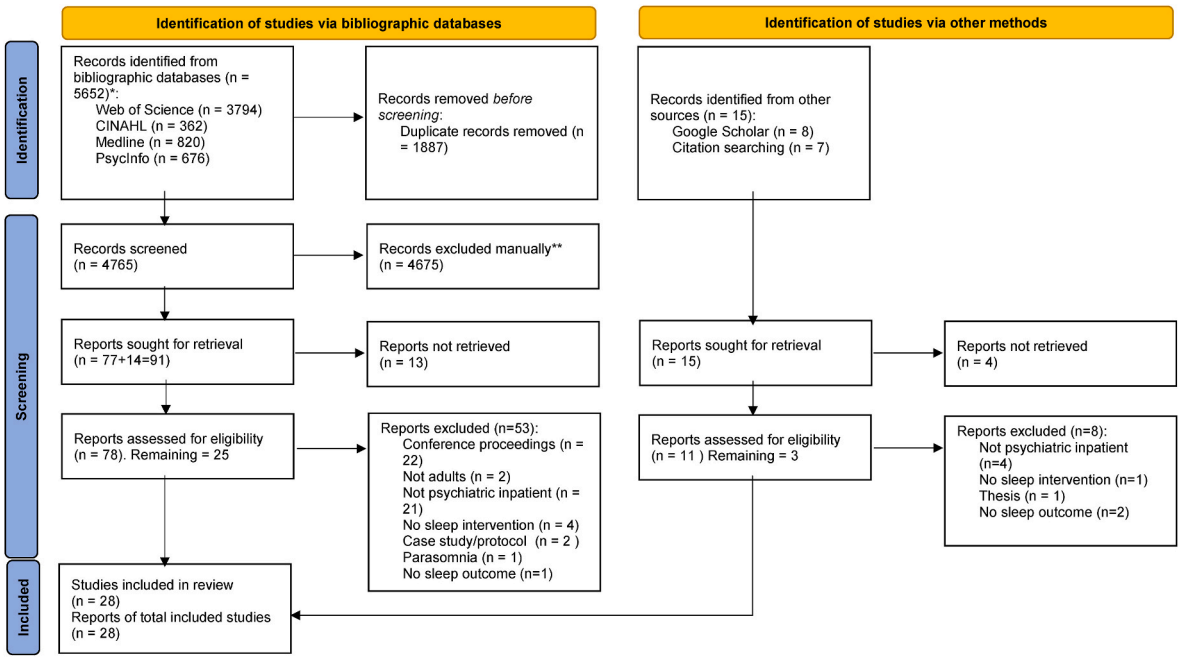

Fig. 1. Adapted PRISMA flowchart of literature search and screening.

discussion, resolution was achieved through discussion with a third reviewer (AA1).

2.5. Data extraction

We used a pre-determined data extraction form which was modified while piloting data extraction from two identified studies. The modified data extraction form with additional items included: author, year of publication, country (additional item), study design, type of inpatient setting, intervention (name, format, facilitator, duration, frequency), intervention participants (gender, age, diagnosis), control, control participants (gender, age, diagnosis), sleep measure instrument/outcome (e.g., nursing sleep chart/sleep duration), intervention effect, main sleep finding, barriers to measuring sleep sample characteristics, other health outcomes (emotional, cognitive, somatic) and study quality scores (additional item), as described below. Data extraction of all included studies was undertaken independently by two researchers, matching an academic (AP, FW, LD, SC) with a clinician (AA2, GA, IS, JC) where possible to strengthen the academic rigor and clinical expertise applied during this phase. Reviewers within each pair then jointly checked data extraction content to ensure accuracy and resolved disagreements through discussion or, if required, with input from a third reviewer (AA1).

Whilst not a stipulated requirement for scoping reviews, we critically appraised all the included studies to understand the quality of the current literature. We used the Cochrane risk of bias tool [41] to assess the randomised controlled trials (RCTs). We also assessed the quality of all studies according to the five quality criteria of the Mixed methods appraisal tool (MMAT) [42]. Using a recognised approach [43], the quality score for each study was expressed as a percentage (low: 0%, 20%; medium: 40%, 60%; high: 80%, 100%). The result allowed the overall quality of studies in the field to be estimated.

2.6. Data presentation

Descriptive statistics were presented of study characteristics and samples. Sleep measures were categorised using a matrix of objective vs. subjective and validated vs. unvalidated and barriers to measuring sleep were noted. Studies were categorised according to intervention type: pharmacological or non-pharmacological. Non-pharmacological interventions were further divided into cognitive behavioural therapy for insomnia (CBT-i) based interventions (e.g., physical activity), environmental interventions (e.g., adjusting bedroom lighting) and other interventions (e.g., repeated transcranial direct current stimulation). Finally, we reported effects on sleep and other health outcomes according to intervention type. Where a measure of statistical significance for a stated effect size was reported, sleep outcomes with effects sizes were presented, including those that were not statistically significant (i.e, effect sizes reported with a p value that was not less than 0.05). We synthesised the findings of the effect of interventions on sleep and other health outcomes by study design based on the presence of a comparison group.

2.7. Patient and public involvement

The guidance for reporting involvement of patients and the public version 2 (GRIPP2) [44] was followed to report patient and public involvement (Supplement 2).

3. Results

3.1. Selection of studies

Fig. 1 shows the results of the literature search and study selection in an adapted PRISMA flow diagram [38]. We identified 4780 unique studies and included 28 studies in the final review (see Table 1).

3.2. Study and participant characteristics

Table 1 and Table 2 summarise key features of the 28 included studies which were published between 1968 and 2022, referring to pharmacological and non-pharmacological interventions respectively. All studies, except two [45,46], were conducted in high-income countries, spanning four continents: Europe (n = 18, 64%) [47–64], Asia (n = 5, 18%) [45,65–68] and North America (n = 3, 11%) [69–71] and Australia (n = 1, 4%) [72]. Twelve (43%) studies were RCTs [45,46,54,57–62,65,66,69]. Of the remaining quasi-experimental or non-randomised studies, six included a control group [48,50,51,53,56,

Table 1
Characteristics and main findings of included pharmacological studies.

