Sleep in Serious Mental Illness: Impact on patients and treatment in services

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Abstract

This thesis explored sleep in the context of serious mental illness (SMI), firstly by investigating the association between sleep and socio-occupational functioning (SOF), and then by investigating how sleep is recorded and treated in current clinical practice, as well as its association with attendance and number of appointments scheduled.

A systematic review was conducted to collate existing research on sleep and SOF in SMI. Comprehensive searches were performed in PubMed and PsycNet, yielding 832 results. After applying inclusion criteria, 24 studies were included. Data were extracted for analysis via narrative synthesis. Collectively, studies investigated sleep quality, satisfaction, duration, disturbance, specific disorders, and objectively-recorded sleep parameters across various study designs and assessment methods. Most studies revealed a significant association between the respective sleep problem(s) and SOF in SMI populations. While limitations such as reliance on primarily subjective measures and the need for randomised controlled trials were identified, the review emphasises the need for sleep assessment and integrated sleep interventions as part of routine SMI care to potentially improve and/or prevent poor SOF.

An empirical study was then carried out to examine the documentation and treatment of sleep problems in records of SMI patients, the association between their sleep and attendance rates and the association between their sleep and number of appointments scheduled. Relevant patient records (n = 133) were extracted from an NHS Trust's electronic database via automatic and manual selection processes. Quantitative content analyses and follow-up chi-square analyses were used to answer the recording and treatment research questions. Mann-Whitney U tests were used to compare attendance rates and number of appointments scheduled by sleep status. Findings revealed that there is inconsistency in the recording of relevant sleep information of SMI patients, and records are often limited to one-word descriptions. Sleep status was not associated with attendance rate or number of appointments scheduled, though low numbers limited this finding. The study echoes previous research regarding the inadequate assessment of sleep and the discrepancy between recognised sleep problems and subsequent treatment adherence to NICE guidelines (e.g., CBT-I, a recommended first-line treatment, was rarely offered). The study

highlights the need for improved recording and consistent treatment of sleep by clinicians, to align with NICE guidelines, and suggests relevant areas for further research.

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Chapter 1

Introduction

Word count: 991 words

Introduction

Sleep is a natural and recurring state of body and mind, essential for humans and animals, in which consciousness is suspended or altered, voluntary movement is inhibited, and sensory interactions with the physical environment are reduced, in order that restorative functions may take place. Sleep is typically characterized by distinct stages, including non-rapid eye movement (NREM) and rapid eye movement (REM) sleep (Assefa et al., 2015). NREM sleep, also referred to as slow-wave sleep (SWS), consists of several stages, with each stage associated with different patterns of brain waves. REM sleep is marked by rapid eye movements, increased brain activity, and vivid dreaming. The functions of sleep are not entirely understood, but it is known to be essential for rejuvenating cognitive function, memory consolidation, emotional regulation, and overall restoration of the body and mind (Xie et al., 2013; Klinzing et al., 2019; Walker & van der Helm, 2009). The amount of sleep required to maintain health varies from person to person and with ageing, but the National Health Service [NHS] (2021) recommends that seven to nine hours of sleep per night is optimal for adults, and the National Institute for Health and Care Excellence [NICE] (2022) recognises the standard amount of time to fall asleep ('sleep-onset latency') as typically less than 30 minutes. Insufficient, disturbed, or poor-quality sleep risks jeopardising the functions outlined above. Conversely, having *too much* sleep (even when it is of good quality) is associated with increased risk of multiple physical health problems (Jike et al., 2018), compromised physical, emotional, and social functioning (Lallukka et al., 2018), and worse memory and cognitive function (van Oostrom et al., 2018). Despite sleep's clear role in maintaining mental functioning, patients' sleep is not routinely assessed or recorded across mental health services.

It is estimated that approximately one-third of UK adults in the general population experience sleep problems, with 6-10% meeting the criteria for insomnia disorder (Wilson et al., 2019). Sleep problems are thought to be particularly common in people with serious mental illness (SMI) (Scott et al., 2021a; Freeman et al., 2020; Laskemoen et al., 2019). SMIs encompass enduring health conditions marked by significant functional limitations across symptom domains. These limitations frequently result in challenges in sustaining meaningful employment, limited social support, recurrent psychiatric hospitalizations, homelessness,

and concurrent substance misuse. For the purposes of this thesis, SMI includes psychotic disorders, bipolar disorder (BD), major depression and anxiety disorders, and eating disorders or personality disorders characterised by severe functional impairment (World Health Organization, 2019) (Scott et al., 2021; Freeman et al., 2020; Laskemoen et al., 2019). There are numerous reasons sleep may be worse in SMI populations, such as increased predispositions to experience anxiety or paranoia (Taylor et al., 2015), interactions of antipsychotic medication with hormones involved in circadian rhythm regulation (Krystal et al., 2008), and increased likelihood of physical comorbidity impacting sleep (Kalucy et al., 2013).

The National Institute for Health and Care Excellence [NICE] (2022) recommends that chronic (longer than three months) insomnia be addressed via sleep hygiene and CBT-I as a first-line treatment. There is little research into the impact of sleep problems within SMI populations specifically, but unfortunately, it does not tend to be treated in accordance with NICE (2022) guidelines (Rehman et al., 2017; Barret et al., 2020; Reeve et al., 2019). In Barret et al. (2020), clinicians claimed lack of knowledge about sleep assessment/treatment, and beliefs that sleep treatment is too demanding in this population were barriers to patient receiving appropriate sleep treatment. These views are consistent with the current lack of mandatory teaching on sleep problems and their treatment in either medical or clinical training (Romiszewski et al., 2020; Jernelöv & Blom, 2023).

Little is known about how poor sleep might impact SMI patients' socio-occupational functioning (SOF). Social functioning is characterised by an individual's ability to perform various societal roles, including those of a homemaker, worker, student, spouse, family member, or friend as well as the person's satisfaction with their capacity to fulfil these roles, take care of themselves, and engage in leisure/recreational activities (Brissos et al., 2011). Occupational functioning is characterised by a person's ability to effectively fulfil occupational duties within a distinctive work setting's physical, occupational, environmental, and psychological requirement. SOF can therefore be understood as the overall extent to which people are able to engage in all of these areas. SOF is extremely relevant in SMI *diagnosis*, given SMI is partially defined by its impact on functioning, and *treatment*, and since treatment focus is turning from medical management to functional recovery. Treatment approaches have evolved beyond mere symptom control and relapse prevention

to encompass functional recovery, including social and vocational reintegration (Liberman & Kopelowicz, 2005; Drake & Whitley, 2014). For individuals with SMI, the absence of symptoms does not signify a return to a fully normal life. In addition to achieving symptom remission, recovery should involve active participation in work/education, as well as engagement in social, family, and recreational activities. Understanding factors that influence SOF therefore has important clinical relevance in treatment and recovery. Whilst SOF is already known to be significantly lower in SMI populations, it would be helpful to better understand if and to what extent this might be influenced by *sleep*. And if poor sleep *is* associated with compromised SOF, it would be useful to know more about if and how this affects SMI patients' engagement with services, e.g., attendance of appointments.

In light of the above, this thesis aims to explore how sleep in SMI is recorded and treated, whether sleep and SOF in SMI are positively associated, and whether sleep affects SMI patients' engagement with services. Better understanding the link between sleep and SOF in SMI was achieved via a systematic review of the literature, and formation of a narrative synthesis. The empirical paper utilises an electronic records database whereby the records of SMI patients were selected and explored to highlight themes in how sleep is recorded, treated and associated with attendance.

Chapter 2

Systematic Review

Sleep and socio-occupational functioning in adults with serious mental illness: a systematic review

This paper has been developed for submission to *Psychiatry Research*.

Author guidelines are outlined in Appendix B.

Word count limit: 5,000 words

Word count: 4,548 words

Sleep and socio-occupational functioning in adults with serious mental illness: a systematic review

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Abstract

Sleep is recognised as a crucial factor influencing mental health and quality of life. Individuals with serious mental illness (SMI) often experience significant sleep problems, which can further exacerbate their symptoms and impact their socio-occupational functioning (SOF). Despite the well-established bidirectional relationship between sleep and mental health, the specific association between sleep and SOF in the context of SMI remains underexplored. A systematic review was conducted. Comprehensive searches in PubMed and PsycNet, yielded 832 results. After applying inclusion criteria, 24 studies were included in the narrative synthesis. Data were extracted for analysis, including study characteristics and key findings. Collectively, studies investigated sleep quality, satisfaction, duration, disturbance, specific disorders, and objectively-recorded sleep parameters across various study designs and assessment methods. Most studies revealed a significant association between the respective sleep problem(s) and SOF in SMI populations. While limitations such as reliance on primarily subjective measures and the need for randomized controlled trials were identified, the review emphasises the need for sleep assessment and integrated sleep interventions as part of routine SMI care to potentially improve and/or prevent poor SOF.

Keywords:

Schizophrenia

Psychosis

Bipolar disorder

Major depressive disorder

Sleep disturbance

Sleep disorder

Sleep-wake

1. Introduction

It is well established that sleep is essential for physical and mental health; as such sleep problems can increase susceptibility to mental health disorders, reduce quality of life, and negatively impact daily functioning (Freeman et al., 2020). Sleep problems are particularly prevalent in serious mental illness (SMI) (Scott et al., 2021a; Freeman et al., 2020; Laskemoen et al., 2019). SMI is used throughout this review as an umbrella term comprising psychotic disorders, bipolar disorder (BD), major depression and anxiety disorders, and eating disorders or personality disorders where the degree of functional impairment is severe (World Health Organization, 1993). (Personality disorders and eating disorders are not typically counted as SMIs in the UK (although there is no universal, consistent definition of SMI), however people with these diagnoses will sometimes be referred to secondary care mental health services based on high severity of functional impairment, and are hence included for the purpose of this review.) More severe/chronic sleep problems tend to have a more detrimental effect on mental health, and vice versa, forming a bidirectional cycle. In addition, there are multiple overlapping biological and environmental risk factors that are known contributors to both sleep problems and SMI. For example, many people with SMI will have experienced childhood trauma (Varese, 2012) which places them at a much higher risk of insomnia (Grande et al., 2016; Benson, 2015), potentially via trauma-driven physiological, cognitive, and affective hyperarousal (Laskemoen et al., 2021).

The SMI population is generally associated with greater need and increased healthcare costs compared to those with primary, non-comorbid mental health disorders, such as mild to moderate anxiety, depression, or OCD (Somaiya et al., 2014). One potential contributor to this is sleep problems significantly impacting the onset, course, and treatment of mental ill health in SMI populations (Laskemoen et al., 2019). Sleep problems in SMI are associated with more suicide attempts, poorer clinical and cognitive functioning, lower quality of life, and higher mood episode relapse rates (Benson, 2015; Sylvia et al., 2012; Davies et al., 2017; Ritsner et al., 2004; Russo et al., 2015; Kanady et al., 2017). More research is needed to better understand the relationship between sleep and SMI, such as to what *extent* the severity of mental illness might be caused or maintained by poor sleep.

Socio-occupational functioning (SOF) can be defined (and is understood throughout this review) as the extent to which a person is able to engage in *'self-care and activities of daily living, communication and interpersonal relations, instrumental living skills, and work'* (Saraswat et al., 2006, p. 302). SMI is in part defined by its impact on functioning, and therefore it is no surprise that SOF is significantly lower in SMI populations and is identified as a target for intervention. SOF in SMI groups predicts quality of life (Kuehner & Huffziger, 2009) and ability to live independently in the community. For example, better social skills were found to be associated with successfully attaining and retaining housing (Gabrielian et al., 2019). Improvements in occupational functioning may also enhance the recovery process by allowing for self-empowerment and self-actualization (Provencher et al., 2002). Bellido-Zanin et al. (2015) found that social functioning scores predicted the use of mental health resources in patients with SMI, with social isolation predicting greater need for hospitalisation. Since SOF is reduced in SMI, it would be helpful to better understand if and to what extent this might be influenced by sleep.

Sleep problems have been associated with decreased SOF in both SMI and non-clinical populations. In non-clinical populations, sleep problems have been associated with increased absences, workplace accidents, and decreases in career progression (Kucharczyk et al., 2012), reduced ability to accurately interpret social cues and effectively navigate social situations (Lunsford-Avery et al., 2019), reduced marital relationship quality (Troxel et al., 2007), increased reactivity to emotional stimuli and inappropriate processing of social information (Tempesta et al., 2018), and increased risk of social withdrawal and separation, which can become a reinforcing cycle (Ben Simon and Walker, 2018). In SMI populations, sleep problems have been linked to more problematic perceptions of social relationships, poorer social functioning in the community, smaller social networks, and poorer behavioural ratings of social competency (Blanchard et al, 2020).

Although there is some evidence pointing towards reduced SOF in SMI being partially explained by poor sleep, empirical research on the links between sleep, SOF, and SMI is lacking in comparison to that on the link between sleep and either mental health or quality of life. There are numerous reviews amalgamating findings of these aforementioned studies, however there are no such reviews at the time of writing that focus on sleep, SOF, and SMI.

The primary aim of the present systematic review is therefore to explore whether sleep and SOF are positively associated within an SMI population.

2. Methods

2.1 Study selection

This systematic search protocol was pre-registered in PROSPERO (registration number: CRD42023393724). The primary criteria for studies to be included are as follows:

1) SMI participant population (as defined above)
2) Assessment of sleep AND
3) Assessment of SOF (see Appendix A for operationalised search terms)
4) Direct association between sleep and SOF examined (e.g., one is an independent variable, and one is a dependent variable, or the correlation between the two is examined)

Eligible studies were also required to be peer-reviewed, English-language, and published from 1993 onwards in order to conform to the ICD-10 (WHO, 1993) establishment of SMI criteria.

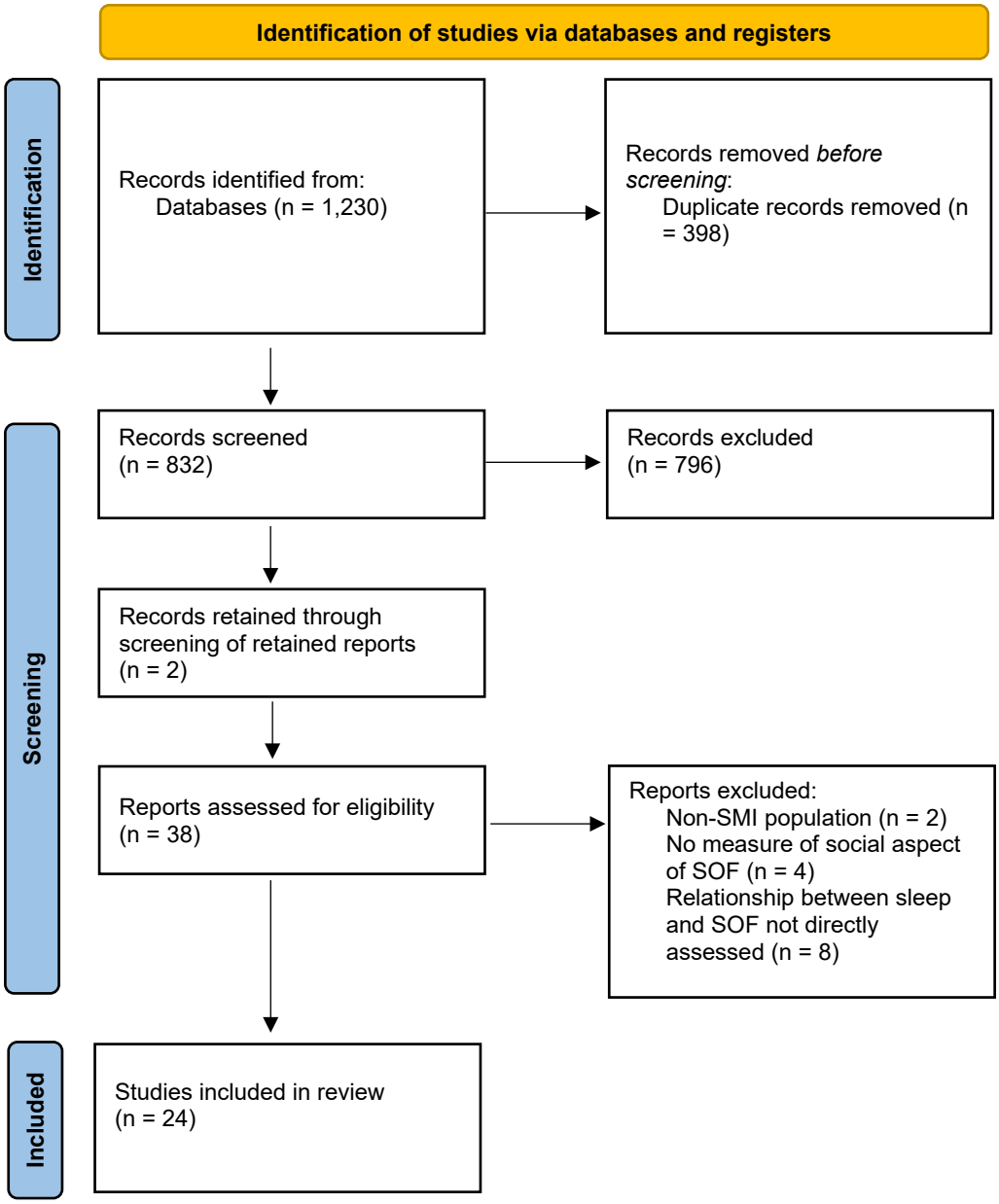
Case studies, grey literature, and studies where participants were primarily under the age of 16 were excluded.