Author (year) citation number, country, study design	Intervention type, intervention and participants, *n*	Control conditions and participants, *n*	Sleep criteria for participants	Instruments used to measure sleep	Effect of intervention on sleep (effect size and *p* value stated where both are reported)	Effect of intervention on other health outcomes (effect size and p value stated where both are reported)	Reported adverse effects experienced by intervention participants
Adamson *et al.* (1970) [70] **Canada, Double-blind cross-over randomised trial**	Mandrax (dose not reported) for two nights $n = 32$	Chloral Hydrate (500 mg), $n = 31$	None	Nurse-led sleep chart/ observations	Increased sleep duration; did not change sleep latency	Not reported	Poor sleep, morning tiredness, confusion (n = 1), fatal fall (n = 1)
Ahmadpanah *et al.* (2022) [46] **Iran Double-blind, placebo-controlled randomised study**	Clonidine (0.2 mg/d – 0.6 mg/d) for 24 days $n = 36$	Placebo $n = 34$	None	PSQI	Improved sleep quality ($F = 7.34$, $p < 0.001$)	Improved mania symptoms ($F = 7.39$, $p < 0.001$); did not change cognitive performance	None reported although possible hypotension was monitored.
Baune *et al.* (2007) [48] **Germany, Pre-test/post-test study**	Quetiapine (up to 800 mg) as an adjunct to existing antidepressant therapy for four weeks, $n = 27$	None	None	PSQI	Increased sleep quality; reduced daytime sleepiness	Reduced depression	Daytime somnolence. No adverse metabolic or clinical events. No significant weight gain.
Benedetti *et al.* (2004), [49] **Italy, Placebo-controlled cross-over trial, non-randomised**	Lormetazepam (0.03 mg/kg of participant) for one night, $n = 38$	Placebo given to intervention group	None	PSQI Sleep diary ESS SSS	Increased sleep quality ($Z = 2.11$, $p = 0.034$); reduced number of awakenings ($Z = 3.32$, $p < 0.001$); did not change current sleepiness ($Z = 1.51$, $p = 0.130$); did not change general sleepiness ($Z = 0.21$, $p = 0.837$)	Did not change depression ($Z = 0.62$, $p = 0.536$)	Not reported
Blumenthal *et al.* (1980) [51] **Finland, Single night double-blind cross-over study, non-randomised**	Nitrazepam (5 mg) for one night, $n = 50$	Triazolam (0.5 mg) for one night given to intervention group	Insomnia (not specified)	Non-validated structured questions	Increased sleep duration ($t = 2.60$, $p < 0.020$; reduced sleep latency ($t = -3.74$, $p < 0.001$); reduced number of awakenings ($t = -3.44$, $p < 0.005$)	None reported	Mild headache, mild fatigue, vertigo, diarrhoea, gastrointestinal irritation. All deemed by investigator not to be related to the intervention.
Haider *et al.* (1968) [60] **UK, Double-blind randomised cross-over trial**	Mandrax (125 mg methaqualone/12.5 mg diphenyhydramine) given sequentially on three nights during a six-night period, $n = 48$	Dihydrochloralphenazine (650 mg) given sequentially on three nights during a six-night period to intervention group	Insomnia (not specified)	Nurse-led sleep chart/ observations	Reduced sleep latency ($t = 6.70$, $p < 0.010$); reduced time awake after sleep onset ($t = 3.67$, $p < 0.010$); increased sleep duration ($t = 2.82$, $p < 0.010$)	Not reported	Hangover, confusion, excitation, unsteadiness.
Hemmeter *et al.* (2001) [54] **Norway, Open non-randomised pilot study**	Ginkgo (intervention) Biloba (240 mg) given daily for four weeks during six weeks of TAU, $n = 8$	TAU - Trimipramine (200 mg) given daily for six weeks, $n = 8$	None	PSG	Increased sleep efficiency (12.00, $p = 0.019$); reduced sleep onset latency ($U = 30.00$, $p = 0.439$); reduced number of awakenings ($U = 52.50$, $p = 0.015$); did not change	Not reported	Not reported

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Table 1 (*continued*)

Author (year) citation number, country, study design	Intervention type, intervention and participants, *n*	Control conditions and participants, *n*	Sleep criteria for participants	Instruments used to measure sleep	Effect of intervention on sleep (effect size and *p* value stated where both are reported)	Effect of intervention on other health outcomes (effect size and p value stated where both are reported)	Reported adverse effects experienced by intervention participants
					total sleep time (U = 39.00, p = 0.253)		
Singer *et al.* (1978) [66] **Hong Kong, Double-blind multiple cross-over trial**	Flunitrazepam (2 mg) for one night and Flunitrazepam (4 mg) for one night, *n* = 47	Flurazepam (30 mg) for one night and Nitrazepam (10 mg) for one night given to the intervention group	Difficulty sleeping (sleep onset or awakenings or short sleep duration) or prescribed a hypnotic for insomnia	Nurse-led sleep chart/ observations Non-validated structured questions	4 mg Flunitrazepam reduced sleep latency compared to Flurazepam (χ^2 = 9.34, p < 0.010) and Nitrazepam (χ^2 = 8.65, p < 0.010)	Not reported	Mild hangover, drowsiness, weakness and unsteadiness of gait

Key: ESS, Epworth sleepiness scale; PSQI, Pittsburgh sleep quality index; PSG, polysomnography; SSS, Stanford sleepiness scale; TAU, treatment as usual.

68]. The mean MMAT score of quality was 65%. The risk of bias across the RCTs was not high but was unclear across many domains, as presented in Fig. 2.

There has been a marked increase in the number of studies of sleep interventions in adult psychiatric inpatient settings published since 2007. Additional trends observed in these studies are highlighted in Supplement 3. The majority of included studies (n = 25, 89%) were conducted in non-specialist inpatient settings with the remainder of studies conducted on wards for older adults [56], military personnel [50] or military veterans [70]. Across all included studies, there were at least 1392 adults, including one study which did not clearly report the sample size [56]. All but one study [55] (n = 291 participants) reported fewer than 100 participants. Among the RCTs, the size of the intervention group ranged from n = 10 [54] to n = 48 [59]. Among the 22 studies that reported gender [45–49,52–55,57–68,70,71], 52% (n = 512) of participants were female. The age of participants across the studies ranged from 18 years [50] to over 71 years [59].

Eleven (39%) studies involved participants with mixed psychiatric diagnoses [49,51,55,57,59,62,64,65,69–71] and 10 (36%) studies recruited participants who had a depressive disorder [46–48,52,53,58,60,61,66,68]. The remaining studies included participants with a single common diagnostic category of: bipolar disorder (n = 1) [45], chronic schizophrenia (n = 1) [67], mania (n = 1) [54], mixed mood and anxiety disorder(n = 1) [72], unspecified mood disorder (n = 1) [63] and dementia and cognitive impairment (n = 1), whilst one study did not report participant diagnosis [50].

3.3. Measurement of sleep outcomes and barriers to measurement

There were 20 distinct instruments used to measure effects on sleep (Supplement 4). Seven (25%) studies used objective measures of polysomnography (PSG) [46,53,61,63] and actigraphy [54,60,71]. Of the 15 validated subjective instruments, the two most frequently used were the Pittsburgh Sleep Quality Index (PSQI) (n = 10) [45–48,61,62,64,66–68,71] and the Insomnia Severity Index (ISI) (n = 4) [52,57,64,70]. Seventeen (61%) studies used only one instrument [45,47,50,51,53,54,56,57,59,60,62,63,66,67,69,70,72], whilst eleven (39%) used at least two instruments [46,48,49,52,55,58,61,64,65,68,71], of which five combined an objective sleep measure (actigraphy or PSG) with a validated subjective sleep measure [46,54,61,64,71]. Over the last fifty years, there has been a marked shift from studies using non-validated subjective measures such as nurse-led sleep charts and patient-reported sleep diaries to studies using validated subjective measures such as the PSQI. In the last two decades that has been a notable growth in studies also using objective sleep measures such as PSG and actigraphy (Supplement 4).

Three (11%) studies reported barriers to measuring sleep in psychiatric inpatient settings [54,70]. Occasional invalid or failed readings was a reported barrier to using actigraphy [54]. The ISI could not be completed accurately when a participant with schizophrenia was described as disoriented and not lucid [70]. Even when supported by staff, some patients had difficulty completing the PSQI, which relies on the ability to recall sleep behaviour over the preceding four weeks [51].

3.3.1. Sleep interventions used

Pharmacological interventions were used in eight (29%) studies. [45,47,48,50,53,59,65,69].

Of these, five studies examined the effects of benzodiazepine [48,50,65] or non-benzodiazepine hypnotics [59,69], whilst two studies tested the impact of antidepressants on sleep [47], one a vasodilator [45] and one a herbal treatment [53]. The remaining studies (n = 20, 71%) used non-pharmacological interventions. Of these non-pharmacological studies, eleven used interventions based on CBT-i. There was a high level of heterogeneity among these studies with only one study [68] using standard non-adapted CBT-i with all the core elements of CBT-i: (i) sleep restriction, (ii) psychoeducation/sleep hygiene, (iii) stimulus control, (iv) relaxation and (v) cognitive therapy. The remaining CBT-i-based studies used additional components [57] or at least one, but not all, of the five core elements of CBT-i [49,51,52,55,64,66,70,72]. Specifically, two studies tested interventions of physical activity [52,61,72] which is advice offered in the sleep hygiene/psychoeducation component of CBT-i. Environmental interventions were used in six studies which tested the effects of room occupancy [71], light [54,56,60,62] and odour [58] on sleep. In addition, studies examined music therapy [67], transcranial direct current stimulation [46], and sleep deprivation (not restriction) followed by chronotherapy [63].

Compared to the non-pharmacological intervention studies, the pharmacological intervention studies tended to measure short-term effects of sleep with a follow-up period of less than one week. Six of the eight (75%) pharmacological studies reported the presence or absence of side effects [45,47,50,59,65,69]. Of these six pharmacological studies, five (83.3%) reported various medication side-effects [47,50,59,65,69], for example, drowsiness, unsteadiness and a fatal fall. In contrast, seven of the twenty (35%) non-pharmacological studies [46,56–58,62,72]

Table 2
Characteristics and main findings of included non-pharmacological studies.