2.2 Study selection and data collection

PubMed and PsycNet were searched in February 2023. The search strategy used across both databases included three comprehensive lists of terms relating to SMI, sleep and sleep measures, and SOF and SOF measures. Using this search strategy (detailed in Appendix A), all titles and abstracts retrieved were scanned for relevance. Duplicates, irrelevant articles, and articles that did not meet the inclusion criteria were removed. Studies were subsequently selected relating to sleep problems and SOF within an SMI population. In instances where eligibility of particular papers was not clear, they were discussed between all authors to meet consensus.

The search process (see Figure 1) produced 1230 results in total. Searching PubMed database using on 27/01/23 generated 691 results, 36 of which were retained. Searching PsycNet on 02/02/23 generated 539 results (398 of which were duplicates), none of which were retained. References of the retained studies were hand-searched to assess for further suitable papers, resulting in two additional papers being identified. Subsequently, 38 articles were identified for full review. Of these, 14 did not meet our inclusion criteria. A total of 24 studies were ultimately retained to be included in the narrative synthesis.

Figure 1. Study selection process



2.3 Quality appraisal

The methodological quality of the studies was assessed using the Mixed Methods Appraisal Tool (MMAT; Hong et al., 2018). Depending on study type, studies were assessed for randomisation, assessor blindness, confounders, data completion level, participant adherence, participant representativeness, appropriateness of measures, and appropriateness of statistical analysis. Based on the ratings of each primary component, the studies received a quality percentage rating. The quality assessments were completed by the primary author (AS) and any issues were resolved through discussion amongst all authors. The studies are otherwise summarised using narrative synthesis.

2.4 Data analysis

The following data were extracted from the studies retained for analysis: country, participant genders and ages, number of participants, study design, sleep measures, SOF measures, relevant findings. A narrative synthesis was then carried out, firstly by identifying common themes across the studies, then examining links between them more closely.

3. Results

3.1 Study characteristics

All but two studies (Batalla-Martín et al. (2022) and Faulkner & Bee (2017)) were quantitative. Twenty-one of the studies employed a cross-sectional design, one was a longitudinal cohort study, and the two qualitative studies used interpretative and/or phenomenological analysis. Study populations covered a range of SMI groups; 13 were schizophrenia-spectrum disorders only (two of which were first-episode psychosis), seven were BD only, and four were a combination of SMI diagnoses. Sample sizes for SMI populations ranged from 15 (Faulkner & Bee, 2017) to 2,024 (Gruber et al., 2009), with a mean of 456. There was a combined sample size of 10,938 SMI individuals. Most participants were middle-aged adults (range = 28–48.8 years). Percentages of male participants ranged between studies from 28%–69%. Ethnicity was only reported in eight out of the 24 studies. The studies were conducted in a wide variety of countries including Norway, Japan,

Singapore, Brazil, France, Tunisia, China, USA, Germany, Spain, UK, Taiwan, Portugal, and Switzerland.

3.2 Quality assessment

Methodological quality of studies varied (see Table 1). Quality percentages calculated using the MMAT ranged between 60% and 100%, with a mean of 94.2%. Limitations were generally due to low participant numbers, incomplete outcome data, or presence of confounding factors such as lack of randomisation. One limitation that was discussed by authors was that multiple studies made no clear account of medication differences between groups, however since it would have been impossible to account for all potentially confounding factors (e.g., symptom status, employment prior to being unwell, education status) it was agreed this would not affect quality score. The exception was when there was a reason to believe that differences in these factors between groups affected/explained the results. The authors agreed a maximum acceptable withdrawal/drop-out rate as 20%, based on the rule of thumb by Furlan et al. (2009).

Table 1. MMAT quality assessment

			Qualitative criterion					Quantitative criterion					Quality percentage %
Study	**S1**	**S2**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
Laskemoen et al. (2021)	Y	Y						Y	Y	Y	Y	Y	100
Baba et al. (2022)	Y	Y						Y	Y	Y	Y	Y	100
Ong et al. (2020)	Y	Y						Y	Y	Y	Y	Y	100
Matsui et al. (2021)	Y	Y						Y	Y	Y	Y	Y	100
Laskemoen et al. (2019)	Y	Y						Y	Y	Y	CT	Y	80
Giglio et al. (2009)	Y	Y						Y	Y	Y	CT	Y	80
Walz et al. (2013)	Y	Y						Y	Y	Y	Y	Y	100
Fekih et al. (2021)	Y	Y						Y	Y	Y	Y	Y	100
Chung et al. (2018)	Y	Y						Y	Y	Y	Y	Y	100
Blanchard et al. (2020)	Y	Y						Y	Y	Y	Y	Y	100
Wang et al. (2020)	Y	Y						Y	Y	Y	Y	Y	100
Drews et al. (2018)	Y	Y						Y	N	Y	Y	Y	80
De la Fuente-Tomás et al. (2018)	Y	Y						Y	Y	Y	Y	Y	100
Bradley et al. (2017)	Y	Y						Y	Y	Y	CT	Y	80
Lai et al. (2014)	Y	Y						Y	Y	Y	Y	Y	100
Gruber et al. (2009)	Y	Y						Y	Y	Y	Y	Y	100
Mulligan et al. (2016)	Y	Y						Y	Y	Y	Y	Y	100
Afonso et al. (2015)	Y	Y						Y	Y	Y	Y	Y	100
Si et al. (2019)	Y	Y						Y	CT	Y	CT	Y	60
Vauth et al. (2021)	Y	Y						CT	Y	Y	Y	Y	80
Gruber et al. (2011)	Y	Y						Y	Y	Y	Y	Y	100
Batalla-Martín et al. (2022)	Y	Y	Y	Y	Y	Y	Y						100
Faulkner & Bee (2017)	Y	Y	Y	Y	Y	Y	Y						100

3.3 Assessment tools

Outcome assessment tools included various subjective and objective measures. The Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989), a subjective questionnaire designed to measure sleep quality and disturbance, was the most frequently used tool for measuring sleep (*n* = 14).

The Global Assessment of Functioning (GAF) (Piersma & Boes, 1997), a subjective questionnaire which rates psychological, social, and occupational functioning, and the Personal Social Performance scale (PSP) (Morosini et al., 2000), a subjective questionnaire which assesses functioning across 'socially useful activities', 'personal and social

relationships', 'self-care', and 'disturbing and aggressive behaviours', were the two most frequently used tools (n = 9 and 7 respectively) for measuring SOF.

The two qualitative studies used semi-structured interviews to assess participants' subjective experiences of SOF.

3.4 Primary findings

The results of the search and study selection are shown in Table 2. Nearly all studies suggested that disturbances in sleep quality, duration, disorder, and/or objectively-measured parameters are associated with decreased SOF in SMI. Six of the 22 quantitative studies did not produce statistically significant results in all measures, however the direction of the relationship between sleep and SOF was consistent in all cases. Results below are presented according to three categories: 1) studies that primarily assess sleep quality/satisfaction/duration, 2) studies that primarily assess sleep disorder/disturbance (i.e., insomnia), and 3) studies that assess objectively-derived sleep variables (i.e., sleep efficiency, sleep stage).

Table 2. Results

Reference	Country	Participant characteristics	*n*	Study design	Sleep measure(s)	SOF measure(s)	Relevant findings	Is sleep associated with SOF? (Y = yes; NS = non-significantly)
Afonso et al. (2015)	Portugal	Sample = adult outpatients with a diagnosis of schizophrenia. Age (mean and SD) = 42.7 (11.64) in the no sleep disturbance group and 42.4 (11.72) in the sleep disturbance group. Male (*n* and %) = 270 (66%) in the no sleep disturbance group and 270 (67%) in the sleep disturbance group.	811	Cross-sectional	PSQI	e-Portuguese and Spanish versions of the PSP	Personal and social functioning was significantly correlated with sleep quality (r = -.23328, $p < .0001$), indicating that patients with worse quality of sleep have lower levels of functioning in every domain ($p < .01$).	Y
Baba et al. (2022)	Japan	Sample = Respondents who self-reported a physician diagnosis of schizophrenia. Age (mean and SD) = 42.70 (14.38). Male (*n* and %) = 89 (50%).	178	Cross-sectional	NHWS	SF-12v2, EQ-5D-5L summary index, and WPAI	Sleep disturbance was associated with worse social and occupational functioning. Participants with more sleep disturbance had poorer social functioning as measured by the SF-12v2, and poorer occupational functioning as measured by the EQ-5D index compared to patients with normal sleep. Participants with sleep disturbance also had significantly higher absenteeism (26.11% vs. 7.20%, $p = .001$), presenteeism impairment (53.11% vs. 29.77%, $p = .001$), total work productivity impairment (63.16% vs. 32.00%, $p < .001$), and total activity impairment (53.30% vs. 34.67%, $p < .001$), indicating lower occupational functioning across specific domains.	Y
Batalla-Martín et al. (2022)	Spain	Sample = adult patients with schizophrenia. Age (mean and SD) = 53 (±10.83) for severe-moderate insomnia, 52 (±14.10) for mild insomnia, 49 (±15.25) for no insomnia. Male (*n* and %) = 8 (88.9%) for severe-moderate insomnia, 5 (41.7%) for mild insomnia, 6 (60.0%) for no insomnia.	31	Descriptive and interpretive analysis	ISI and OSQ	Semi-structured interviews	Worse sleep was linked with worse SOF capacity. The patients described consequences including feeling down with no energy, feeing nervous and anxious, restlessness, a lack of motivation, difficulties concentrating and in performance, memory problems, bad moods, difficulty getting up, irritability, apathy.	Y
Blanchard et al. (2020)	USA	Sample = individuals with a variety of psychotic disorders and healthy non-clinical participants. Age (mean and SD) = 44.44 (11.66). Male (*n* and %) = 55 (61.1%).	90	Cross-sectional	PROMIS	ASRS (social), SLOF (occupational), SNI (social), and UPSA (social)	Results from the ASRS indicated that greater sleep disturbance and sleep-related impairment were related to self-reports of lower perceived emotional support (but not instrumental support), lower ratings of friendship, and greater loneliness (range of $rs = -.25$ to $-.28$, $ps < 05$). Greater sleep disturbance and sleep-related impairment were related to greater social distress as reflected by associations with perceived social rejection and hostility from others ($rs = .36$ to $.44$, $ps < .01$). With regard to social functioning, greater sleep disturbance and sleep-related impairment were associated with poorer functioning across all domains with the exception of activities ($rs = -.25$ to $-.50$, $ps < .05$) as measured	Y

						by the SLOF. Turning to social network size, greater sleep disturbance (but not sleep-related impairment) was related to smaller social networks (r = −.22, p < .05) as measured by the SNI. Finally, greater sleep disturbance and sleep-related impairment were related to poorer social competence as measured by ratings of communication skills (rs = −.26 and −.33, respectively, ps < .05) but not financial skills on the UPSA.	
Bradley et al. (2017)	UK	Sample = patients with BD compared to matched controls. Age (mean and SD) = 48.8 (11.1) in BD patients and 42.5 (11.9) in controls. Male (*n* and %) = 15 (32.6%) in BD patients and 13 (31%) in controls.	88	Cross-sectional	Triaxial wrist accelerometer	FAST	Disturbed sleep (including circadian rhythm disturbance and moderately severe obstructive sleep apnoea) was significantly associated with worse SOF (p < .004).	Y
Chung et al. (2018)	China	Sample = schizophrenia patients with delayed sleep-wake phase and normal sleep-wake phase. Age (mean and SD) = 44.08 (12.64). Male (*n* and %) = 30 (45.45%).	66	Cross-sectional	Actigraphy and sleep diary	SOFAS, Social Rhythm Metrics-5 (SRM-5)	Sleep irregularity (based on participants with delayed sleep-wake phase) was not found to be significantly associated with SOF as measured by SOFAS, though it was significantly positively associated with symptoms of 'social rhythm irregularity' as measured by SRM-5. Specifically, higher irregularity in time in bed (b = −.74, p < .001), sleep efficiency (b = −.30, p = .006), and total sleep time (b = −.64, p < .001)) (but not sleep onset latency, wake after sleep onset, or number of awakenings), as measured by actigraphy, were significantly associated with social rhythm irregularity. Higher irregularity in bedtime and wake time (b = −1.34, p < .001), sleep efficiency (b = −.30, p = .005), total sleep time (b = −.70, p < .001), and great variability in the level of refreshment upon awakening (b = −.13, p < .001) (but not higher irregularity in sleep onset latency, wake after sleep onset, or nap duration), as measured by sleep diary, were significantly associated with social rhythm irregularity.	NS
De la Fuente-Tomás et al. (2018)	Spain	Sample = euthymic BD outpatients. Age (mean and SD) = 46.3 (12.2). Male (*n* and %) = 41 (34.5%).	119	Secondary analysis of a cross-sectional study	OSQ	FAST and GAF	The results of the hierarchical multiple regression showed that, after controlling by age, caffeine consumption, number of drugs and use of benzodiazepines, only sleep duration* (long sleep duration group: *beta* = .279, p = .013) remained in the model [F (5, 93) = 2.666, p = .027]. The model explained 12.5% of the variance in the total FAST score. The same result was found in the case of the GAF (long sleep duration group: *beta* = −.245, p = .021). This model explained 14.8% of the variance [F (5, 101) = 3.516, p = .006]. Among the different functioning dimensions evaluated in the FAST scale, only the occupational dimension obtained a significant model. This model explained 18% of the variance in the FAST occupational score [F (5, 94) = 4.129, p = .002]. In this case, the cofounding factor 'number cups of coffee per day' was retained (*beta* = −.251, p = .012) along with sleep duration (long sleep duration group: *beta* = .311, p = .004).	Partially NS

						In summary, long sleep duration, but not short sleep duration, was significantly associated with worse SOF as measured by the GAF and worse occupational functioning as measured by the FAST. There was no significant association between low sleep satisfaction and SOF. *'Normal sleepers' = 6.5–8.5 h slept per night (*n* = 65); 'short sleepers' ≤ 6 h slept per night (*n* = 12); 'long sleepers' ≥ 9 h slept per night (*n* = 33).	
Drews et al. (2018)	Germany	Sample = patients with either schizophrenia (n = 15) or major depression (n = 16). Age (mean and SD) = 37 (6.7). Male (*n* and %) = 11 (36%).	31	Longitudinal	Polysomnography	Employment status, living arrangement and partnership status (the three variables were then merged into one single social functioning sum score)	Multiple regression analysis showed slow-wave sleep (SWS) and number of hospitalizations as significant predictors accounting for 50% of the variance in SOF. The follow up mediation analysis showed that SWS had a significant positive direct effect of on SOF (not mediated by number of hospitalisations) (effect = .025; 95%-CI: .008– .041). However, sleep duration, sleep efficiency, other sleep stages, and REM latency did not have a significant predictive capacity.	Partially NS
Faulkner & Bee (2017)	UK	Sample = adult patients with schizophrenia, schizoaffective disorder, or delusional disorder. Age (mean and SD) = 45 (10.55). Male (*n* and %) = 10 (67%).	15	Interpretive Phenomenological Analysis	PSQI	Semi-structured interviews	Worse sleep was linked with loss of jobs, friends, and a reduced ability or opportunity to participate in valued activities. SOF benefits attributed to adequate sleep included feeling more sociable, increased energy and motivation, thinking more clearly. Participants described work and occupational goals, acknowledging that many of these were contingent on adequate amount and quality of sleep.	Y
Fekih et al. (2021)	Tunisia	Sample = first-episode schizophrenia patients, their unaffected siblings, and healthy controls. Age (mean and SD) = 26.8 (6.1) in patients, 28.6 (4.8) in siblings, and 27.9 (5.5) in controls. Male (*n* and %) = 35 (75%) in patients, 34 (60.7%) in siblings, and 44 (72.1%) in controls.	171	Cross-sectional	PSQI	GAF	Sleep quality and SOF were found to be positively correlated ($p < .05$). (Note, these findings were minimally reported on.)	Y
Giglio et al. (2009)	Brazil	Sample = BD patients. Age (mean and SD) = 40.26 (9.75) in normal sleep group and 44.05 (12.08) in dysfunctional sleep group. Gender not provided.	190	Cross-sectional	Questions 4, 5 and 6 of the HDRS	GAF and SDS	Presence of insomnia was significantly associated with worse SOF scores on the GAF ($p = .002$), and the work ($p = .001$), social ($p = .001$), and familial ($p = .001$) sub-scales of the SDS.	Y
Gruber et al. (2009)	USA	Sample = BD patients. Age (mean and SD) = 38.00 (13.07). Male (*n* and %) = 893 (44.1%).	2024	Cross-sectional	Average total sleep time in the past week and Sleep variability via Clinical Monitoring Form	GAF and LIFE-RIFT	Self-reported short and long sleep duration was associated with worse SOF compared to normal sleep duration as measured by the GAF ($F = 27.95$, $p < .001$) and the LIFE-RIFT (work $F = 12.91$, $p < .001$; relationships $F = 12.72$, $p < .001$; recreation $F = 25.99$, $p < .001$; satisfaction $F = 26.50$, $p < .001$). Furthermore, the long sleep participants displayed significantly higher sleep variability, relative to both the short sleep and normal sleep participants.	Y