Author (year), citation, country, study, design	Intervention type, intervention and participants, *n*	Control conditions and participants, *n*	Sleep criteria for participants	Instruments used to measure sleep	Effect of intervention on sleep (effect size and *p* value stated where both are reported)	Effect of intervention on other health outcomes (effect size and *p* value stated where both are reported)	Reported adverse effects experienced by intervention participants
Biancosino *et al.* (2006), [50] **Italy, Pre-test/post-test study**	Sleep psychoeducation delivered as one 60-min group session per week for two weeks, *n* = 36	N/A	ICD-10 Persistent non-organic insomnia	NSOS DSS Sleep diary	Reduced sleep latency (t = 3.34, p = 0.002); reduced time awake after sleep onset (t = 3.09, p = 0.004); reduced use of hypnotics (t = 4.429, p < 0.001); no change in number of awakenings or daytime sleepiness	Not reported	Not reported
Canazei *et al.* (2022), [61] **Austria, Randomised controlled trial**	Dynamic bedroom lighting of artificial dawn and dusk with blue-light-depleted night-time lighting used for 2 weeks, *n* = 14	Standard lighting system, *n* = 16	None	Actigraphy	Increased total sleep time (F = 10.41,p = 0.003); increased sleep efficiency (F = 7.63, p = 0.010); reduced wake after sleep onset (F = 23.56, p < 0.001); reduced sleep onset time (F = 8.64, p = 0.007)	Did not change length of hospitalisation or use of other psychotropic medication	Not reported
Chien *et al.* (2015) [67] **Taiwan, Cluster randomised controlled trial**	CBT for depression with sleep hygiene and breathing exercise delivered as three 60-min group sessions per week for four weeks, *n* = 43	TAU, *n* = 46	PSQI>5	PSQI	Increased sleep quality (β = −1.57, p < 0.010)	Increased heart rate variability (β = 5.99, p < 0.001)	Not reported
De Niet *et al.* (2010) [52] **Netherlands, Pre-test/post-test study**	1. Stimulus control component of CBT-i (SC), *n* = 29 2. Music-assisted relaxation (MAR), *n* = 11	TAU, *n* = 14	Screen positive for insomnia and negative for sleep apnoea/RLS using three-question checklist	RCSQ	MAR - Increased sleep quality (t = −2.13, p = 0.040) SC – Did not change sleep quality (t = −1.25, p = 0.220)	Not reported	Not reported
Gerber *et al.* (2019) [53] **Switzerland, Pre-test/post-test study**	Exercise: sprint interval training, or continuous aerobic exercise training, delivered as three 35-min group sessions for four weeks by an experienced exercise coach *n* = 53	None	None	ISI FEPS II	Reduced insomnia symptoms (F = 21.4, p < 0.001); reduced dysfunctional sleep cognitions – ruminations (F = 22.2, p < 0.001)	Increased cardiorespiratory fitness (F = 6.20, p < 0.050) and reduced depression (F = 112.40, p < 0.001)	Not reported
Haynes *et al.* (2011) [71,74] **USA, Pre-test/post-test study**	Behavioural treatment for insomnia, *n* = 19	None	None	ISI	Reduced insomnia severity (F = 5.70, p < 0.050)	Not reported	Not reported
Henriksen *et al.* (2020) [55] **Switzerland, Single blind placebo-controlled randomised controlled trial**	Blue light blocking glasses worn overnight for seven consecutive nights, *n* = 10	Clear glasses (placebo) worn overnight for seven nights, *n* = 10	None	Actigraphy	Increased sleep efficiency and reduced wake after sleep onset	Not reported	Not reported
Hsu *et al.* (2015) [69] **Taiwan, Prospective parallel-group design**	CBT-i delivered as one 90-min session per week for six weeks by a CBT-i-trained nurse, *n* = 18	Health educational manuals for insomnia for 6 weeks, no frequency, *n* = 15	Receiving benzodiazepine treatment for insomnia	PSQI DBAS PSAS SHPS	Increased sleep quality (χ^2 = 15.52, p < 0.001); reduced pre-sleep arousal (χ^2 = 6.22, p = 0.010); did not change sleep dysfunctional beliefs/attitudes	Not reported	Not reported

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Table 2 (*continued*)

Author (year), citation, country, study, design	Intervention type, intervention and participants, *n*	Control conditions and participants, *n*	Sleep criteria for participants	Instruments used to measure sleep	Effect of intervention on sleep (effect size and *p* value stated where both are reported)	Effect of intervention on other health outcomes (effect size and *p* value stated where both are reported)	Reported adverse effects experienced by intervention participants
					($\chi^2 = 0.15$, p = 0.700); did not change sleep hygiene practice ($\chi^2 = 1.78$, p = 0.180)		
Imboden *et al.* (2020) [62,75,76] **Switzerland, Randomised controlled trial**	Aerobic exercise on indoor bicycles in three 40-50-min sessions per week for six weeks. *n* = 22	Stretching of major muscles in three 40-50-min sessions per week for six weeks. *n* = 20	None	PSQI PSG	Did not change sleep quality (F = 0.11, p = 0.741); did not change sleep efficiency (F = 0.63, p = 0.434); did not change total sleep time (F = 0.96, p = 0.336); did not change sleep onset latency (F = 1.87, p = 0.184)	Not reported	Not reported
Laguna-Parras *et al.* (2013) [56] **Spain, Pre-test/post-test study**	Sleep enhancement nurse interventions including psychoeducation and stimulus control, *n* = 291	None	Disturbed sleep pattern noted in nursing admission records	NOC OSQ	Reduced insomnia (t = 11.36, p < 0.001); reduced hypersomnia (t = 6.58, p < 0.001); reduced severity and degree of compromised sleep (t = 50.27, p < 0.001); increased sleep satisfaction (t = 18.36, p < 0.001)	Not reported	Not reported
Lu *et al.* (2022) [68] **Taiwan, Non-randomised trial**	Music therapy listening to slow-beat (60–80 bpm) music in activity room 9–10pm daily for 4 weeks, *n* = 35	Unspecified standard care, *n* = 31	None	PSQI	Improved sleep quality (B = −7.05, p < 0.001)	Not reported	Not reported
Martin *et al.* (2018) [57] **UK, Pre-test/post-test study**	Narrow-band red-light for night-time lighting, *n* = 9–16	Broad-band white night lighting used prior to intervention	None	Nurse-led sleep chart/ observations	Did not change number of times seen to be asleep during 30-min checks at night (U = 627.50, p = 0.490)	Not reported	Did not increase number of falls. Reports of hindering night-time nursing safety checks and care provision.
Okkels *et al.* (2020) [63] **Denmark Parallel group randomised controlled trial**	Pre-set adjustable circadian lighting with no blue light, *n* = 27	Lighting as usual, *n* = 27	None	PSQI	Did not change sleep quality	No significant change in depression (Major Depression Inventory scale) or wellbeing (WHO-5 wellbeing index)	No reported serious side effects. Dim lighting causing difficulties in undertaking evening hygiene procedures. Amber bathroom lighting reported to create a "creepy" environment.
Pyrke *et al.* (2017) [72] **Canada, Pre-test/post-test study**	Move from dorm-style shared rooms to new mental health facility with private rooms for sleep which control light and noise, *n* = 47	None	None	Actigraphy PSQI	Increased sleep efficiency (Z = −2.67, p = 0.008); reduced number of awakenings (Z = −2.03, p = 0.042); reduced time awake after sleep onset (Z = −3.43, p = 0.003; did not increase total sleep time (Z = −1.85, p =	Not reported	Not reported

(*continued on next page*)

Table 2 (*continued*)

Author (year), citation, country, study, design	Intervention type, intervention and participants, *n*	Control conditions and participants, *n*	Sleep criteria for participants	Instruments used to measure sleep	Effect of intervention on sleep (effect size and *p* value stated where both are reported)	Effect of intervention on other health outcomes (effect size and *p* value stated where both are reported)	Reported adverse effects experienced by intervention participants
					0.065); did not improve sleep quality (Z = −0.64, p = 0.526)		
Sarzetto *et al.* (2022) [64] **Italy, Pre-test/post-test study**	3 consecutive cycles of (36 h of total sleep deprivation with light therapy followed by 1 recovery night of sleep) followed by one week of light therapy, *n* = 11	None	None	PSG	Increased percentage of N2; decreased percentage of N3, decreased REM density in the last REM stage	Decreased depressive symptoms (HDRS)	Not reported
Schneider *et al.* (2020) [65] **Switzerland, Pre-test/post-test**	SLEEPexpert pragmatic behaviour intervention of adapted CBT-i based on bedtime restriction and circadian adaptation involving three phases of input: therapist-guided, nursing support, self-management, *n* = 15	None	DSM-5 co-morbid insomnia disorder or acute insomnia	PSQI ISI	Reduced time in bed; reduced insomnia severity, increased sleep efficiency; increased sleep quality; increased total sleep time	Did not change brief psychiatric symptoms (Brief Symptom Inventory)	Daytime fatigue.
Sheaves *et al.* (2018) [58] **UK, Single-blind randomised controlled trial**	Adapted CBT-i Sleep Treatment at Acute Crisis including light-dark exposure and digital sleep monitoring delivered as at least five sessions over two weeks by a clinical psychologist plus standard care, *n* = 20	TAU, *n* = 20	Score of 8 on ISI and wanting help for sleep	ISI	Reduced insomnia severity	Did not change mental wellbeing; did not change symptoms of mania or schizophrenia; did not change suicidal ideation or global distress	1 x suicide attempt deemed by trial safety review group to be unrelated to the intervention
Stanton *et al.* (2016) [73] **Australia, Pre-test/post-test study**	Morning aerobic and strengthening exercise delivered as a single 40-min group session by an exercise scientist, *n* = 40	None	None	RCSQ	Increased sleep quality (F = 4.37, p = 0.020)	Not reported	None reported
Vitinius *et al.* (2014) [59] **Germany, Single-blind, placebo-controlled randomised crossover trial**	Rose-scented odorant inhaled overnight via a device attached to nostrils for three consecutive nights preceded or followed three nights of placebo, *n* = 27	Placebo given to the intervention group	None	SF-A SF-B	Did not change sleep quality (F = 1.40, p = 0.225)	Did not change subjective wellbeing	Unable to tolerate the nasal tube and feeling sleep deprived (n = 3), odour evoked negative memories (n = 1)
Zhou *et al.* (2020) China, Randomised controlled trial	Transcranial direct current stimulation (tDCS) in addition to regular treatment. Twenty sessions for 30 min followed by four weekly treatments, *n* = 47	Sham tDCS, *n* = 43	ICD-10 insomnia	PSQI PSG	Increased sleep quality (F = 4.22, p < 0.050); increased sleep efficiency (F = 8.09, p = 0.005); increased total sleep time (F = 6.02, p < 0.050)	Reduced depression and anxiety	Mild tingling and infrared skin under the electrode.

Key: CBT, cognitive behavioural therapy; CBT-i, cognitive behavioural therapy for insomnia; DBAS, Dysfunctional beliefs and attitudes about sleep; DSS, Daytime sleepiness scale; FEPSIII, Fragebogen zur erfassung allgemeiner persönlichkeitsmerkmale schlafgestörter (a questionnaire assessing dysfunctional sleep-related cognitions); HDRS, Hamilton depression rating scale; ISI, Insomnia severity index; MAR, music-assisted relaxation; NSOS, Nocturnal sleep onset scale; NOC, Nursing outcome classification; OSQ, Oviedo sleep questionnaire; PSG, polysomnography; PSQI, Pittsburgh sleep quality index; PSAS, Pre-sleep arousal scale; RCSQ, REM, rapid eye movement; Richards-Campbell sleep questionnaire; RLS, restless legs syndrome; SC, stimulus control; SF-A, German sleep questionnaire A; SF-B, German sleep questionnaire B; SHPS, Sleep hygiene practice scale; TAU, treatment as usual.

reported the presence or absence of side effects. Of these seven non-pharmacological studies, five identified a wide range of intervention side-effects from daytime fatigue [64], feeling sleep deprived [58] and skin irritation [46] to hindered care-giving [56,62] and the evocation of negative emotions [58].