Gruber et al. (2011)	USA	Sample = patients aged 15 years or older with BD. Age (mean and SD) = 38.87 (14.35). Male (*n* and %) = 85 (43.3%).	196	Cross-sectional	Average total sleep time in the past week and Sleep variability (SV) via Clinical Monitoring Form	GAF	There was no relationship over time between total sleep time and SOF [F (1, 1313) = .72, p = .40]. Improved sleep variability over time was associated with better SOF [F (1, 1330) = 7.99, p < .01], although this association was no longer significant once SUM-M and SUM-D scores were covaried [F (1, 1268) = .34, p > .10].	NS
Lai et al. (2014)	Taiwan	Sample = major depressive and Bipolar disorders, first-degree relatives, and healthy controls. Age (mean and SD) = 35.48 (12.36) in BD group, 45.62 (12.53) in MDD group, 46.30 (13.88) in affected relatives, 48.82 (15.11) in non-affected relatives, 47.43 (8.53) in healthy controls. Male (*n* and %) = 173 (47.66%) in disorder group, 49 (31.21%) in relatives' group, 23 (34.85%) in healthy controls group.	1276	Cross-sectional	PSQI	WHOQOL-BREF and SDS	Mood disorder patients with good sleep quality reported significantly better satisfaction in all four domains of SOF as measured by WHOQOL-BREF than patients with poor sleep quality (p < .0001). The percentage of moderate to very severe impairment according to SDS was higher in the poor sleeper group across all four domains of functional impairment (67.5–78.8% due to depressive episode and 59.7–69.4% due to manic episode), compared with the good sleeper group (41.7–62.5% due to depressive episode and 40.0–53.3% due to manic episode). For the overall role impairment score, poor sleepers reported having significantly more severe impairment than good sleepers (p = .007 due to a depressive episode and p = .043 due to a manic episode). Additionally, poor sleepers exhibited greater disability at home, at work, and impaired social life (p < .05) under either depressive or manic episodes.	Y
Laskemoen et al. (2019)	Norway	Sample = schizophrenia spectrum and Bipolar disorders. Age (mean and SD) = 30.7 (9.8) in schizophrenia group, 34.0 (12.0) in BD group, and 34.8 (10.1) in healthy controls group. Male (*n* and %) = 353 (57.2%) in schizophrenia group, 171 (40.5%) in BD group, and 124 (55%).	1230	Cross-sectional	The first four items of IDS-C	GAF-F	Sleep disturbances (insomnia, hypersomnia and delayed sleep phase) were significantly associated with lower SOF across diagnostic groups (p > .001, η2 = .0071).	Y
Laskemoen et al. (2021)	Norway	Sample = schizophrenia-spectrum (n = 418) and Bipolar (n = 348) disorders. Age (mean and SD) = 31.6 (10.6). Male (*n* and %) = 384 (50.1%)	766	Cross-sectional	The first four items of IDS-C	The functioning subscale of the GAF	Insomnia was significantly correlated with SOF (r = −.158 p < .001).	Y
Matsui et al. (2021)	Japan	Sample = Outpatients with schizophrenia. Age (mean and SD) = 47.5 (12.6). Male (*n* and %) = 45 (42.9%).	105	Cross-sectional	ISI, clinical interview, and sleep diary	GAF	There were trends toward lower GAF scores in the Circadian Rhythm Sleep-Wake Disorder (CRSWD) group (n = 19) (p < .05) compared to the non-CRSWD group (n = 86), although this was not significant following a false discovery rate correction.	NS
Mulligan et al. (2016)	UK	Sample = patients with a diagnosis of schizophrenia. Age (mean and SD) = 37.4 (10.4). Male (*n* and %) = 13 (59%).	22	Cross-sectional	ISI, actigraphy, CSD, and BSSD	PSP	Greater objective and subjective sleep efficiency (p < .001), subjective sleep quality (p < .0001), and objective and subjective total sleep time (p = .001) predicted greater next-day functioning scores, whilst greater objective sleep fragmentation predicted decreased next-day functioning (p < .001), after adjusting for baseline PANSS scores.	Y

Ong et al. (2020)	Singapore	Sample = First episode psychosis. Mean age not provided. Male (*n* and %) = 142 (50.7%).	280	Cross-sectional	PSQI	WHOQOL-BREF	Poor sleep quality as measured by PSQI was associated with significantly lower social and occupational functioning scores as measured by the WHOQOL-BREF domains (physical health domain = $p < .001$, CI −2.919–-1.554; psychological domain = $p < .001$, CI −2.817–-1.118; social relationship domain = $p = .003$, −2.266–-.486; environment domain = $p < .001$, −2.359–-.950).	Y
Samalin et al. (2017)	France	Sample = BD outpatients. Age (mean and SD) = 47.7 (12.5). Male (*n* and %) = 192 (41%).	468	Cross-sectional	PSQI	FAST	Sleep quality was indirectly associated with SOF via residual depressive symptoms and perceived cognitive performance (path coefficient = .23).	NS
Si et al. (2019)	China	Sample = adults with diagnosis of schizophrenia. Age (mean and SD) = 32.4 (11.31). Male (*n* and %) = 289 (48.01%).	602	Cross-sectional	Not specified	PSP	Sleep (characterised by sleep quality and daytime drowsiness) was significantly positively correlated ($p \leq .05$) with SOF.	Y
Vauth et al. (2021)	Switzerland	Sample = adult patients with nonacute but symptomatic schizophrenia, who had previously been unsuccessfully treated with oral antipsychotics. Age (mean and SD) = 40.1 (12.6). Male (*n* and %) = 1086 (59.9%).	1812	Cross-sectional	Sleep quality and daytime drowsiness scales	PSP	Sleep quality ($p < .0001$) and daytime drowsiness ($p < .0001$) were, along with other clinical outcomes, significant predictors of SOF.	Y
Walz et al. (2013)	Brazil	Sample = outpatients with BD. Age (mean and SD) = 43.5 (12.3) in BD sample and 45.8 (12.7) in control group. Male (*n* and %) = 23 (29%) in BD sample and 21 (26.2%) in control group.	160	Cross-sectional	ESS and PSQI	FAST	Worse quality sleep and greater sleepiness predicted worse SOF ($B = .87$, 95% CI .40–1.35, $p < .001$).	Y
Wang et al. (2020)	China	Sample = inpatients with schizophrenia. Age (mean and SD) = 42.26 (10.02). Male (*n* and %) = 137 (66.2%).	207	Cross-sectional	PSQI	PSP	There was a significant positive association between poor sleep quality and poor SOF ($T = −3.35$, $p = .001$).	Y

ASRS, Adult Social Relationships Scales; BSSD, Brief Screen for Sleep Disorders; CSD, Consensus Sleep Diary; CMF, Clinical Monitoring Form; ESS, Epworth Sleepiness Scale; HDRS, Hamilton Depression Rating Scale; FAST, Functioning Assessment Short Test; GAF, Global Assessment of Functioning; IDS-C, Inventory of Depressive Symptomatology, Clinician Rating; ISI, Insomnia Severity Index; LIFE-RIFT, Range of Impaired Functioning Tool; NHWS, Japan National Health and Wellness Survey; OSQ, Oviedo Sleep Questionnaire; PROMIS, The Patient-Reported Outcomes Measurement Information System; PSP, Personal and Social Performance Scale; PSQI, Pittsburgh Sleep Quality Index; SDS, Sheehan Disability Scale., SF-12v2, Short Form 12 item (version 2) Health Survey; SLOF, Specific Levels of Functioning Scale; SOFAS, Social and Occupational Functioning Assessment Scale; WHOQOL-BREF, World Health Organization Quality of Life Brief Version; UPSA, The UCSD Performance-Based Skills Assessment; WPAI, Work Productivity and Activity Impairment Questionnaire

3.4.1 Relationship between sleep quality, satisfaction, and/or duration and SOF

Thirteen studies assessed sleep quality, satisfaction, and/or duration in relation to SOF, twelve of which were cross-sectional by design and one qualitative study which used interpretive phenomenological analysis. Eight included PSQI as a sleep assessment tool. Seven focused specifically on schizophrenia or psychosis, five focused specifically on BD, and one focused on participants with mixed SMI diagnoses. Improved sleep quality, sleep satisfaction, and/or sleep duration tended to be associated with improved SOF across studies (though not always significantly).

One example of a study that found a significant effect of sleep quality on SOF is Lai et al. (2014). They found that the percentage of moderate to very severe functional impairment was higher in participants with poor sleep quality across domains of physical health, psychological health, social relationships, and environment (67.5–78.8% due to depressive episode and 59.7–69.4% due to manic episode), compared to participants with good quality sleep (41.7–62.5% due to depressive episode and 40.0–53.3% due to manic episode). Participants with poor quality sleep also reported having significantly more severe impairment for work disability, social life disability, and family life disability than those with good quality sleep.

Eight other studies (Ong et al. (2020), Walz et al. (2013), Samalin et al. (2017), Fekih et al. (2021), Wang et al. (2020), Afonso et al. (2015), Si et al. (2019), and Vauth et al. (2021)) also measured sleep quality. Of these, all but Samalin et al. (2017) found a significant direct association between sleep quality and SOF. However, Samalin et al. (2017) *did* find a significant indirect association between sleep quality and SOF via residual depressive symptoms and perceived cognitive performance. Walz et al. (2013) and Fekih et al. (2021) also found a significant association between sleepiness (as measured by the Epworth Sleepiness Scale) and SOF.

The remaining three quantitative studies (Gruber et al. (2011), Gruber et al. (2009), and De la Fuente-Tomás et al. (2018)) looked at sleep duration and/or satisfaction in relation to SOF. Gruber et al. (2011) found no lasting significant relationship between total sleep time or sleep variability with SOF, yet this conflicts with De la Fuente-Tomás et al. (2018) and the much higher-powered Gruber et al. (2009) study which both found a significant positive

association between long sleep duration and SOF. Regarding sleep satisfaction, De la Fuente-Tomás et al. (2018) found no significant association with SOF.

One qualitative study (Faulkner & Bee, 2017) reported an interpretative phenomenological analysis of interviews with patients with schizophrenia and comorbid poor-quality sleep. Participants reported that worse sleep was linked with 'loss of jobs and friends' and 'a reduced ability or opportunity to participate in valued activities'. SOF benefits attributed to *adequate* sleep included 'feeling more sociable', 'increased energy and motivation', and 'thinking more clearly'. Participants also described work and occupational goals, acknowledging that many of these were contingent on adequate amount and quality of sleep. This supports the quantitative relationships reported between sleep quality/duration and SOF.

3.4.2 Relationship between sleep disorders and SOF

Seven studies primarily assessed disturbance or specific disorders (i.e., insomnia) in association with SOF, all but one of which were cross-sectional by design, the other again utilising descriptive and interpretive analysis in their qualitative approach. Four studies focused specifically on schizophrenia or psychosis diagnoses, one focused specifically on BD, and two reported on participants with both schizophrenia and BD. Sleep assessment tools varied across the studies. Most of the studies assessed for presence of insomnia or non-specific sleep disturbance, whilst Matsui et al. (2021) focused on Circadian Rhythm Sleep-Wake Disorder specifically. The GAF was used to measure SOF in four of the seven studies.

Baba et al. (2022), Blanchard et al. (2020), and Giglio et al. (2009) were the three studies within this category to examine the influence of sleep disorder/disturbance on *multiple aspects* of functioning (e.g., more than just the GAF). Baba et al. (2022) measured social and occupational functioning individually using two different measures, as well as recording scores for absenteeism, presenteeism, work productivity impairment, and total activity impairment, finding significant associations between sleep disturbance and every individual measure of SOF. Similarly, Giglio et al., (2009) found that presence of insomnia was significantly associated with worse SOF scores on not only the GAF but all three sub-scales (work, social, and familial) of the SDS. Blanchard et al. (2020) found sleep disturbance was significantly positively associated with SOF across four measures including sub-domains of:

relationships, work skills, personal care, physical functioning, planning ability, house management, and perceived loneliness/hostility/rejection.

Studies that assessed insomnia/non-specific sleep disturbance all found a significant positive association between sleep and SOF overal. However, Matsui et al. (2021) only found trends toward lower GAF scores in the Circadian Rhythm Sleep-Wake Disorder (CRSWD) group (n. = 19) compared to the non-CRSWD group (n. = 86), which did not reach statistical significance following a false discovery rate correction.

Batalla-Martín et al. (2022) conducted semi-structured interviews with 31 schizophrenia patients with insomnia. Participants described several consequences of insomnia that relate to SOF including 'feeling down with no energy', 'feeling nervous and anxious', 'restlessness', 'a lack of motivation', 'difficulties concentrating and in performance', 'memory problems', 'bad moods', 'difficulty getting up', 'irritability', and 'apathy', supporting the relationship between insomnia and SOF in patients with schizophrenia.

3.4.3 Relationship between objectively recorded sleep variables and SOF

Two studies (Bradley et al., 2017 and Drews et al., 2014) used objective means of assessing and measuring sleep. Bradley et al. (2017) found that accelerometer-determined sleep disturbances (including circadian rhythm disturbance and moderately severe obstructive sleep apnoea) were significantly positively associated with SOF (as measured by the FAST self-report questionnaire). Drews et al. (2014) conducted a longitudinal (6-year) study on 31 patients with either schizophrenia or major depression to investigate the relevance of polysomnographic sleep parameters for social functioning as measured by employment status, living arrangement and partnership status. This comprised the only study to use polysomnography in this review. Multiple regression analysis showed slow-wave sleep (SWS) and number of hospitalizations as significant predictors accounting for 50% of the variance in SOF. The follow up mediation analysis showed that SWS had a significant positive *direct* effect of on SOF (not mediated by number of hospitalisations). However, no other sleep variables (including sleep duration, sleep efficiency, other sleep stages, and REM latency) significantly predicted SOF.

Mulligan et al. (2016) and Chung et al. (2018) used a combination of subjective and objective means to assess sleep. Mulligan et al. (2016) examined the role of sleep disturbance

(measured via actigraphy and self-report measures) in predicting SOF day-to-day in 22 patients with schizophrenia. They found that objective and subjective sleep efficiency, subjective sleep quality, and objective and subjective total sleep time predicted improved next-day functioning, whilst objective sleep fragmentation predicted worse next-day functioning. Chung et al. (2018) used actigraphy and sleep diaries to explore correlates of sleep irregularity (i.e., variations in sleep onset, offset, and mid-point) in 66 patients with schizophrenia. Sleep irregularity was not found to be significantly associated with SOF in this study, though it was significantly positively associated with 'social rhythm irregularity', which comprises an element of social functioning.

4. Discussion

The aim of this systematic review was to explore the link between sleep and SOF within an SMI population. Nearly all studies in this review suggested that sleep is related to SOF. The majority of studies reported on self-reported sleep duration and quality, but the few studies that utilised objective or combined objective-subjective measures support and give weight to the notion that sleep is a highly relevant feature in understanding reduced SOF within SMI groups. The included qualitative studies also add depth and richness to this relationship, and support that the effect of sleep on SOF is meaningful to patients. This consistency in findings is especially notable given the huge variations in how sleep and SOF were measured, and the range of SMI diagnoses included across studies. The studies collated in this review collectively support that sleep is a relevant target for further research in understanding SOF in SMI and support the potential role of improved sleep as a route to improved SOF in these groups.

When considering *how* sleep affects SOF, the studies reported in this review provide limited detail, since many of them report on sleep problems in terms of a single overall score, rather than looking at specific parameters. Nevertheless, some plausible mechanisms were indicated, though these varied across studies. For example, Walz et al. (2013) and Fekih et al. (2021) found a significant association between *sleepiness* and SOF whilst Gruber et al. (2009) found a significant association between sleep *duration* and SOF. Mulligan et al., (2016) found that sleep *efficiency, quality, duration,* and *fragmentation* were associated with SOF. The

only polysomnographic study (Drews et al., 2018) found that slow-wave sleep (SWS) was the only sleep parameter to significantly predict long-term social functioning in their sample. This is plausible since SWS is already known to be key for reducing somnolence and improving memory and cognitive functioning (Stepan et al., 2021; Walker, 2009; Knowles et al., 1986) and is also reduced in SMI generally (Kaskie et al., 2019; Chan et al., 2017; Reimann et al., 2001). In contrast to these direct associations, Samalin et al. (2017) reported that the relationship between sleep and SOF in their sample was mediated by depressive symptoms and cognitive performance (e.g., poor sleep leads to reduced mood/cognitive performance, and this contributes to reduced SOF). It could also be hypothesised that additional factors such as anxiety could mediate the relationship between sleep and SOF to varying degrees, given sleep's well-documented effect on mental health. Whilst multiple mechanisms are suggested here, it is clear they require further testing in appropriate designs to better understand their impact on SOF.

4.1 Clinical implications

The findings of this review point to a high likelihood of sleep problems impacting negatively on SOF in SMI groups, and so highlight various clinical implications. Firstly, since improving sleep is likely to lead to improved SOF in these groups (whether directly or indirectly), it seems justifiable to implement efficient routine assessment of sleep for SMI patients to enable clinicians to gauge how potentially problematic it is in each case. Unfortunately, sleep difficulties tend not to be routinely recorded or monitored, instead often viewed as secondary symptoms of other mental health difficulties, meaning they do not receive the treatment they warrant (Rehman et al., 2017; Reeve et al., 2019; Barret et al., 2020). Secondly, this review provides further support for following existing NICE-recommended treatment for patients (including with SMI) affected by insomnia, such as offering sleep hygiene advice, CBT-I and/or short-term sleep medication, whilst simultaneously ensuring comorbidities are optimally managed (National Institute for Health and Care Excellence, 2022). Based on this review, if improved SOF was deemed a relevant goal for an SMI patient, incorporating sleep intervention into treatment as usual could be especially useful.

Alleviating sleep problems in this way has already been shown to improve the symptoms of comorbid primary mental health problems (Scott et al., 2021b), but is also likely to create an 'upward cycle' of beneficial outcomes in SMI groups given the evidence collated so far that

SOF improves as sleep does. A third implication of this review is the potential benefit of providing sleep hygiene information alongside treatment as usual for *all* patients with SMI, if only as a measure to prevent worsening symptoms (including but not limited to SOF), given their inherent vulnerability to sleep problems in the first instance.

4.2 Strengths and limitations

Only nine studies reported effect sizes for the associations examined between sleep and SOF, many of which were not standardised, limiting meaningful interpretation of effect sizes between studies. Lack of any effect size in the remaining studies further limits what can be inferred from the findings. Statistical heterogeneity between studies also prohibited conducting a meta-analysis.