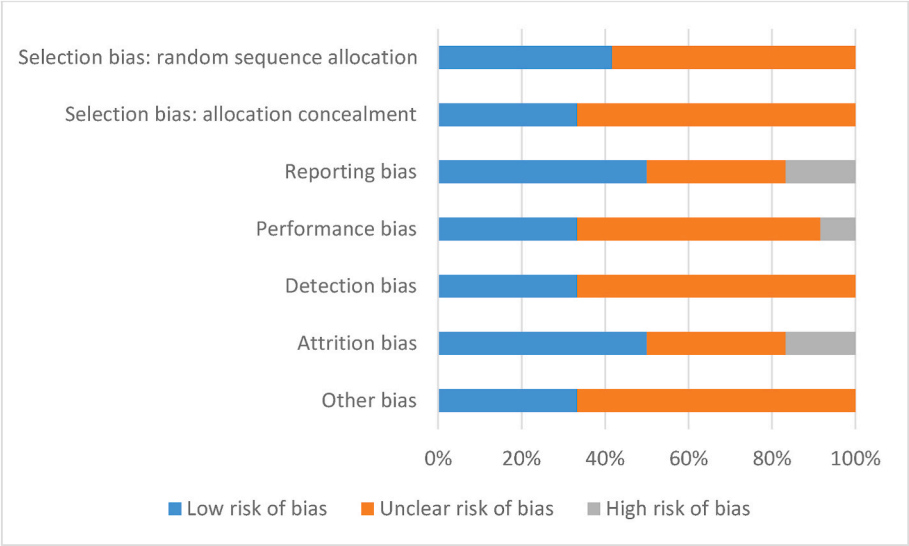

Fig. 2. Risk of bias across randomised controlled trial studies included in the scoping review.

3.4. Effects of pharmacological interventions

3.4.1. Studies with a control group

All but one of the studies of pharmacological interventions included a control group. Among these, benzodiazepine and non-benzodiazepine hypnotics increased sleep duration [50,59,69] and reduced sleep latency [50,59,65]. Both types of hypnotic reduced the time awake after sleep onset [59], with benzodiazepines specifically reducing the number of awakenings [48,50]. Hypnotic medication increased sleep quality but did not change depression scores [48]. The use of the herbal preparation Ginkgo Biloba alongside existing antidepressant therapy was shown via PSG to increase sleep efficiency by reducing the number of awakenings but did not change the total sleep time; the effect on depression was not reported [53]. Clonidine used as an adjunct to Lithium for bipolar disorder improved sleep quality and reduced mania symptoms but did not change cognitive performance on the Mini-Mental State Examination [45].

3.4.2. Studies without a control group

In the pharmacological study that did not include a control group, Quetiapine (an antidepressant and antipsychotic) used alongside existing antidepressant therapy not only increased sleep quality and reduced daytime sleepiness, but also reduced depression [47]. There were no reported effects of pharmacological interventions on physical health in the included studies.

3.5. Effects of non-pharmacological interventions (cognitive behavioural – based)

3.5.1. Studies with a control group

Of the eleven studies that involved interventions based on CBT, five (45%) included control groups [51,57,61,66,68]. Standard CBT-i increased sleep quality and reduced levels of pre-sleep arousal [68]. CBT-i with three enhancements (the addition of patient-worn digital devices to monitor sleep and increase motivation; light-dark exposure to enhance circadian rhythm; and strategies to reduce the impact of observations by staff at night) reduced insomnia symptoms. Despite the positive effect on sleep, this enhanced CBT-i did not change mental wellbeing, suicidality, manic symptoms or symptoms of schizophrenia [57]. There was little evidence that sleep psychoeducation alone improved sleep [51]. However, sleep hygiene/psychoeducation administered with breathing exercises and CBT for depression not only increased sleep quality but had the added physical health benefit of increasing heart rate variability [66]. (Lower heart rate variability predicts higher all-cause mortality [73].) Subjective sleep quality increased when sleep hygiene/psychoeducation was supplemented with music-assisted relaxation but not when given alone or with stimulus control [51]. Regular aerobic exercise did not change sleep quality, sleep efficiency or total sleep time [61].

3.5.2. Studies without a control group

Six non-pharmacological studies based on cognitive behavioural therapy had a single-arm design with no control [49,52,55,64,70,72]. Of these, two focused exclusively on exercise [52,72]. A non-pharmacological intervention with three components of CBT-i (sleep hygiene/psychoeducation, stimulus control and sleep restriction) did not reduce the number of awakenings [49]. However, it was associated with reduced sleep latency, reduced time awake after sleep onset, and reduced use of as required insomnia medication [49]. An intervention comprising four of the six components of standard CBT-i (sleep hygiene, stimulus control, relaxation and cognitive therapy) reduced insomnia [70]. Moreover, a similar intervention offering five CBT-i components not only reduced insomnia, but also reduced hypersomnia and increased sleep satisfaction [55]. A highly streamlined version of CBT-i focusing only on sleep restriction and circadian adaptation was associated with reduced insomnia severity and increased sleep quality and sleep efficiency [64]. Sleep interventions involving only guided physical exercise increased sleep quality [72] and reduced insomnia and were associated with fewer dysfunctional sleep cognitions, for example, less ruminating about sleep [52]. Additional health benefits of physical exercise interventions were reduced depression and increased cardiorespiratory fitness, respectively [52].

3.6. Effects of non-pharmacological interventions (environmental)

3.6.1. Studies with a control group

Five (83%) environmental intervention studies included a comparison group [54,56,58,60,62]. An RCT compared clear glasses with "blue-blocking" glasses which block the low wavelength blue light that suppresses melatonin [54]. Using actigraphy, the study found that wearing blue-blocking glasses between 18:00 and 08:00 increased sleep efficiency [54]. Further, hospital bedrooms with dynamic dawn and dusk lighting (depleted of blue light at night) evaluated using actigraphy not only increased sleep efficiency, but also increased total sleep time and reduced sleep onset time [60]. In contrast, a similar study of pre-set adjustable circadian lighting with no blue light evaluated using the PSQI

was associated with no significant change in sleep quality, depression or wellbeing [62]. Similarly, another light intervention (switching night lights in the hospital from white light - which includes blue and red light - to high wavelength red light) did not change total sleep time as measured through nursing observations [56]. Sleeping in a room with a rose odour did not change sleep quality and had no effect on wellbeing [58].

3.6.2. Studies without a control group

An intervention-only study found that a hospital move from shared to single bedroom accommodation improved actigraphy-measured sleep efficiency by reducing the time awake after sleep onset and reducing the number of awakenings [71]. However, the change of accommodation did not reduce total sleep time or perceived sleep quality [71].

3.7. Effects of non-pharmacological interventions (other)

3.7.1. Studies with a control group

Compared to sham transcranial direct current stimulation (tDCS) in an RCT, active tDCS given over several sessions significantly increased total sleep time and sleep efficiency (measured with PSG), increased overall PSQI sleep quality, and reduced symptoms of anxiety and depression [46]. In a non-randomised trial, when evaluated against standard care, listening to slow-beat music for an hour at night over four weeks significantly increased reported sleep quality [67].

3.7.2. Studies without a control group

An intervention comprising three cycles of 36-h sleep deprivation with light therapy and a recovery day, followed by one cycle of 7-day light therapy reduced time spent in sleep stage N3 (based on PSG recordings). It also reduced depressive symptoms [63].

4. Discussion

Over the past 50 years, there has been an increase in sleep intervention studies undertaken in psychiatric inpatient settings. Previous reviews have combined studies from psychiatric inpatient settings with those from non-psychiatric inpatient settings [34], prisons [33] and psychiatric community settings [74], or focused exclusively on CBT-i [75]. To our knowledge, this is the first scoping review of all sleep intervention studies of adults with mental disorders admitted only to psychiatric wards. Our findings show that most studies focused on non-pharmacological rather than pharmacological interventions. Furthermore, non-pharmacological sleep interventions largely improved sleep and had the potential for improving other health outcomes such as depression and cardiovascular health. Most studies of pharmacological interventions were RCTs whereas many studies of non-pharmacological interventions did not include a comparison group. The use of objective sleep measures was limited and subjective assessment tools varied considerably. Studies rarely reported barriers to measuring sleep in the psychiatric inpatient setting.

4.1. Measurement of sleep

Instruments used to measure sleep varied and were mostly validated subjective questionnaires. The most common was the PSQI [76]. Over time, fewer studies have relied on non-validated subjective measures like sleep diaries and nursing observations. Our review identified some studies that used costly objective sleep measurements including polysomnography and actigraphy. Whilst objective measures do not require patients to have the level of cognitive functioning that is necessary for the use of subjective sleep questionnaires [51,70], such technologies involving the use of batteries or wires may be less suitable for studies with patients at high risk of self-harm and suicide. Whilst patient-reported subjective measurements encourage positive patient involvement, they can underestimate sleep duration even when objectively sleep duration is normal [77]. This means it is possible that even when sleep is objectively improved with mental health benefits, patients may subjectively perceive that they are not sleeping better. However, given that there is a subjective element to the diagnosis of insomnia, it is important to include a validated subjective instrument when assessing the effectiveness of an intervention for chronic sleep disturbance.

When selecting a sleep measurement, consideration should be given to the degree to which the measurement is validated to measure the specific process of sleep or circadian rhythmicity that the researcher or clinician intends to measure. For example, actigraphy provides a reliable measurement of daytime activity and is highly sensitive to sleep, but overestimates total sleep time and is less effective as a measure of circadian rhythm [78,79]. Similarly, the degree to which a patient feels sufficiently rested on waking to get up and start the day is better assessed using subjective rather than objective measurements. Ultimately, the choice of sleep measurement will be guided by the sleep process intended to be measured, individual patient factors and financial resources.

4.2. Interventions

Our review identified many studies reporting effective pharmacological and non-pharmacological sleep interventions in psychiatric inpatient settings among patients with a diversity of mental disorders, and a few studies did not find any sleep benefits. Inadequate powering of studies with few participants may lead to clinically important sleep benefits not being reflected in the analyses and statistical significance not being reached. Few non-pharmacological studies reported the presence or absence of adverse effects of an intervention on sleep. In comparison, a larger meta-analysis of RCTs of pharmacological and non-pharmacological sleep interventions in prisons and psychiatric hospitals also found that the majority of studies reported positive effects on sleep, whereas 2% found adverse effects on sleep [33]. The known long-term side-effects of tolerance and dependency of benzodiazepines [80] were not thoroughly investigated in included studies and were therefore not reported in the relevant pharmacological studies. This is most likely due to the short observation time for measuring the effect of the pharmacological intervention on sleep which identified the known short-term side-effects. To inform future risk-benefit decisions around sleep interventions in psychiatric inpatient settings, it is important for studies to report the positive and negative effects on sleep and the side-effects of the intervention over an extended period of time.

Findings were consistent with other studies showing the increasing use of non-pharmacological interventions, particularly those based on CBT-i in psychiatric inpatient research [33,34] and a small but growing number of environmental interventions [33]. Based on the strong evidence base, CBT-i is the recommended first-line treatment for adults with chronic insomnia [81] and is a safer alternative to pharmacological interventions with a high level of reported side-effects. However, there remains a relative paucity of CBT-i studies among individuals admitted to psychiatric inpatient settings [75]. Furthermore, among this population some individuals will not be able to access or benefit from this intervention. For example, CBT-i may not be readily available in some psychiatric inpatient settings due to financial costs and lack of training [82]. Critically, the lack of available CBT-i has resulted in widespread over-prescribing of benzodiazepines which are associated with side-effects of sedation, tolerance and dependence [80]. CBT-i also requires a high level of patient engagement and without this, the benefits are unlikely to be obtained.

Where financial resources are limited, a digital version of CBT-i (dCBT-i) could be used [83]. DCBT-i has been used with adults experiencing mood and anxiety disorders [84] and is more cost-effective than individual and group face-to-face CBT-i as well as pharmacological sleep interventions [85]. However, studies are needed to measure the effectiveness of and identify the barriers to using dCBT-i in the psychiatric hospital setting. Alternatively, in the absence of standard CBT-i, we

Practice points

1. Clinicians can feasibly use validated subjective sleep measures instead of relying on non-validated subjective measures to assess sleep in adults admitted to the psychiatric setting.
2. Clinicians should monitor side-effects in patients receiving any sleep intervention.
3. Where hypnotic medication is being considered, clinicians should first discuss the side-effect profile and weigh up the risks and benefits with patients.

found evidence that sleep benefits can be achieved from the receiving only the most effective components of CBT-i, for example, sleep restriction [64].