The age range of participants included in this review (28–48.8 years) sits outside the age SMI diagnoses might typically be *diagnosed* (Baldessarini et al., 2012; Na Zhan et al., 2023), however since SMIs are often persistent, long-term illnesses, the observed relationships between sleep and SOF remains a highly relevant finding. This review excluded studies where participants were under the age of 16, and so in that sense it limits findings about the association between sleep and SOF in 'early intervention' cohorts. That said, *'psychosis'* was included as an individual search term, and studies focusing on first episode psychosis were included, so the unfortunate absence of participants aged 16–27 seems to reflect a paucity of studies examining the relationship between sleep and SOF in early intervention cohorts.

Most of the studies included in this review relied solely on subjective measures. These have benefits and disadvantages. They have sometimes been shown to clash with results of objective sleep measures (Chung et al., 2020). They often amalgamate multiple properties of sleep into one 'total' score which is not helpful for distinguishing key influential aspects. They also cannot measure certain sleep parameters in the way that polysomnography, the 'gold standard' for assessing sleep, can. Subjective measures do, however, provide an understanding of how people *perceive* their sleep, mental health, functioning, etc., and so provide a unique and invaluable insight in that sense.

As with sleep measures, there are also limitations to using subjective social and occupational functioning measures. Clinician-rated measures such as the GAF, PSP, and SOFAS were the most commonly used measures of SOF across this review. The main limitation of the GAF

and SOFAS is their lack of sensitivity to dysfunction within specific subdomains (Searle et al., 2022); collating functioning into a single global score makes it harder to detect small changes in specific domains (Harvey, 2013). The PSP uses more formally operationalised scores in four discrete domains of social and occupational functioning and is therefore somewhat more reliable.

4.3 Directions for future research

One valuable topic for future research is whether and which sleep parameters (i.e., slow-wave sleep, REM sleep) are most associated with SOF. Another interesting avenue is what types of sleep disorder (i.e., insomnia, hypersomnia) feature most commonly in SMI populations and which factors (i.e., trauma, medication) mediate this, as this could affect how sleep, and indirectly, SOF, are treated. It would be beneficial to see more consistency in measures across studies and more RCTs, since no relevant RCTs were retained after scoping the literature. Ideally, future studies will include both objective (such as actigraphy or polysomnography for sleep) and reliable subjective measures (such as PSQI or ISI for sleep and PSP or a performance-based assessment for SOF).

An aspect of sleep which would be interesting to explore further based on the findings in this review is long sleep duration (10+ hours of sleep per night). Only three studies looked at long sleep duration despite it being well known to have deleterious effects on functioning (Lallukka et al., 2018; van Oostrom et al., 2018). The largest study found that long sleep duration was indeed significantly associated with reduced SOF. Long sleep duration in SMI is likely due to a bidirectional relationship between lack of quality sleep and predisposing factors (such as environment, comorbid conditions, and medication effects), but overall has not been given as much research attention (Reeve et al., 2021). There are multiple ways in which long sleep duration could specifically impact SOF. For example, oversleeping could affect ability to work and attend social engagements. Low daily activity could also maintain low mood, and so further exacerbate a decline in SOF (Ekers et al., 2014).

This review looks exclusively at participants with an existing SMI diagnosis, which itself inhibits SOF due to factors such as increased likelihood of social stigma. It would be useful for future studies to explore the relationship between sleep and SOF in at-risk but un-diagnosed participants and/or participants who may have symptoms (i.e., hallucinations) but

do not require clinical care. Such studies would also help test whether medication might be an explanatory factor in the sleep-SOF relationship.

4.4 Conclusion

Although caution should be taken in generalising the findings, the studies included in this review collectively suggest that sleep may help to explain reduced SOF in SMI groups since they all point toward worse sleep being associated with worse SOF and vice versa. This review supports clinical consideration of sleep as a factor in supporting people with SMI to protect, develop, or restore their SOF. Further research is certainly warranted considering how common sleep problems are in this population and the potential harm they could have on functioning.

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Chapter 3

Bridging Chapter

Word count: 489 words

Bridging Chapter

In the previous chapter, a systematic review aimed to better understand whether and how sleep may affect socio-occupational functioning (SOF) in patients with serious mental illness (SMI). This was explored by conducting a narrative synthesis of 24 papers that looked at the association between sleep and SOF in SMI populations. Collectively, studies investigated sleep quality, satisfaction, duration, disturbance, specific disorders, and objectively-recorded sleep parameters across various study designs and assessment methods. The findings indicated broadly that poor sleep *does* tend to be associated with compromised SOF, and this was predominantly consistent across various types of sleep problem (although specific gaps in the research were identified). This provided further support for the proposition that sleep assessment and integrated sleep interventions should become a higher priority in routine care of SMI patients.

To treat sleep effectively, it needs to be assessed effectively. However, there is little evidence of sleep being routinely assessed or monitored across NHS primary or secondary care mental health services. Poor sleep in SMI patients tends to be recognised as a problem by clinicians, but only assessed informally, and rarely followed up in line with NICE-recommended protocol for sleep treatment (Rehman et al., 2017; Reeve et al., 2019; Barret et al., 2020). It can be hypothesised that this problem becomes a vicious cycle whereby sleep problems (and their potential consequences) are not recognised, so they are not treated effectively, and then they continue to present a barrier to patients' recovery. No previous studies to date have investigated the rate and nature of sleep assessment and treatment for SMI populations within NHS trusts based on routine clinical records, instead relying on report from clinicians which may be biased accordingly (e.g., those who do more sleep work being more likely to respond to survey advertisements). The deleterious effects of poor sleep on mental health have been well evidenced in recent years, so it would be reasonable to expect that clinicians are at least moderately well-informed on the importance of treating sleep problems.

It could also be hypothesised that if sleep affects SOF in SMI patients, then poor sleep in SMI patients may (directly or indirectly) reduce their attendance of healthcare appointments

(e.g., due to feeling too tired to wake up in a timely manner/engage with others). We know that missed appointments incur high financial costs for NHS services and also associated with higher risk of poor mental health outcomes and increased future service, so this seems a worthwhile possibility to investigate further.

The aims of the empirical paper in the following chapter are therefore to build on existing research by further exploring how poor sleep is assessed and treated in SMI. It will also further explore the association between poor sleep and SOF, specifically investigating whether poor sleep is associated with attendance of healthcare appointments and number of sessions required. Importantly it will do this using real-world clinical records data in order to best objectively assess current practice.

Chapter 4

Empirical Paper

How Sleep in Patients with Serious Mental Illness is Recorded and Treated, and its Impact on Service Engagement

This paper has been developed for submission to *Sleep Medicine*.

Author guidelines are outlined in Appendix H.

Word count limit: N/A

Word count: 5,432 words

How Sleep in Patients with Serious Mental Illness is Recorded and Treated, and its Impact on Service Engagement

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Abstract

Background: Mental health and sleep share a bidirectional relationship, with problems in one exacerbating the other. Sleep problems are particularly pronounced in SMI populations. This study aimed to examine the documentation and treatment of sleep problems in health records of SMI patients, as well as their association with attendance rates and number of appointments scheduled.

Methods: Relevant patient records within a specified time period (*n* = 133) were identified and extracted from the Cambridgeshire and Peterborough NHS Foundation Trust Research Database electronic database. Quantitative content analyses and follow-up chi-square analyses were used to assess documentation and treatment. Mann-Whitney U tests were used to compare attendance rates and number of appointments scheduled by sleep status.

Results: Findings revealed a lack of detail in sleep documentation, often limited to one-word descriptions. Recommended treatments like CBT-I and sleep hygiene were seldom offered, with 38.2% receiving non-recommended, mostly pharmacological, treatments, and 48% receiving no treatment. Inpatient status correlated with higher rate of non-recommended treatments. No significant associations were found between sleep and attendance or number of appointments scheduled, although small sample sizes and incomplete data limited these findings.

Conclusions: The study echoes previous research regarding the inadequate assessment of sleep and the discrepancy between recognised sleep problems and low adherence to NICE guidelines around treating sleep problems. The study highlights the need for improved sleep assessment and consistent treatment that aligns with NICE guidelines. Future research avenues include investigating the feasibility of implementing routine sleep assessment within services.

Keywords: *sleep, serious mental illness, insomnia, electronic database, sleep assessment, sleep treatment*

1. Introduction

There is extensive literature demonstrating that sleep problems can increase susceptibility to mental health disorders and reduce general functioning. Examples of the effects of poor sleep include increased anxiety and low mood, emotion dysregulation, increased psychotic experiences, lower pain threshold, poor response inhibition, impaired decision-making (e.g., more likely to make emotion-driven choices), working memory impairment, increased tendency to perceive neutral stimuli as negative/threatening, increased interpersonal conflict, and poorer problem solving (Freeman et al., 2020; Simon et al., 2020; Reeve et al., 2019).

Current clinical guidance generally highlights the importance of treating insomnia within mental health services. The National Institute for Health and Care Excellence [NICE] (2022) recommends that chronic (longer than three months) insomnia be addressed via sleep hygiene and CBT-I as a first-line treatment. Updated DSM-5 guidelines (American Psychiatric Association, 2013) marked an important shift in the classification of insomnia, as it was recommended that chronic insomnia be thought of as a disorder in its own right, irrespective of comorbid mental health or sleep disorders, in recognition that insomnia requires and responds to independent clinical attention (Khurshid, 2018; Wilson et al., 2019). The International Classification of Diseases 11th Revision (ICD-11) (World Health Organization, 2019) is less clear with respect to whether insomnia can be diagnosed in the case of co-morbid conditions, but still recommends independent clinical attention where warranted.

Growing evidence supports the positive impact of treating sleep disorders in mental health populations, with a large effect indicated for improvement in sleep and a small effect supported in larger studies for knock on improvements in mental health (Scott et al., 2021b). According to Harvey (2022), individuals with co-existing mental health and sleep disorders do not fit neatly into established diagnostic categories and, consequently, may not receive appropriate and effective treatment through conventional single-disorder approaches. Evidence suggests that Cognitive Behavioral Therapy for Insomnia (CBT-I) alone can alleviate a broad spectrum of associated psychiatric symptoms (Scott et al., 2021b), such as anxiety (Belleville et al., 2011), depression (Lau et al., 2022), psychosis (Waters et al., 2020), and overall quality of life (Wu et al., 2015). This further supports the idea that sleep represents a

transdiagnostic vulnerability factor (Harvey et al., 2011; Baglioni et al., 2016, Scott et al., 2021b).

Given its impact on mental health and functioning, it follows that sleep should be seen an important topic to include in mental health assessment, and yet there is limited research into how sleep is assessed across mental health services. A recent survey (Rehman et al., 2017) reported that clinicians recognise a high incidence of sleep disruption in their patients, and yet predominantly rely only on informal means of assessing sleep. When surveying secondary care mental health clinicians, Rehman et al. (2017) found that the most common treatments offered were sleep hygiene and/or medication, and rarely CBT-I, the NICE-recommended first-line treatment for long-term insomnia (NICE, 2022). When surveying secondary care mental health patients, Reeve et al. (2019) found high comorbidity of sleep disorders in patients diagnosed with psychosis, yet despite many of these patients discussing their sleep problems with a clinician, almost three-quarters received no treatment for their sleep problems, and none received NICE-recommended sleep treatment from the NHS. In Norway, Barret et al. (2020) similarly found that clinicians reported sleep problems to be common in patients with psychosis, the negative consequences of which were also recognised. Yet once again, standardised assessment and utilisation of recommended interventions were rare. Clinicians in Barret et al. (2020) claimed lack of knowledge about sleep assessment/treatment, and beliefs that sleep treatment is too demanding in this population were barriers. It is clear that sleep requires more attention in terms of assessment and treatment than it currently receives.

An unexplored but possible impact of poor sleep is reduced propensity to attend healthcare appointments. Poor sleep has been shown to increase workplace absenteeism (Baba et al., 2022) and it is possible it affects propensity to attend outpatient appointments in a similar vein. Attendance is known to be a problem in NHS mental health services generally. According to the NHS Benchmarking Network (2019) report regarding all outpatient departments across 2018/19, patients did not attend (DNA) 8% of appointments, and the average cost of each DNA was £153, so missed appointments incur high costs for services. Non-attendance is also associated with higher risk of poor mental health outcomes and increased future service use (Maughan & Pearce, 2015). The two most reported reasons for DNAs are patients forgetting their appointments and administrative errors (NHS Institute for

Innovation and Improvement, 2008), however there could be numerous other factors at play including greater deprivation (as found by Campbell et al., 2015), mental health severity, and/or sleep problems (e.g., increased likelihood of forgetfulness, or being asleep at the appointment time). There is a clear gap in the research surrounding the relationship between poor sleep and healthcare appointment attendance rates.

A second plausible impact of poor sleep is longer-term requirement of support from healthcare services. Sleep deprivation reduces memory consolidation and neural plasticity (Dolsen et al., 2017; Jha & Jha, 2019) and inadequate memory of treatment is linked to low adherence and poor outcomes (Gumport & Harvey, 2022; Dong et al., 2017; Harvey et al., 2016; Harvey et al., 2014). de Beurs (2020) suggests the more complex the mental health problem, the longer treatment is required. Dolsen et al. (2017) posited that enhancing sleep may improve patients' treatment adherence and concluded by suggesting that future studies "*should examine whether improved sleep … is also an ingredient to the successful outcome of psychosocial interventions"* (Dolsen et al., 2017, p. 647).

Sleep issues are notably common in serious mental illness (SMI) (Scott et al., 2021a; Freeman et al., 2020; Laskemoen et al., 2019) and are associated with a higher number of suicide attempts, compromised clinical and cognitive functioning, lower quality of life, and higher rates of mood episode relapse (Benson, 2015; Sylvia et al., 2012; Davies et al., 2017; Ritsner et al., 2004; Russo et al., 2015; Kanady et al., 2017). Due to the increased financial burden, and more importantly, the burden of human suffering, implicated in SMI, it would seem particularly worthwhile to include this population in consideration of more effective sleep assessment and treatment.

In conclusion, the evidence base suggests that improved sleep may lead to improved treatment outcomes, which could be especially impactful for SMI populations who are at the most risk. Clinicians and patients have previously reported inadequate assessment and treatment of sleep, however, the evidence surrounding these issues is limited. At the time of writing no studies have explored clinical records to capture the reality of routine practice. The extent to which sleep affects attendance rates or requirement of support within secondary care mental health settings is also still unclear. Given that there are evidence-based sleep treatments available, exploring these issues further could highlight the need

and the means for better quality assessment of sleep problems and integration of sleep-specific treatments for SMI patients.

Research questions

1. The primary research question is 'How are sleep problems in SMI patients recorded?'
2. The secondary research question is 'How are sleep problems in SMI patients treated?'
3. Additional exploratory research questions include: 1) 'Are SMI patients with sleep problems scheduled more appointments than SMI patients with good sleep?' and 2) 'Does SMI patients' sleep affect their attendance* rates?'

*Throughout this paper, non-attendance comprises cancellation, where the appointment is changed with notice by patient or clinician/service, or 'did-not-attend' (DNA), where the patient either does not attend the appointment or cancels too close to the appointment for the appointment to be re-allocated effectively (i.e., within 24 hours).

2. Method

2.1 Design

This study is a secondary data analysis utilising the Cambridgeshire and Peterborough NHS Foundation Trust Research Database (CPFTRD) which uses the Clinical Records Anonymisation and Text Extraction (CRATE) software system (Cardinal, 2017) to search health records from 'Systm One', the Trust's electronic healthcare record system. CRATE collects and anonymises routine medical data from Cambridgeshire and Peterborough NHS Foundation Trust (CPFT) patients for use in research. Free-written notes and letters were unavailable via CRATE, so this study focused on content within Systm One's standardised questionnaires such as Risk Assessments and Care Plans. As of October 2020, the data within CRATE was derived from approximately 260,000 people who received care from CPFT (Cambridgeshire and Peterborough NHS Foundation Trust [CPFT], 2022).

The data retrieved was generated between 01.09.21 – 31.08.22 because this was the most recent data available at the start of the study and is likely more relevant than prior data in that it reflects post-pandemic healthcare.

2.2 Participants

The study aimed to draw conclusions about working age adults with SMI. Patients under CPFT's community mental health teams (CMHTs) (Peterborough Adult Locality Team, Huntingdon Adult Locality Team, Fenland Adult Locality Team, Cambridge Adult Locality Team) and early intervention in psychosis teams (EIPs) (CAMEO North and CAMEO South) were included based on the assumption that patients accepted under these services fit the criteria for SMI. The population the sample was drawn from totals approximately 894,300 people (Cambridgeshire and Peterborough Insight, 2024).