CBT-i may be less suitable for some patients on psychiatric wards who lack motivation and concentration due to the nature and severity of their mental disorder [78]. In such cases, there are effective pharmacological interventions for patients with capacity and a willingness to accept medication. A few studies consistently reported effectiveness of environmental interventions, such as blocking out blue light [54], on sleep among adults in the psychiatric inpatient setting. Therefore, more RCTs are needed before implementation is possible. Environmental interventions may offer an alternative to medication for patients unable to benefit from CBT-i. Evidence for the use of sleep deprivation, as opposed to restricted time in bed which is a highly effective component of CBT-i, and tDCS remains sparse. We found no evidence for the use of aromatherapy in the psychiatric inpatient setting, whereas in physical health inpatient settings the evidence for effectiveness is mixed [34]. Furthermore, our review revealed an absence of studies evaluating acupuncture and melatonin which have been shown to have varying degrees of effectiveness on sleep in non-psychiatric inpatient settings [34]. To avoid the effects of one sleep intervention (eg, morning sedation from hypnotic medication) unhelpfully counteracting the effects of or hindering access to another sleep intervention (eg, attending a morning physical exercise group), it is recommended that a coordinated approach be taken by the inpatient multidisciplinary team in selecting and planning a sleep intervention [75].

Although there is limited evidence regarding longer-term effects such as reducing hospital length of stay, some studies showed sleep interventions used in the psychiatric inpatient setting have potential to improve sleep in the short-term whilst also improving physical fitness and reducing mental ill-health. Though few studies reported on non-sleep outcomes, there was some consistency with a recent meta-analysis reporting that CBT-i-based interventions improve the mental health of individuals with mental health diagnoses [86], whilst we found no evidence that hypnotics offer additional health benefits. Our findings are in line with evidence from healthy and other clinical populations on the direct associations between improved sleep and physical health [12] and greater positive affect [87]. However, more controlled studies are needed with large sample sizes in psychiatric inpatient settings to examine the impact of sleep interventions on other health outcomes such as.improved cognition [22], reduced suicidality [23] and reduced aggression [26].

5. Limitations

To complement existing reviews, our search strategy included a larger number of databases, excluded studies that were not conducted in psychiatric inpatient settings [33], and did not exclude pharmacological interventions [34]. However, we did not search grey literature such as doctoral theses which may have helped to identify additional studies. In restricting the review to studies published in English, we excluded sleep interventions described in other languages. The risk of selection bias could have been reduced by using two reviewers instead of a single reviewer to screen titles and abstracts. A key shortcoming is the relatively low proportion of non-pharmacological studies that were designed without a comparison group. This limited the opportunity to draw conclusions about the effectiveness of many non-pharmacological sleep interventions.

There was a disproportionately high number of studies from European countries with little representation from low- and middle-income countries (LMICs), despite a growing number of sleep health publications outside of high income countries [88,89]. Whilst the prevalence of sleep disturbances does not appear to vary globally [89], some LMICs have unique cultural understandings of sleep [88], which could affect the acceptability of some sleep interventions that are used effectively in high income countries. This review did not aim to identify interventions that report cost-effectiveness within a psychiatric inpatient setting, but this information would be particularly useful for LMICs.

6. Conclusions

This review has identified a growing body of evidence for the use of non-pharmacological and, to a lesser degree, pharmacological, interventions to improve sleep of adults in psychiatric inpatient settings.

Research agenda

To advance research into sleep interventions for adults with mental disorders in inpatient psychiatric settings.

1 .Validated subjective measures (e.g., PSQI and ISI) should be used in future studies of insomnia and may, where feasible and necessary, be supplemented with the use of validated objective measures such as actigraphy
2. Study designs should include a comparison group
3. Intervention studies should be designed to identify the presence or absence of side effects
4. There is a need for sleep intervention research conducted in psychiatric inpatients settings in low- and middle-income countries.
5. Longitudinal studies are needed to understand any distal effects of sleep interventions on mental and physical health.
6. Greater homogeneity of reported sleep outcomes is desired between intervention studies

The choice of sleep intervention is likely to be determined by a combination of factors including availability, effectiveness and side-effects. Validated subjective measures are feasible in inpatient psychiatric sleep research and can be supplemented by objective measures, where appropriate. The review highlights gaps in the evidence for environmental sleep interventions from research conducted in low- and middle-income countries and from studies that measure additional health outcomes. There is a need for more RCTs into sleep interventions that can be used in adults in psychiatric inpatient settings.

Conflicts of interest

The authors have no conflicts of interest to declare.

Acknowledgements

The authors acknowledge contributions made at the start of the study by Mr. B, a Forensic Sleep Research Group member with lived experience of the scoping review topic. We thank the Information Service Manager at the Centre for Reviews and Dissemination, University of York, UK for undertaking searches on databases. We also acknowledge the role of a Dr Shivali Shah, Specialty Trainee in Forensic Psychiatry, Tees, Esk and Wear Valleys NHS Foundation Trust, UK who contributed to the scoping review protocol. We thank the two peer reviewers for their helpful feedback. An.Ab and FW received funding from the National Institute for Health and Care Research (NIHR) Applied Research Collaboration (ARC) North East and North Cumbria (NENC) (NIHR200173). The views expressed are those of the authors and not necessarily those of the NIHR or the Department of Health and Social Care. LD is also grateful for support from the National Institute for Health Research under the Applied Research Collaboration program for North West London, the National Institute for Health Research North West London Patient Safety Research Collaboration and the Imperial National Institute for Health Research Biomedical Research Centre.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.smrv.2024.101950.

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