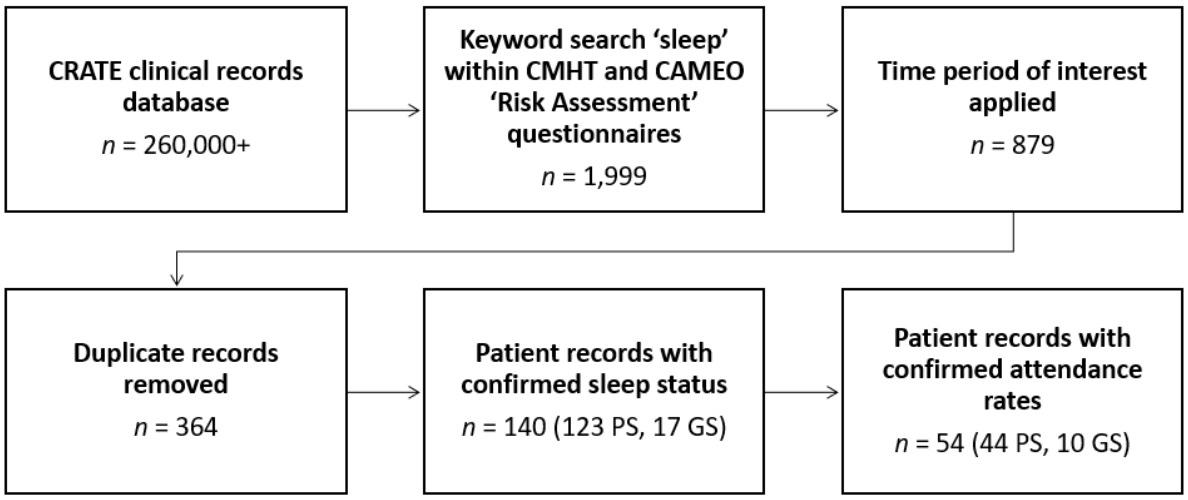
2.3 Case Selection and data extraction

An original protocol for case selection and data extraction was developed for the purposes of this study. Patient records were selected via Structured Query Language (SQL) (e.g., code-based searches) and manual selection means (e.g., keyword searching within selected patients' notes), according to specific inclusion/exclusion criteria (outlined below). A scoping search was initially carried out with the aid of a data technician to assess viability of the approach, and discern which Systm One questionnaire(s) were most likely to contain relevant mentions of the word 'sleep' to streamline the search process, and this overwhelmingly transpired to be the 'Risk Assessment' questionnaire. Based on this, an initial scoping search was run which highlighted the presence of the keyword 'sleep' in all free-text record fields within 'Risk Assessment' questionnaires under CMHT and EIP services, retrieving 1,999 rows of data. Of these, 879 rows of patient data fell within the time period of interest (01.09.21 – 31.08.22). This reduced to 364 individual patient records after duplicate patient records were manually removed. All the notes included within each individual patient record were then searched and either excluded or assigned to a group ('Poor sleep' or 'Good sleep') according to the following inclusion/exclusion criteria:

- If *explicit* mention of poor (or equivalent description) sleep has been used to describe the patient *within* period of interest, assign to 'Poor Sleep'.
- If *explicit* mention of sleep being good (or equivalent description) within the period of interest, assign to 'Good Sleep'.
- If mentions of sleep are inconsistent or irrelevant (e.g., 'sleeping rough' or 'sleeping at friend's house'), exclude.

Subsequently, 231 patient records were excluded due to insufficient clarity regarding sleep status whilst 123 records were assigned 'Poor Sleep' and 17 records were assigned 'Good Sleep'. Following another SQL search to generate attendance data (at least 50% of this data had to have been present to be 'sufficient') across patient records with confirmed sleep status, 54 patient records had sufficient attendance data available to answer the exploratory questions (44 'Poor Sleep' and 10 'Good Sleep'). (The case selection process is illustrated in Figure 1.)

Figure 1. Case selection process



PS = Poor Sleep; GS = Good Sleep

Two further SQL searches were utilised to generate the demographic details associated with each patient record. (See Appendix C for full details of the case selection process including search queries.) Demographic details were extracted alongside all patient records. Demographic details included age, ethnicity, gender, employment status, diagnosis, and inpatient status. Patient age on 01.03.22 was calculated from all dates of birth for use in reporting, as this was the midway point of the time period of interest. A patient's 'gender' is understood throughout this paper as denoting their socially constructed identity and is understood as a non-binary variable, however at the time the data was gathered, Systm One provided only four options for recording a patient's gender: 'male', 'female', 'indeterminate', or 'unspecified/unknown', and so the study does not distinguish between identified gender and the gender that patients were assigned at birth in cases where these may have differed.

Patient records assigned to the 'Poor sleep' group very clearly had a sleep problem within the relevant time period, and there was no evidence of it improving before the end of that time period. For this reason, all 123 'poor sleep' cases are understood as having had 'chronic (> 3 months) insomnia' as defined by ICD-11 and all mentions of 'recommended treatment' below are based on NICE (2022) guidelines pertaining to chronic insomnia.

The next phase of data extraction involved running electronic keyword searches across all available notes of each of the 123 patient records assigned 'Poor sleep' status. The keyword searches included the following keywords: 'sleep', 'nightmare', 'hour', 'insomnia', 'apn', 'restless leg', 'circadian', 'zopiclone', 'zolpidem', 'melatonin', 'group', 'CBT', and 'sleep hygiene'.

2.4 Content analyses

A quantitative content analysis was conducted to answer the primary research question, *'How are sleep problems in SMI patients recorded?'*. All occurrences of the words 'sleep', 'nightmare', 'hour', 'insomnia', 'apn', 'restless leg', and 'circadian' were explored in context so that patterns could be identified in terms of *how* sleep was described. Descriptions of sleep problems could broadly be characterised by 1) descriptions of how/why sleep is a problem, 2) descriptions of sleep pattern, 3) simultaneous descriptions of both *how/why sleep is a problem* and *sleep pattern*, 4) descriptions of average hours of daily sleep, 5) mentions of a specific sleep disorder (i.e., insomnia, obstructive sleep apnoea, circadian rhythm disorder, nightmare disorder), and 6) descriptions of the sleep problem's role/impact (e.g., 'exacerbates mental health symptoms').

Descriptions of sleep problems were then categorised as follows:

- 'One word' = one-word description only
- 'Minimal' = sleep role OR description of why/how sleep is problematic OR description of sleep pattern OR daily average hours of sleep included OR specific sleep disorder described
- 'Adequate' = 1) description of why/how sleep is problematic AND description of sleep pattern AND daily average hours of sleep included OR 2) specific sleep disorder described

- ‘Good’ = sleep role, description of why/how sleep is problematic, description of sleep pattern, AND daily average hours of sleep included

A quantitative content analysis was conducted to answer the secondary research question, ‘*How are sleep problems treated?*’. Methods by which sleep was treated were coded in accordance with the key shown in Figure 2 (primarily based on NICE (2022) guidelines) by authors AS and SR. A Cohen’s kappa score of .90 was achieved, indicating ‘almost perfect’ agreement according to McHugh (2012).

Figure 2. Coding key for descriptions of methods in which sleep was treated

Y = Recommended treatment offered	**NR = Non-recommended treatment offered**	**N = No treatment offered / self-treated**
Y.1 = sleep hygiene advice*	NR.1*** = non-recommended medication offered for sleep	N.1 = no treatment offered
Y.2 = CBT-I**	NR.2**** = recommended sleep medication not adjunct to CBT-I	N.2 = self-treated (including over-counter medication)
Y.3 = short-term recommended sleep medication to CBT-I	NR.3 = sleep group offered (excluding Mulberry ward sleep groups)	N.3 = treatment by non-MH team (e.g., resolved by GP)
Y.4 = specialist support (e.g., CPAP machine)	NR.4***** = only limited aspects of sleep hygiene advice offered	N.4 = using recreational substances to self-treat

*Y.1 ‘Sleep hygiene advice’ is understood as any confirmation of sleep hygiene having been discussed/offered to that patient; **Y.2 CBT-I includes a sleep group offered on Mulberry Wards as this was based on CBT-I; ***NR.1 non-recommended medication is assumed if there is no mention of medication name; ****NR.2: for the purposes of this study, recommended medications include: Melatonin, Zopiclone, Zolpidem (NICE-recommended), and Promethazine (included based on the rationale that it is a histaminergic sedative rather than a Benzodiazepine, so arguably reasonable to prescribe to patients with previous substance dependency or where there are concerns about interaction with other medications, both common risks in SMI populations); *****NR.4: includes allusions to sleep hygiene being discussed in the future, but no evidence that it was

2.5 Statistical analyses

SPSS version 29.0.1.0 (IBM Corp, 2022) was used to analyse the data. Participant sample numbers were based on maximum number available after data extraction was complete.

In relation to the primary research question, '*How are sleep problems in SMI patients recorded?'*, chi-square tests of independence were conducted to examine whether there was a significant difference in how sleep was described ('one-word', 'minimal', or 'adequate') based on gender, ethnicity, or inpatient status.

In relation to the secondary research question, '*How are sleep problems treated?*, chi-square tests of independence were conducted to examine whether there was a significant difference in how sleep was treated ('recommended treatment offered', 'non-recommended treatment offered', or 'no treatment offered') based on gender, ethnicity, or inpatient status.

To answer the exploratory research question, '*Are SMI patients with sleep problems scheduled more appointments than SMI patients with good sleep?*', a Mann-Whitney U test was conducted to evaluate whether number of appointments scheduled significantly differed by sleep status ('good sleep' and 'poor sleep').

To answer the exploratory research question, '*Does SMI patients' sleep affect their attendance rates?*', a Mann-Whitney U test was conducted to examine whether there was a significant difference in the percentage of appointments attended or DNA'd/cancelled between groups ('good sleep' and 'poor sleep').

2.6 Ethics

All patients who had information about them recorded electronically at CPFT since 2005, have contributed to the CRATE database (with identifying information removed) unless they specifically requested to opt-out. The CRATE board granted ethical approval for this study in November 2022. CPFTRD is approved for secondary data analysis use for research by NHS ethics (reference: 22/EE/0264).

3. Results

All retrieved patient records which had confirmed sleep status of 'Poor Sleep' were used to answer both the primary and secondary research questions. Patients' mean age was 42 (SD = 12.94). Further descriptive features are provided in Table 1.

Table 1. Descriptive features of patients included in the Poor Sleep sample used to answer the primary and secondary research questions (n = 123)

	Poor Sleep (*n* = 123)
Gender	
Female	73 (59.35%)
Male	50 (40.65%)
Ethnicity	
White British	76 (61.79%)
Non-white ethnicity	23 (18.7%)
Other/Unspecified	24 (19.51%)
Employment Status	
Long term sick or disabled, receiving benefits	49 (29.84%)
Employed	20 (16.26%)
Unemployed	7 (5.7%)
Other/Unspecified	47 (38.21%)
Mental Health Diagnosis	
Schizophrenia/Psychosis	23 (18.7%)
Bipolar Disorder	19 (15.45%)
Schizoaffective Disorder	8 (6.5%)
Depression	8 (6.5%)
Anxiety	4 (3.25%)
Comorbid disorders	20 (16.26%)
Other / Unspecified	41 (33.33%)
Inpatient for part of relevant time period	
Yes	48 (39.02%)

No	75 (60.98%)

3.1 Primary research question

Across all notes (including multiple notes within individual records), *how/why sleep is a problem* was described 35 times (across 20 records), *sleep pattern* was described 30 times (across 26 records), *how/why sleep is a problem* and *sleep pattern* were simultaneously described 10 times, average hours of daily sleep were described 34 times (across 26 records), specific sleep disorders were named 13 times (across 12 records) (10 mentions of insomnia and three mentions of obstructive sleep apnoea (OSA)), and the sleep problem's role/impact was described 47 times (across 37 records).

The most common type of description for the sleep problem's role/impact was regarding exacerbation of mood, mental state, or symptoms in general, with 22 occurrences. Other mental health-related descriptions of sleep's role were in regard to its exacerbation of specific symptoms, worse functioning, and increased risk. There were also four occurrences of descriptions of sleep's physically-related impacts.

Out of the 123 patient records, there were 56 patient records with 'one-word' descriptions of sleep problems, 52 records with 'minimal' descriptions of sleep problem, 15 records with 'adequate' descriptions of sleep problems, and no 'good' descriptions of sleep problems.

There was no significant association between sleep description ('one-word', 'minimal', or 'adequate') and ethnicity (X^2 (2, N = 99) = 1.25, p = .535), gender (X^2 (2, N = 123) = 1.15, p = .564), or inpatient status (X^2 (2, N = 123) = .67, p = .717) (see Appendix D for primary research question SPSS outputs).

3.2 Secondary research question

Fifty-nine (48%) patients were offered no treatment by their mental health team (although two of these did access treatment via their GP), 47 (38.2%) patients were offered non-recommended treatments at best, and 17 (13.8%) patients were offered recommended treatments.

Of the 17 patients offered recommended treatments, four were offered CBT-I. Of these four patients, three were offered group-based CBT-I and recommended sleep medication

alongside it, whilst the other patient was offered individual CBT-I via a sleep study. Twelve of the 17 patients were offered sleep hygiene without CBT-I. One of the 17 received specialist support in the form of a CPAP machine for obstructive sleep apnoea.

Amongst the 47 patients offered non-recommended treatments, 35 were offered a recommended sleep medication but not alongside CBT-I and eight were offered non-recommended medication for sleeping: Temazepam (*n* = 3), Olanzapine (*n* = 2), Mirtazapine (*n* = 1), or unspecified (*n* = 3).

There was no significant association between sleep treatment ('recommended', 'non-recommended', or 'no treatment') and ethnicity (X^2 (2, *N* = 99) = .74, *p* = .692) or gender (X^2 (2, *N* = 123) = 1.7, *p* = .428).

There was a statistically significant difference between sleep treatment and inpatient status, with moderately sized effect (X^2 (2, *N* = 123) = 6.42, *p* = .040, *V* = .23) (see Appendix E for secondary research question SPSS outputs). Twenty-nine percent of outpatients were offered non-recommended treatments compared with 52% of inpatients. Post-hoc comparisons using Bonferroni adjustment indicated that significantly more inpatients were offered non-recommended treatments than outpatients (*p* = .011). Fifty-five percent of outpatients were offered no treatment compared with 38% of inpatients. There was a trend level association (*p* = .063) between outpatient status and being less likely to receive any treatment. Sixteen percent of outpatients were offered recommended treatments compared to 10% of inpatients, with no significant between-groups difference (*p* = .379).

3.3 Exploratory research questions

The retrieved records which had 1) confirmed sleep status and 2) sufficient attendance data, were used to answer both the exploratory research questions. Mean age of patients was 41 (*SD* = 13.73) in the 'Poor sleep' group and 36 (*SD* = 14.46) in the 'Good sleep' group. Further descriptive features are provided in Table 2. Note that the majority of diagnoses classified as 'other/unspecified' had no diagnostic information available and the rest had unique, stand-alone descriptors.

Table 2. Descriptive features of patients included in the Poor Sleep and Good Sleep groups (n = 54)

	Both groups (*n* = 54)	Poor Sleep only (*n* = 44)	Good Sleep only (*n* = 10)
Gender			
Female	34 (62.96%)	28 (63.64%)	6 (60%)
Male	20 (37.04%)	16 (36.36%)	4 (40%)
Ethnicity			
White British	34 (62.96%)	26 (59.1%)	8 (80%)
Non-white ethnicity	9 (16.67%)	7 (15.91%)	2 (20%)
Other/Unspecified	11 (20.37%)	11 (25%)	0
Employment Status			
Long term sick or disabled, receiving benefits	23 (42.6%)	18 (40.91%)	5 (50%)
Employed/Other/Unspecified	31 (57.41%)	26 (59.1%)	5 (50%)
Mental Health Diagnosis			
Schizophrenia/Psychosis, Bipolar Disorder, or Schizophrenia	15 (27.78%)	10 (22.73%)	5 (50%)
Comorbid disorders	9 (16.67%)	9 (20.45%)	0
Other / Unspecified	30 (55.56%)	25 (54.55%)	5 (50%)
Inpatient for part of relevant time period			
Yes	18 (33.33%)	14 (31.82%)	4 (40%)
No	36 (66.67%)	30 (68.18%)	6 (60%)

'Are SMI patients with sleep problems scheduled more appointments than SMI patients with good sleep?'

The poor sleep group were scheduled an average of 20 appointments (*SD* = 13.34) whilst the good sleep group were scheduled an average of 14 appointments (*SD* = 8.99). There was no significant between-groups difference in number of appointments scheduled (z = -1.37, p = .170) (See Appendix F for SPSS output).

'Does SMI patients' sleep affect their attendance rates?'

Patients with poor sleep attended an average of 85.53% of appointments. Patients with good sleep attended an average of 81.88% of appointments. There was no significant between-groups difference in percentage of appointments attended (z = -0.70, p = .945) (See Appendix G for SPSS output).

4. Discussion

This study used routine clinical records to establish the current practices for assessment and treatment of sleep problems in patients in secondary mental health care. The ways in which clinicians described sleep problems and their roles/impacts suggests that there is some awareness amongst clinicians of the importance of recording relevant details about sleep. Despite this, we found that sleep problems were rarely appropriately assessed, and the majority of cases either not treated at all or treated with non-recommended medication. This supports the findings from previous clinician and patient surveys (Rehman et al., 2017; Reeve et al., 2019; Barrett et al., 2020) that routine assessment and treatment of sleep problems is severely lacking in secondary mental health settings, despite a well-established bidirectional causal relationship between sleep and MH.

NICE (2022) guidelines were used as the basis for which treatments were expected to be offered in cases of 'long-term (> 3 months) insomnia' (which all retained cases were categorised as*), namely sleep hygiene advice and CBT-I a first-line treatment for chronic insomnia, with *temporary* (preferably less than one week) medication (melatonin, zopiclone, zolpidem, or promethazine) offered alongside these if required. It is overwhelmingly evident from the results that NICE (2022) guidelines were rarely followed. CBT-I was offered to only four out of 123 patients (three via inpatient group intervention and one via a research

study). Barret et al. (2020) has previously found this tendency to be due to lack of knowledge about sleep assessment/treatment, and beliefs that sleep treatment is too demanding in SMI populations. It could also be the case that few clinicians are aware of NICE (2022) guidelines for insomnia as a comorbid disorder, and whether and whose responsibility it is to treat it in such cases. This lack of appropriate treatment for insomnia is an unfortunate reality since CBT-I has been shown to be a cost-effective treatment (although the literature on cost-effectiveness of CBT-I in SMI is limited), and could reduce long-term service costs and patient morbidity in the longer term (Tsiachristas et al., 2018; Darden et al., 2021; Natsky et al., 2020). Mentions of sleep hygiene being advised were more frequent. However, most of these were only brief mentions with little to no elaboration of how detailed or tailored that advice was, and no descriptions of how effective it was for the patient. For SMI populations, merely providing advice with no follow up is likely insufficient without support to implement it (Waite et al., 2016). The vast majority of patients were offered no or non-recommended (primarily appropriate medication but not adjacent to sleep hygiene/CBT-I as is advised) treatments. Over-the-counter treatments are expressly advised *against* by NICE (2022), yet there was one record of a patient being advised to seek over-the-counter medication for their sleep. One defence for poor assessment and treatment of sleep problems in mental health teams (aside from training being generally sparse) is that the ICD-11's (WHO, 2019) subjective definition of insomnia could prevent sleep problems being recognised and targeted in their own right. However, it is clear from this study that many clinicians do recognise and attempt to treat sleep problems, but that, more often than not, they are treated inappropriately. Patient care may therefore improve hugely from services making treatment guidance clearer.

Across the sample of patients identified as having sleep problems (*n* = 123), some inferences may be drawn by observing the prima facie within-group demographic differences. There were more female patients (59.3%) than males. This may be because women are more likely to access psychological therapies than men (Sagar-Ouriaghli et al., 2019), and/or may reflect how insomnia is more common in women (Zeng et al., 2022). At least 61.8% of patients were White British and at least 18.7% percent were of non-white ethnicity (unfortunately, there were insufficient patient numbers to further sub-categorise ethnicity), with 19.5% unclear. The White British populations in Cambridge and Peterborough account for 53.0% and 59.5%

of total population respectively (Office for National Statistics, 2023), suggesting non-white ethnicity populations are underrepresented here. This is a complex issue which would merit further research in its own right since non-white ethnicity populations tend to be *underrepresented* in primary care mental health service provision and *overrepresented* in crisis pathways and detention (Barnett et al., 2019; Bansal et al., 2014), however underrepresentation in this small SMI sample could for instance indicate a lower likelihood of sleep problems being recognised and/or recorded in non-white ethnicity populations.

Gender and ethnicity did not significantly impact on how sleep was treated, but inpatient status did. Non-recommended treatments (primarily medication not adjacent to sleep hygiene or CBT-I) were offered to inpatients more frequently than outpatients, which may be explained by easy accessibility to medication on inpatient wards, e.g., they can be offered on a needs-basis. Accessibility would also make sense of the finding (with a trend towards significance) that outpatients are more often offered no treatment at all than inpatients. It is important to note that inpatient status was assigned to patients who had been admitted to a mental health ward for any period of time within the relevant time period (01.09.21 – 31.08.22) and the results do not control for the exact time point at which treatment was offered (e.g., some treatment mentions captured may have been prior or subsequent to being an inpatient). It may be worth investigating this association in more detail. Future research could also focus on understanding the different factors influencing treatment decisions for sleep problems in inpatient and outpatient settings, exploring strategies to improve the implementation of recommended treatments, and addressing the accessibility of appropriate interventions in different healthcare settings.

Based on the evidence that poor sleep tends to lead to worse socio-occupational functioning in SMI populations (Vauth et al., 2021; Blanchard et al., 2020; Lai et al., 2014; Gruber et al., 2009), this study had an exploratory aim of elaborating on a possible association between sleep and attendance rate of appointments. Somewhat surprisingly, patients in the 'poor sleep' group attended *more* and DNA'd *fewer* sessions than patients in the 'good sleep' group, although differences were not significant. It could be hypothesised that patients with sleep problems are more worried about their symptoms which could motivate high attendance rates.

A final aim of the study was to investigate whether sleep was associated with number of appointments scheduled. More appointments were scheduled for patients with poor sleep, though the difference was not significant. Low *n* size was again a limiting factor here with only 10 patient records in the 'good sleep' group. de Beurs et al. (2020) found that the relationship between mental health complexity (broadly characterised by comorbid conditions, additional psychosocial problems, and reduced functioning) and treatment outcome *was* mediated by treatment dose (e.g., more treatment was offered to patients with higher complexity) although not strongly. This led to a suggestion that alternative variables such as process characteristics (e.g., type of treatment, therapeutic relationship) may be more impactful on treatment outcome than length of treatment or number of appointments.

4.1 Study advantages and limitations

An advantage of this research approach was that it provided a non-invasive way to analyse a range of data since it was extracted from a pre-existing sample. The data is highly relevant due its capture of very recent clinical practices and approaches, allowing easy extrapolation from research findings to potential improvements in clinical practice. Additionally, although other studies have investigated assessment/treatment of sleep in SMI, they relied on recruitment of patients/clinicians who opted into the research process and whose responses may have been biased (e.g., by demand characteristics), whereas this study looked directly at clinical notes and records. It is also more recent, and may therefore reflect advances in practice following recent high-profile research on relevance of sleep in SMI.

Another advantage is that the case selection protocol is detailed and repeatable, however this came at a cost of sample size. Initially, inclusion / exclusion criteria were planned to be less stringent, however, it was felt this approach would not be reliable enough. The forfeit of reliability in this case was a very small sample size (n = 10) for the 'good sleep' group, which severely limits the generalisability of the findings.

The advantage of utilising this real-world clinical data paradoxically presents an intrinsic limitation, namely that data usability was entirely reliant on historic recording by clinicians. It had been expected that this would be a limiting factor, especially since we know that sleep is not routinely assessed. However, even mandatory data records such as attendance

outcomes were sparsely recorded, and likely varied by team and/or clinician speciality, which further limited the extent to which some questions could be answered.

4.2 Implications and directions for future research

One area indicated for further research is the assessment and treatment of obstructive sleep apnoea (OSA) in SMI populations. Prevalence of OSA is estimated to be 15–48% of patients with schizophrenia, 21–43% of patients with bipolar disorder, and 11–18% of patients with recurrent depressive disorder (Szaulińska et al., 2015; Myles et al., 2018). Despite this, only three of the 123 patients retrieved in this study had been diagnosed as having (or potentially having) OSA (one of whom had been appropriately treated with CPAP therapy). This suggests that OSA may be under identified (and subsequently undertreated) which would carry a number of risks (e.g., some drugs prescribed for SMI treatment may aggravate the symptoms of obstructive sleep apnoea).

We suggest two ways that routine assessment of sleep could be incorporated into standard practice within SMI (or indeed any) mental health services, which we recommend are piloted via feasibility studies. The first is for adoption of a standardised outcome measure such as the Insomnia Severity Index (ISI) or Pittsburgh Sleep Quality Index (PSQI), to be routinely completed at assessment stage. The second is integration of specific sleep questions that capture 1) average amount of daily sleep, 2) whether and how sleep is problematic, 3) description of sleep pattern, 4) identified role/impact of the sleep problem, 5) presence of specific sleep disorder, and 6) how sleep is being treated, into respective services' routine questionnaires (such as the Risk Assessment questionnaire within CPFT services). Sleep data would then be available for every patient and would be routinely updated across services.

4.3 Conclusion

This study examined the documentation and treatment of sleep problems in records of SMI patients, the association between their sleep and attendance rates and the association between their sleep and number of appointments scheduled. While clinicians demonstrate some awareness of the importance of recording sleep details, there is inconsistency in the recording of relevant information, and records are often limited to one-word descriptions. The study echoes previous research regarding the inadequate assessment of sleep and the

discrepancy between recognised sleep problems and subsequent treatment adherence to NICE guidelines; for instance, CBT-I, a recommended first-line treatment for insomnia, was almost never offered. Whilst gender and ethnicity did not impact sleep treatment, non-recommended treatments were offered to inpatients more frequently than outpatients. No significant associations were found between sleep and either attendance rate or number of appointments scheduled, although these findings were limited by small sample sizes and incomplete attendance data. This study underscores the need for improved recording and treatment of sleep by clinicians, to align with NICE guidelines. Future research could investigate the feasibility of incorporating standardised sleep assessments into routine practice and/or integrating specific sleep-related questions into routinely updated questionnaires, to facilitate systematic assessment and treatment of sleep in mental health services.

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Chapter 5

Discussion and Critical Evaluation

Word count: 3,039 words

Discussion and Critical Evaluation

This chapter reflects on and critically reviews both the unique and combined contributions of the systematic review (SR) and the empirical paper (EP).

Researcher reflections

Before undertaking this portfolio, I had rewarding prior experiences of working with serious mental illness (SMI) patients clinically, and a personal interest in sleep and sleep problems. Investigative research into aspects of sleep in the context of SMI was therefore a naturally intriguing prospect and has continued to be throughout the process of this thesis. I am grateful the topics were so interesting as the process was challenging at times, particularly having to navigate an electronic records system with no prior knowledge of how the search process would work or how much and what type of information would be available. The process for the EP especially required a lot of flexibility, with a change in primary research question occurring halfway through the timeline due to limited data availability. For example, attendance data which is mandatory to report was minimally reported on inhibiting the potential to explore the association between sleep and attendance. Even our basic assumptions about presence of sleep description were unmet, and this in itself became a worthy finding to report on. Despite the challenges, the process has been rewarding because I feel I have been able to explore these topics in new ways, and contribute new and clinically valuable findings to the field of clinical psychology. As a researcher I have developed multiple new skills, and as a clinician, I will carry a lasting appreciation for the profound and multi-faceted impact sleep has on the patients we work with.

Summary of findings

The SR aimed to explore whether sleep and socio-occupational functioning (SOF) are positively associated within SMI populations. The findings were categorised according to 1) the relationship between sleep quality, satisfaction, and/or duration and SOF, 2) the relationship between sleep disorders and SOF, and 3) the relationship between objectively recorded sleep variables and SOF. The studies collated in the review, although widely varied

in measures used, sleep characteristic measured, and mental health disorder examined, collectively supported that sleep may help to explain reduced SOF in SMI groups since they all pointed toward worse sleep being associated with worse SOF and vice versa. Possible mechanisms by which sleep may affect SOF were highlighted (e.g., slow-wave sleep (SWS) could be the primary sleep phase to predict functioning, long sleep duration may particularly affect SOF, and depression symptoms and cognitive performance may mediate the effect of sleep on SOF), however the need for further research was acknowledged.

The EP aimed to examine how sleep problems of SMI patients were recorded and treated, the association between their sleep and attendance rates, and the association between their sleep and number of appointments scheduled. The findings revealed that there is inconsistency in the recording of relevant sleep information of SMI patients, and records are often limited to one-word descriptions. The study echoes previous research (Rehman et al., 2017; Reeve et al., 2019; Barrett et al., 2020) regarding the inadequate assessment of sleep and the discrepancy between recognised sleep problems and subsequent treatment adherence to NICE (2022) guidelines (e.g., CBT-I, a recommended first-line treatment, was rarely offered). Inpatient status was found to be significantly associated with rate of non-recommended treatments. No significant associations were found between sleep and either attendance rate or number of appointments scheduled, although these findings were limited by small sample sizes and incomplete attendance data.

Combined discussion

The significant impact of sleep on mental health in general was well documented across both the SR and the EP. Although the two papers have different focuses, there were some specific findings that were emphasised in both.

In accordance with recent literature, they both highlighted the potential value of assessing and treating sleep. The stark differences in functioning between SMI patients with and without sleep problems highlighted in the SR point to the practical and ethical benefits of addressing sleep early in the treatment process. The EP then evidenced the reality of how sleep is recorded (minimally) and treated (not in line with recommendations) in current practice, further emphasising the need for change.

An element of the association between sleep and SOF highlighted by the SR was further investigated in the EP via the exploratory research questions, *'Does SMI patients' sleep affect their attendance rates?'* and '*Are SMI patients with sleep problems offered more appointments than SMI patients with good sleep?*'. Since poor SOF is partly characterised by absenteeism, it was hypothesised that sleep problems could indirectly affect patients' attendance of appointments (e.g., due to sleeping later in the day or becoming drawn into a vicious cycle of social avoidance). It was also hypothesised that patients with sleep problems would be offered more appointments (e.g., due to sleep's impact on cognitive functioning such as reduced memory consolidation). There was no significant effect in either direction for either question, however it is possible this was due to the small sample size in the 'good sleep' group (n = 10). The fact that so few cases of SMI patients with good sleep were identifiable did, however, serve to further support the finding that sleep was generally poorly recorded, especially if it was not viewed as problematic.

In the same way that tools for measuring sleep varied greatly across existing literature collated in the SR, there was no consistency in recording of sleep in the empirical study. There is no guidance for measuring sleep in either research or clinical fields, other than that objectively measuring sleep can of course provide insight into otherwise inaccessible parameters of sleep (e.g., sleep phases). The suggestion of using more consistent sleep measures across research studies could be echoed for the purposes of clinical assessment, for example using the ISI or PSQI to routinely assess sleep across secondary care services (self-report sleep measures would be more accessible than objective sleep measures for the purpose of routine practice).

Another notable overlap in the study findings was between the qualitative descriptions of sleep's effect on SOF included in the SR and the descriptions of sleep's role/impact gathered as part of the content analysis in the EP. The qualitative descriptions of sleep's effect on SOF included 'feeling down with no energy', 'feeing nervous and anxious', 'restlessness', 'a lack of motivation', 'difficulties concentrating and in performance', 'memory problems', 'bad moods', 'difficulty getting up', 'irritability', 'apathy' (Batalla-Martín et al., 2022), 'loss of jobs and friends', and 'a reduced ability or opportunity to participate in valued activities' (Faulkner & Bee, 2017). These descriptions bear remarkable resemblance to some of the descriptions of the role/impact of sleep outlined by clinicians in patient records, which

included ‘exacerbating mood/mental state/symptoms’, ‘worse daytime function/engagement’, ‘increased suicidal thoughts’, ‘loss of control’, ‘increased chaotic thoughts’, ‘increased distress’, ‘lack of focus’, ‘worse quality of life’, ‘muddled thoughts’, ‘signing self off work’, and ‘reduced self-care’. This particular aspect of the EP investigation therefore further corroborates the findings of the SR.

Systematic review critical review

The primary aim of the SR was to indicate whether a significant association between SOF and sleep was identified by the studies collated, and if so, whether this differed by sleep parameter tested. To answer this question, a narrative synthesis was conducted that included both quantitative and qualitative literature, allowing for both objective and subjective interpretations of sleep’s effect on SOF. Few relevant qualitative studies were identified (*n* = 2) meaning the results perhaps lacked in richness that would have otherwise benefited the innately complex and subjective nature of sleep and its *perceived* effects. However, it is important to note that elements of the quantitative studies were still subjective in that most of the sleep measures employed across studies were self-report measures. Self-report sleep measures have sometimes been shown to clash with the findings of objective sleep measures such as actigraphy or polysomnography (Chung et al., 2020), rendering them less reliable in one sense. That said, subjective sleep measures do provide a unique and invaluable insight into how people *perceive* their sleep/functioning, revealing aspects which may be most important to individual patients. In this sense, the SR is strengthened by comprising of a combination of subjective and objective studies which still predominantly agreed in their findings.

Empirical paper critical review

The EP’s methodology involved analysing data extracted from an electronic records database and this in itself presented a number of advantages and limitations. It had the practical and ethical advantages of non-invasively generating recent data that was not biased by demand characteristics. However, participant numbers were limited to those that met the inclusion/exclusion criteria of the study. It was originally intended that there would be approximately 40 participants in each of the comparison groups, based on g*power analyses (Faul et al., 2007) (see Appendix I) to answer the attendance and appointment number

questions, which were originally going to comprise the primary focus of the study. However, there were only 10 participants reliably identifiable as having good sleep. Upon realising any subsequent analyses would be underpowered, the primary focus changed to that of how sleep was recorded and subsequently treated in SMI. This turned out to be a valuable aim and generated valuable results, however the question of how sleep affects attendance and number of appointments offered in secondary care remains relatively unclear.

The advantage of utilising this real-world clinical data paradoxically presents an intrinsic limitation, namely that data usability was entirely reliant on historic recording by clinicians. It had been expected that this would be a limiting factor, especially since we know that sleep is not routinely assessed. However, even mandatory data records such as attendance outcomes were sparsely recorded, which further limited the extent to which some questions could be answered. For example, 86 of the 310 patient records that were not used to answer the tertiary research questions could not be used for the specific reason that insufficient (< 50%) attendance data was recorded by clinicians. Seventy-nine of these 86 had been assigned 'poor sleep' status and seven 'good sleep' status. It is unfortunate that standard record-keeping guidelines had not been consistently adhered to within the services of interest as this prevented a more comprehensive analysis of the data. That said, even if all attendance data had been completed, the 'good sleep' group would still have been limited to only 17 patient records. This suggests that the more pressing issue is routine recording of sleep status in the first place, especially where it is problematic.

A procedural limitation to this study was that, at the time of data collection, the CRATE database did not contain Systm One 'Tabbed Journal' notes (e.g., free-written clinical notes uploaded to the system, and not in a structured questionnaire). It is highly likely such notes would have also included mention of and details about sleep, and they would also have provided an opportunity to verify information such as patients' assigned sleep status as being accurate and up to date. Notes available for scrutinising were limited to Systm One-generated 'questionnaires' (e.g., risk assessments, care plans, safeguarding referral forms, etc.) or Systm One-generated outcome measures (e.g., HONOS). That said, problematic sleep is a risk factor for deterioration in mental health that should ideally be detailed in the 'Risk Assessment' questionnaire, and Risk Assessment questionnaires are routinely updated (between every three months to one year depending on individual service guidelines). Risk

Assessments would seem an appropriate place to record sleep status (whether as a risk or a protective factor) since this would provide a consistent and efficient way to ascertain a patient's sleep status. Furthermore, having access to 'Tabbed Journal' notes and/or letters would have presented a much larger task that would likely have required the use of natural language processing tools or other methods beyond the remit of this study.

Clinical implications

Sleep is not a niche symptom that requires specialist assessment in only limited circumstances. It is an integral part of every human's functioning, a basic necessity for survival. Insomnia is the most common symptom of any mental health disorder, featuring within 22 different diagnostic criteria (Forbes et al., 2023), and yet its presence is not routinely captured.

Both the SR and the EP evidence the need for more consistent sleep assessment and treatment in secondary care mental health services. The SR findings suggested that implementation of efficient routine assessment and treatment of sleep for SMI patients in would be a worthwhile endeavour, especially given this population's inherent vulnerability to sleep problems in the first instance. The EP then evidenced that neither of these processes are happening in current clinical practice.

Despite the clear potential benefit of routine assessment and treatment of sleep there are still barriers. It would require systemic change, either within individual services (e.g., incorporated as routine practice by service leads), or within wider recording guidelines (e.g., similarly to how Systm One Risk Assessment questionnaires are mandatorily completed at regular intervals). However, the body of evidence to support such a change is still growing and further work is likely necessary to create such a paradigm shift.

One change which may need to take place in order to see sleep assessed and treated more routinely across secondary care is the ICD-11 diagnosis of insomnia which is in itself somewhat confusing and open to interpretation. Regarding short- and long-term insomnia diagnostic classification it states, '*If the insomnia is due to another sleep-wake disorder, a mental disorder, another medical condition, or a substance or medication, chronic insomnia should only be diagnosed if the insomnia is an independent focus of clinical attention'* (World Health Organization, 2019). This is problematic firstly because due to the bidirectional

relationship between sleep and mental health, it can be difficult to ascertain whether insomnia is *due to* or *caused by* a mental disorder. This is especially true since insomnia is the most frequently overlapping diagnostic symptom in mental health disorders, featured within 22 DSM-5 diagnoses (Forbes et al., 2023). Secondly, the diagnosis of insomnia is here dependent on how insomnia is treated (which will likely vary across services and clinicians) as opposed to treatment being informed by diagnosis, which is arguably more objective. Furthermore, there is evidence that targeting sleep problems can alleviate mental health symptoms (Scott, 2021b) so following treatment guidelines for insomnia may still be helpful even in the presence of a comorbid mental health disorder.

Complexity in mental health can be defined as resulting from '*interactions of biological, psychological and social factors that create barriers to treatment, challenge therapeutic alliances and modify the usual maintenance of a disorder*' (Barton et al., 2017, p. 2). Patients with complexity are known to sometimes be unresponsive to disorder-specific protocols (Goddard et al., 2015). In such cases, Barton et al. (2017) suggests a more flexible, formulation-driven approach should be taken to target the interaction between therapy-interfering complexity factors and the mental health disorder, so that progress can be resumed. It is reasonable to suppose that in some cases, insomnia comprises such a therapy-interfering factor, given the evidence of its disruptive effects on functioning collated in the SR and wider literature. In this sense, insomnia should form a treatment target as long as it is preventing recovery in some way (e.g., engaging fully with treatment). However, regardless of whether a diagnosis of 'insomnia' is assigned to patients with sleep problems, clinicians cannot make an informed decision about whether it interferes with treatment to the point of preventing progress and requires targeted treatment unless sleep is sufficiently assessed in the first instance.

Directions for future research

Several areas are highlighted as valuable directions for future research across this portfolio. The resounding message pertains to improving current assessment and treatment of sleep, and a stronger evidence base would help achieve this aim.

Further research on the cost-effectiveness of CBT-I for SMI populations, demonstrating that it can reduce long-term service costs and patient morbidity in the longer term, would

provide a stronger rationale for including sleep assessment as part of routine secondary care. There is preliminary evidence that CBT-I is a cost-effective treatment (considering factors such as insomnia-related healthcare expenditure and lost workplace productivity) (Darden et al., 2021; Natsky et al., 2020), however only one such cost-effectiveness study has focused on an SMI population (Tsiachristas et al., 2018).

A primary topic of future research highlighted by the EP was that of feasibility trials regarding the incorporation of routine assessment of sleep across secondary care (e.g., utilisation of sleep outcome measures or inclusion of sleep descriptions within mandated electronic records). Such research would ideally be backed by and feed into relevant cost-effectiveness studies to create a strong rationale for wider clinical implementation.

Directions for future research indicated in the SR specifically, relate to better understanding specific sleep disorders (e.g., insomnia, hypersomnia) or sleep parameters (e.g., slow-wave/REM sleep) that may influence SOF, as this may further develop understanding about what to target. For instance, if the relationship between long sleep duration and SOF was clearer (e.g., regarding its interaction with external factors such as environment, medication effects, and activity levels), it could help create more targeted treatment aims in CBT-I. Another highlighted research topic that could affect how sleep is treated was the mediation (e.g., by trauma, medication, etc.) of sleep's effect on SOF (and mental health symptoms if focusing more broadly).

Conclusions

In conclusion, this portfolio comprises a comprehensive examination of the relationship between sleep and SOF in SMI populations, followed by a more focused look at how sleep was recorded and treated for SMI patients within a specific NHS trust. The researcher's professional background in clinical work with SMI patients, coupled with an interest in sleep-related issues, provided a meaningful context for this undertaking. The SR, through a meticulous examination of existing literature, suggested a significant association between sleep and SOF in SMI, highlighting the potential value of addressing sleep early in treatment. The EP, drawing on real-world clinical data, demonstrated a stark contrast between the recognised importance of sleep in SMI and the actual recording and treatment practices in current clinical settings. Despite methodological challenges, both papers underscore the

critical need for systemic changes in secondary care mental health services to incorporate routine assessment and treatment of sleep. However, barriers such as the ICD-11 diagnosis of insomnia and a paucity of research in some important areas, require further work to facilitate such a shift.

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Appendices

Appendix A

Systematic review search strategy

Search strategy

PubMed and PsychNet were searched in February 2023. The search strategy used across all databases was as follows:

("Severe mental illness" OR "serious mental illness" OR "Schizophrenia" OR "Schizoaffective disorder" OR "Schizotypal disorder" OR "Psychotic" OR "psychotic disorde" OR "Delusional disorder" OR "Psychosis" OR "Bipolar" OR "Cyclothym*" OR "Sever* depress*" OR "Persistent depress*" OR "Dysthymia" OR "Severe eating disorder" OR "Severe personality disorder")*

AND

("activity leve" OR "quality of life" OR "HRQoL" OR "The Personal Social Performance" OR "Adult Social Relationships Scales" OR "Specific Levels of Functioning Scale" OR "UCSD Performance-Based Skills Assessment" OR "UPSA-B" OR "Work Productivity and Activity Impairment Questionnaire" OR "WPAI" OR "Work and Social Adjustment Scale" OR "International Physical Activity Questionnaire" OR "IPAQ" OR "Sheehan Disability Scale" OR "social occupational functio*" OR "social functio*" OR "occupational functio*" OR "functioning" OR "work productivity" OR "Time Use Survey" OR "Social and Occupational Functioning Assessment Scale" OR "Occupational Functioning Scale" OR "Social functioning questionnaire" OR "Social functioning schedule" OR "Social functioning scale" OR "Social Adjustment Scale Self-Report" OR "SAS-SR" OR "Social Adjustment Scale" OR "The Structured and Scaled Interview to Assess Maladjustment" OR "SSIAM" OR "Social Behaviour Assessment Schedule" OR "Interview Schedule for Social Interaction" OR "Katz Adjustment Scale" OR "EQ-5D" OR "Health of the Nation Outcome Scales" OR "HoNOS" OR "Assessment of Occupational Functioning" OR "Global Assessment of Functioning" OR "Functioning Assessment Short Test" OR "Range of Impaired Functioning Tool" OR "Longitudinal Interval Follow-up Evaluation" OR "LIFE-RIFT" OR "Personal and Social Performance scale" OR "Specific Level of Functioning Scale" OR "psychological wellbeing")*

AND

(“sleep” OR "insomnia" OR "nightmare" OR "IDS-C" OR "Inventory of Depressive Sympto" OR "Pittsburgh Sleep Quality Index Global Scale" OR "PSQI" OR "insomnia severity index" OR "DISP" OR "Diagnostic Interview for Sleep Patterns and Disorders" OR "SLEEP-50" OR "Oviedo Sleep Questionnaire" OR "polysomnography" OR “actigraphy” OR "Epworth Sleepiness Scale")*

NOT

("dementia" OR “parkinso”)*

Appendix B

Systematic Review Author Guidelines (*Psychiatry Research*)

Rapid publication is a priority; hence, authors are requested to pay close attention to the following instructions for the submission of manuscripts to the journal *Psychiatry Research*.

Preparation of manuscripts

Title page. The Title page should include the author byline, with names of authors on the same line(s). Superscript letters (a, b, c), not numerals, should be used to key institutional affiliation (if all authors are in the same department, the superscript letter should be omitted); an asterisk should be entered to designate the corresponding author. Underneath the byline, institutional affiliations should be listed (department, institution, city, state or province (if applicable) and country. Funding information should not be included on the title page but should instead be given following the Discussion section.In an asterisked Corresponding Author footnote at the bottom of the title page, telephone/fax numbers and e-mail address of the corresponding author should be provided; e-mail addresses, if desired, may also be provided for the co-authors (or co-corresponding author, if applicable).

Abstract. The Abstract should be 150-200 words for full-length articles and 100 words for short communications (formally known as Brief Communications), summarizing the aims of the study, the

methods used, the results and the major conclusions. Do not include a summary at the end of the article. Note that *Psychiatry Research* does not use the structured abstract style; do not include bold-faced headings within the abstract. The Abstract should be a single paragraph. Do not include detailed statistics or p-values in the abstract; simply say “significant “or “non-significant” .

The abstract should be followed by up to seven key words which accord with the indexing conventions of Index Medicus. Note that the keywords should not duplicate words used in the title of the article, which will be automatically indexed.

Text. Although exceptions will be considered, manuscripts should not exceed 5000 words, and shorter manuscripts (e.g., 3000 words) are preferred. Each article should contain the following major headings: Introduction (preceded by arabic number 1.), Methods (preceded by number 2.), Results (preceded by number 3.), Discussion (preceded by number 4.), Acknowledgment (optional section following the discussion, which should not be preceded by a numeral), and References (should not be preceded by a numeral).

Subheadings should follow the numbering system used in the major heading; for example, the subheading "Subjects" within the Methods section should be flush left on a separate line and designated 2.1., the subheading "Procedures" should be designated 2.2., etc.

Lower level headings, if required, should also be numbered (e.g., "2.1.1. Patients." as a lower order heading under "2.1. Subjects.").

Only the first letter of the first word of each heading should be capitalized.

The use of abbreviations within the text should be minimized, and each abbreviation, when introduced, must be defined and used consistently thereafter. Systeme International measurements should be used. For products or instruments (do not abbreviate) used in the research reported, provide the name, city and country of the supplier in parentheses. All tables and figures must be referred to in the text.

Manuscript categories

Research Articles. Although exceptions will be considered, manuscripts should not exceed 5000 words, and shorter manuscripts (e.g., 3000 words) are preferred. Each article should contain the following major headings: Introduction (preceded by arabic number 1.), Methods (preceded by number 2.), Results (preceded by number 3.), Discussion (preceded by number 4.), Acknowledgment (optional section following the discussion, which should not be preceded by a numeral), and References (should not be preceded by a numeral). Subheadings should follow the numbering system used in the major heading; for example, the subheading "Subjects" within the Methods section should be flush left on a separate line and designated 2.1., the subheading "Procedures" should be designated 2.2., etc. Lower level headings, if required, should also be numbered (e.g., "2.1.1. Patients." as a

lower order heading under "2.1.Subjects."). Only the first letter of the first word of each heading should be capitalized.

Short communications. Short communications (formally called Brief reports) should not exceed 1500 words, including a 100-word abstract, 3 keywords, text, and references plus 1 table or 1 figure.

Case reports. Case reports will only be considered as Correspondence (see following instructions.)

CorrespondenceCorrespondence items (formally Letters to the Editor) should be 750-1000 words or less. It should not include a title page, abstract or key words. Authors' names and affiliations should be listed at the end of the letter, along with the corresponding author's email address. There should be no more than 5 references, and no tables or figures.

Manuscript categories

Conflict of interest. All authors are requested to disclose any actual or potential conflict of interest including any financial, personal or other relationships with other people or organizations within three (3) years of beginning the work submitted that could inappropriately influence, or be perceived to influence, their work. Examples of potential conflicts of interest that should be disclosed include employment, consultancies, stock ownership (except for personal investment purposes equal to the lesser of one percent (1%) or USD 5000), honoraria, paid expert testimony, patent

applications, registrations, and grants. If there are no conflicts of interest, authors should state that there are none.

Abbreviations. Define abbreviations at their first occurrence in the article. Abbreviations should be defined when they first occur in the abstract, in the text, and also in tables and figure legends. Once an abbreviation has been introduced in the main body of the text, it should be used throughout.

Statistical reporting. Statistical reporting should be complete, including at a minimum name of statistical test, test value, degrees of freedom where appropriate, and *p*-value. Italic font should be used for *n* (sample size) and statistical terms, e.g., *t, r, F, U, p*.

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• A competing interests statement is provided, even if the authors have no competing interests to declare
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Appendix C

Empirical paper case selection process

The initial scoping search involved running a search query (see Figure 1) for the term 'sleep' within CAMEO and all Adult Locality services including only the free notes from 'Risk Assessment' questionnaires. There were 879 rows of patient data that fell within the time period of interest (01.09.21 – 31.08.22) which were reduced to 364 total number of patients after duplicate patient records were manually removed.

Figure 1. Search query 1

```
SELECT TOP 3000 * FROM s1.[dbo].[s1_freetext]
WHERE (TeamName like '%cameo%' or TeamName like '%locality%')
AND (QuestionnaireName like '%Risk Assessment%')
AND  [FreeText] LIKE '%sleep%'
ORDER BY EventDate, rid
```

Next, an individual search query was run (see Figure 2) for each of the 364 remaining patient records. This search included all services and notes for that patient record. If the 'Team Name' column indicated that the patient was referred to inpatient services for any point throughout the time period of interest, this was noted. All 'FreeText' notes were searched for the keyword 'sleep' and any other relevant details in order to confirm the patient's sleep status and assign them to either the 'Good Sleep' group or the 'Poor Sleep' group. They would be excluded from the study if neither could be determined. Inclusion/exclusion criteria to determine 'Poor Sleep' or 'Good Sleep' status were as follows:

- If *explicit* mention of poor (or equivalent description) sleep has been used to describe the patient *within* period of interest, assign to 'Poor Sleep'.
- If explicit mention of sleep being good (or equivalent description), assign to 'Good Sleep'.
- If mentions of sleep are contradictory within the record, or irrelevant (i.e., 'sleeping rough' or 'sleeping at friend's house'), assign to 'N/A'.

Figure 2. Search query 2

```
SELECT TOP 3000 * FROM s1.[dbo].[s1_freetext]
WHERE rid in ('(insert rid)')
ORDER BY EventDate
```

Next, another individual search query (see Figure 3) was run to generate lists of appointments that had been scheduled for each patient and the attendance status of those appointments (i.e.,

attended, DNA'd, or cancelled by patient). Each set of results included a column for 'Eventdetailsdescription' to describe the type of appointment. 'Treatment', 'Intervention', 'Initial Appointment', 'Follow Up Assessment', 'Medication Review', 'Peer Support Work' appointments were included. 'Unknown', 'Outreach contact', 'MDT Discussion', 'On Call/Duty', 'Triage' appointments were excluded. Any appointments that appeared multiple times on the same date were excluded (except if two same-date appointments had different attendance outcomes) as it was assumed these were the same appointment outcomed by different clinicians. Any appointments which are described as 'Letter' or 'Administration' in 'eventdetailsmethoddescription' were included as it was assumed this description was entered in error when the appointment was actually F2F/video/telephone. If a method such as 'text' (which is impossible to conduct treatment via) was listed as method under both the 'contactmethoddescription' and the 'eventdetailsmethoddescription' columns, that row of data was discarded. After this point, all cases had to have a minimum of 50% of the attendance outcome data available to be included. If there was less than 50% of attendance data available in a record, the record was noted to have 'insufficient attendance data' (meaning that record could not be used toward the attendance research question). Total number of appointments scheduled across the relevant time period were recorded for answering the 'number of appointments offered' research question. Next, any rows with 'NULL' or 'cancelled by provider' in the 'attendedordna' column were then discarded and remaining records were recorded for answering the 'does sleep affect attendance' research question. Note: Attendance for records assigned to the 'Good Sleep' group was only calculated starting from the date they were recorded to have been sleeping well (so as to prevent their previous poor sleep, if applicable, confounding results).

Figure 3. Search query 3

```
SELECT ae.rid,
                  Cast (ae.dateevent AS DATE) event_date,
                  contactmethoddescription,
                  costcentredesc,
                  eventdetailsdescription,
                  eventdetailsmethoddescription,
                  [role],
                  teamname,
                  organisationname,
                  appointmentstatusdescription,
                  app.attendedordna
FROM   [S1].[dbo].[s1_activityevent] AS AE
       LEFT OUTER JOIN [S1].[dbo].[s1_appointments] AS app
                    ON AE.rid = app.rid
                       AND Cast (ae.dateevent AS DATE) = Cast (
                           appointmentdate AS DATE)
WHERE  ae.rid in ('(insert rid)') AND
   CAST (DateEvent AS DATE) BETWEEN '2021-09-01' AND '2022-08-31'
   AND
  ( eventdetailsdescription NOT IN ('Administration', 'Clinical Administration', 'Data
Migration', 'Administration Clinical', 'Administration Clinical', 'Patient record' ) )
  AND ( contactmethoddescription NOT IN ('Administration', 'Clinical Administration',
'Data Migration') )
AND (CostCentreDesc LIKE '%CAMEO%' OR
       CostCentreDesc LIKE '%PALT%' OR
       CostCentreDesc LIKE '%HALT%' OR
       CostCentreDesc LIKE '%CALT%' OR
       CostCentredesc LIKE '%FALT%')
ORDER BY -- ae.rid,
          costcentredesc desc,
          dateeventdatetime
```

Lastly, two additional search queries were run to generate demographic details assigned with each patient record. The first (see Figure 4) generated date of birth, ethnicity, employment status, and gender and the second (see Figure 5) generated diagnosis.

Figure 4. Search query 4

```
SELECT dem.rid, pat.dob, dem.Ethnicity, dem.EmploymentMHSDSStatusDescription,
dem.Gender, dem.IMD_Rank
FROM s1.dbo.s1_patient AS PAT
INNER JOIN s1.dbo.S1_Demographics dem
ON pat.rid = dem.rid
WHERE pat.rid IN
('(insert rid) ')
```

Figure 5. Search query 5

```
SELECT rid, code, Description, DateDiagnosis
FROM s1.dbo.S1_Diagnosis dia
WHERE rid IN
(' (insert rid) ')
ORDER BY DateDiagnosis, code
```

Appendix D

SPSS output re primary research question, 'How are sleep problems recorded?'

Figure 1.1 Chi-square test output re sleep description by ethnicity

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.249[a]	2	.535
Likelihood Ratio	1.254	2	.534
Linear-by-Linear Association	.008	1	.928
N of Valid Cases	99		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 3.02.

Figure 1.2 Chi-square test output re sleep description by ethnicity

How_Sleep_Recorded * Ethnicity Crosstabulation

			Ethnicity		
			White British	Minority Ethnic	Total
How_Sleep_Recorded	One-word	Count	31a	11a	42
		Expected Count	32.2	9.8	42.0
		% within How_Sleep_Recorded	73.8%	26.2%	100.0%
		% within Ethnicity	40.8%	47.8%	42.4%
		% of Total	31.3%	11.1%	42.4%
		Residual	-1.2	1.2	
		Standardized Residual	-.2	.4	
	Minimal	Count	36a	8a	44
		Expected Count	33.8	10.2	44.0
		% within How_Sleep_Recorded	81.8%	18.2%	100.0%
		% within Ethnicity	47.4%	34.8%	44.4%
		% of Total	36.4%	8.1%	44.4%
		Residual	2.2	-2.2	
		Standardized Residual	.4	-.7	
	Adequate	Count	9a	4a	13
		Expected Count	10.0	3.0	13.0
		% within How_Sleep_Recorded	69.2%	30.8%	100.0%
		% within Ethnicity	11.8%	17.4%	13.1%
		% of Total	9.1%	4.0%	13.1%
		Residual	-1.0	1.0	
		Standardized Residual	-.3	.6	
Total		Count	76	23	99
		Expected Count	76.0	23.0	99.0
		% within How_Sleep_Recorded	76.8%	23.2%	100.0%
		% within Ethnicity	100.0%	100.0%	100.0%
		% of Total	76.8%	23.2%	100.0%

Figure 1.3 Chi-square test output re sleep description by ethnicity

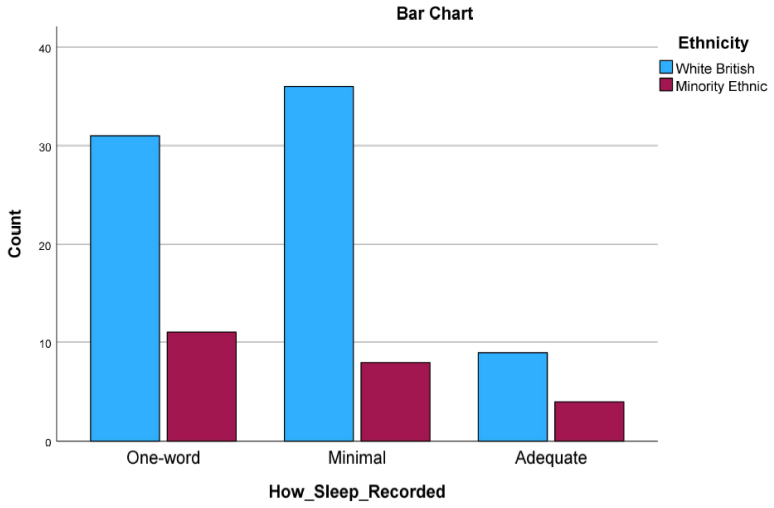


Figure 2.1 Chi-square test output re sleep description by gender

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.147[a]	2	.564
Likelihood Ratio	1.126	2	.569
Linear-by-Linear Association	.510	1	.475
N of Valid Cases	123		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.10.

Figure 2.2 Chi-square test output re sleep description by gender

How_Sleep_Recorded * Gender Crosstabulation

			Gender		
			Male	Female	Total
How_Sleep_Recorded	One-word	Count	22a	34a	56
		Expected Count	22.8	33.2	56.0
		% within How_Sleep_Recorded	39.3%	60.7%	100.0%
		% within Gender	44.0%	46.6%	45.5%
		% of Total	17.9%	27.6%	45.5%
		Residual	-.8	.8	
		Standardized Residual	-.2	.1	
	Minimal	Count	20a	32a	52
		Expected Count	21.1	30.9	52.0
		% within How_Sleep_Recorded	38.5%	61.5%	100.0%
		% within Gender	40.0%	43.8%	42.3%
		% of Total	16.3%	26.0%	42.3%
		Residual	-1.1	1.1	
		Standardized Residual	-.2	.2	
	Adequate	Count	8a	7a	15
		Expected Count	6.1	8.9	15.0
		% within How_Sleep_Recorded	53.3%	46.7%	100.0%
		% within Gender	16.0%	9.6%	12.2%
		% of Total	6.5%	5.7%	12.2%
		Residual	1.9	-1.9	
		Standardized Residual	.8	-.6	
Total		Count	50	73	123
		Expected Count	50.0	73.0	123.0
		% within How_Sleep_Recorded	40.7%	59.3%	100.0%
		% within Gender	100.0%	100.0%	100.0%
		% of Total	40.7%	59.3%	100.0%

Figure 2.3 Chi-square test output re sleep description by gender

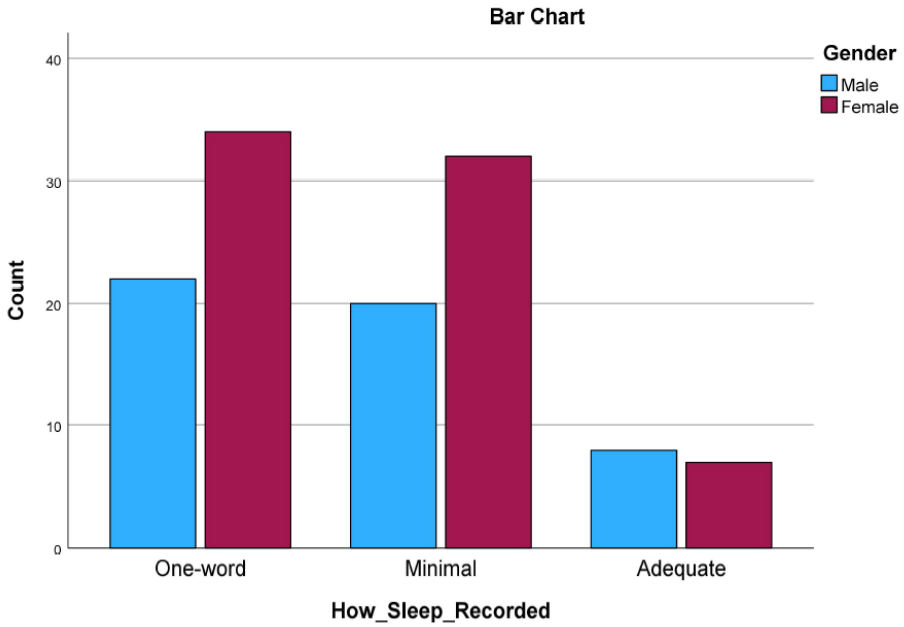


Figure 3.1 Chi-square test output re sleep description by inpatient status

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.666[a]	2	.717
Likelihood Ratio	.662	2	.718
Linear-by-Linear Association	.654	1	.419
N of Valid Cases	123		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.85.

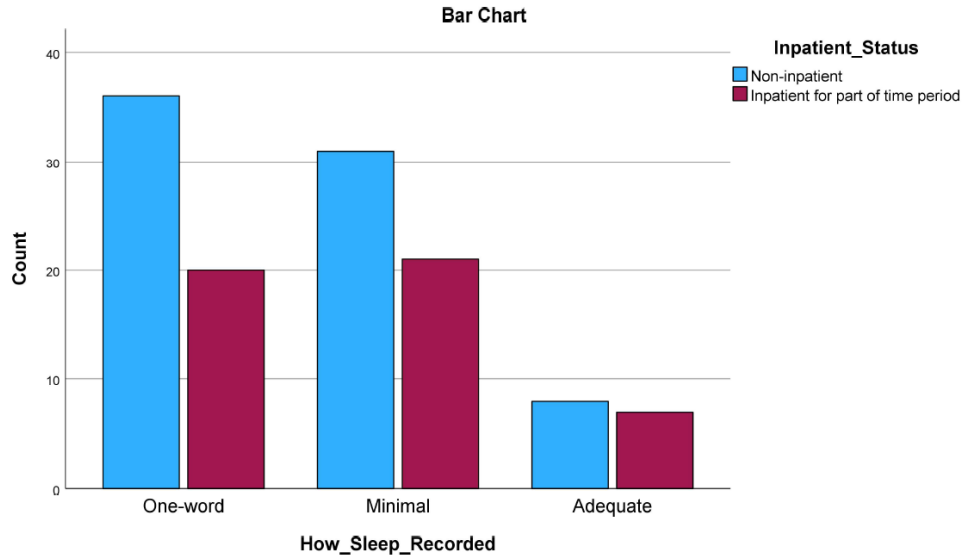
Figure 3.2 Chi-square test output re sleep description by inpatient status

How_Sleep_Recorded * Inpatient_Status Crosstabulation

			Inpatient Status		
			Non-inpatient	Inpatient for part of time period	Total
How Sleep Recorded	One-word	Count	36[a]	20[a]	56
		Expected Count	34.1	21.9	56.0
		% within How Sleep Recorded	64.3%	35.7%	100.0%
		% within Inpatient Status	48.0%	41.7%	45.5%
		% of Total	29.3%	16.3%	45.5%
		Residual	1.9	-1.9	
		Standardized Residual	.3	-.4	
	Minimal	Count	31[a]	21[a]	52
		Expected Count	31.7	20.3	52.0
		% within How Sleep Recorded	59.6%	40.4%	100.0%
		% within Inpatient Status	41.3%	43.8%	42.3%
		% of Total	25.2%	17.1%	42.3%
		Residual	-.7	.7	
		Standardized Residual	-.1	.2	
	Adequate	Count	8[a]	7[a]	15
		Expected Count	9.1	5.9	15.0
		% within How Sleep Recorded	53.3%	46.7%	100.0%
		% within Inpatient Status	10.7%	14.6%	12.2%
		% of Total	6.5%	5.7%	12.2%
		Residual	-1.1	1.1	
		Standardized Residual	-.4	.5	
Total		Count	75	48	123
		Expected Count	75.0	48.0	123.0
		% within How Sleep Recorded	61.0%	39.0%	100.0%
		% within Inpatient Status	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%

Each subscript letter denotes a subset of Inpatient Status categories whose column proportions do not differ significantly from each other at the .05 level.

Figure 3.3 Chi-square test output re sleep description by inpatient status



Appendix E

SPSS outputs re secondary research question, 'How are sleep problems treated?'

Figure 1.1 Chi-square test output re sleep treatment by ethnicity

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.735[a]	2	.692
Likelihood Ratio	.806	2	.668
Linear-by-Linear Association	.364	1	.546
N of Valid Cases	99		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 3.25.

Figure 1.2 Chi-square test output re sleep treatment by ethnicity

Sleep_treament * Ethnicity Crosstabulation

			Ethnicity		
			White British	Minority Ethnic	Total
Sleep_treament	No treatment	Count	34a	11a	45
		Expected Count	34.5	10.5	45.0
		% within Sleep_treament	75.6%	24.4%	100.0%
		% within Ethnicity	44.7%	47.8%	45.5%
		% of Total	34.3%	11.1%	45.5%
		Residual	-.5	.5	
		Standardized Residual	-.1	.2	
	Non-recommended	Count	30a	10a	40
		Expected Count	30.7	9.3	40.0
		% within Sleep_treament	75.0%	25.0%	100.0%
		% within Ethnicity	39.5%	43.5%	40.4%
		% of Total	30.3%	10.1%	40.4%
		Residual	-.7	.7	
		Standardized Residual	-.1	.2	
	Recommended	Count	12a	2a	14
		Expected Count	10.7	3.3	14.0
		% within Sleep_treament	85.7%	14.3%	100.0%
		% within Ethnicity	15.8%	8.7%	14.1%
		% of Total	12.1%	2.0%	14.1%
		Residual	1.3	-1.3	
		Standardized Residual	.4	-.7	
Total		Count	76	23	99
		Expected Count	76.0	23.0	99.0
		% within Sleep_treament	76.8%	23.2%	100.0%
		% within Ethnicity	100.0%	100.0%	100.0%
		% of Total	76.8%	23.2%	100.0%

Each subscript letter denotes a subset of Ethnicity categories whose column proportions do not differ significantly from each other at the .05 level.

Figure 1.3 Chi-square test output re sleep treatment by ethnicity

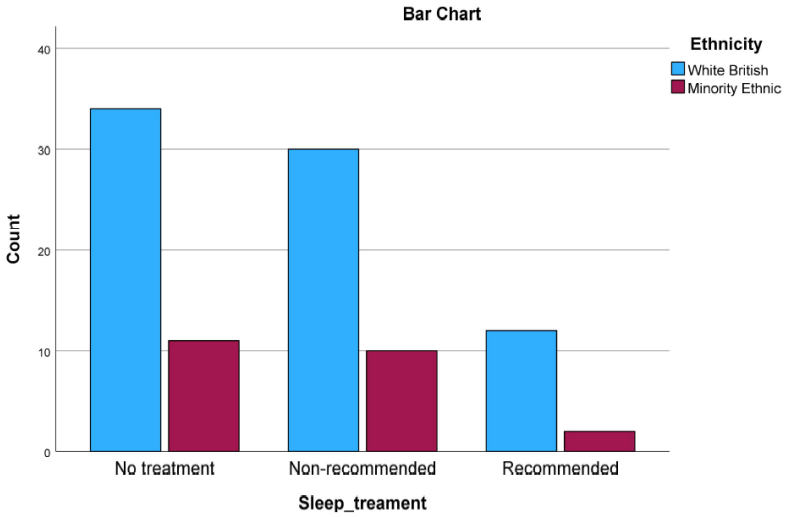


Figure 2.1 Chi-square test output re sleep treatment by gender

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.697[a]	2	.428
Likelihood Ratio	1.723	2	.422
Linear-by-Linear Association	.057	1	.811
N of Valid Cases	123		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.91.

Figure 2.2 Chi-square test output re sleep treatment by gender

Sleep_treament * Gender Crosstabulation

			Gender		
			Male	Female	Total
Sleep_treament	No treatment	Count	23a	36a	59
		Expected Count	24.0	35.0	59.0
		% within Sleep_treament	39.0%	61.0%	100.0%
		% within Gender	46.0%	49.3%	48.0%
		% of Total	18.7%	29.3%	48.0%
		Residual	-1.0	1.0	
		Standardized Residual	-.2	.2	
	Non-recommended	Count	22a	25a	47
		Expected Count	19.1	27.9	47.0
		% within Sleep_treament	46.8%	53.2%	100.0%
		% within Gender	44.0%	34.2%	38.2%
		% of Total	17.9%	20.3%	38.2%
		Residual	2.9	-2.9	
		Standardized Residual	.7	-.5	
	Recommended	Count	5a	12a	17
		Expected Count	6.9	10.1	17.0
		% within Sleep_treament	29.4%	70.6%	100.0%
		% within Gender	10.0%	16.4%	13.8%
		% of Total	4.1%	9.8%	13.8%
		Residual	-1.9	1.9	
		Standardized Residual	-.7	.6	
Total		Count	50	73	123
		Expected Count	50.0	73.0	123.0
		% within Sleep_treament	40.7%	59.3%	100.0%
		% within Gender	100.0%	100.0%	100.0%
		% of Total	40.7%	59.3%	100.0%

Each subscript letter denotes a subset of Gender categories whose column proportions do not differ significantly from each other at the .05 level.

Figure 2.3 Chi-square test output re sleep treatment by gender

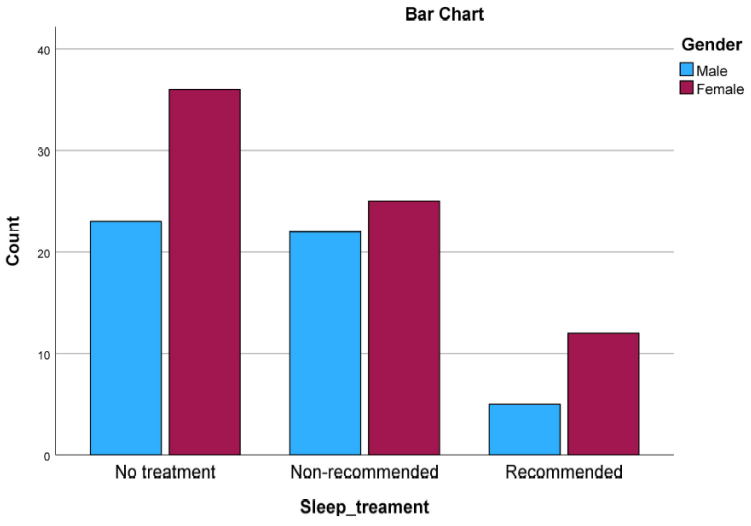


Figure 3.1 Chi-square test output re sleep treatment by inpatient status

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.423[a]	2	.040
Likelihood Ratio	6.394	2	.041
Linear-by-Linear Association	.777	1	.378
N of Valid Cases	123		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.63.

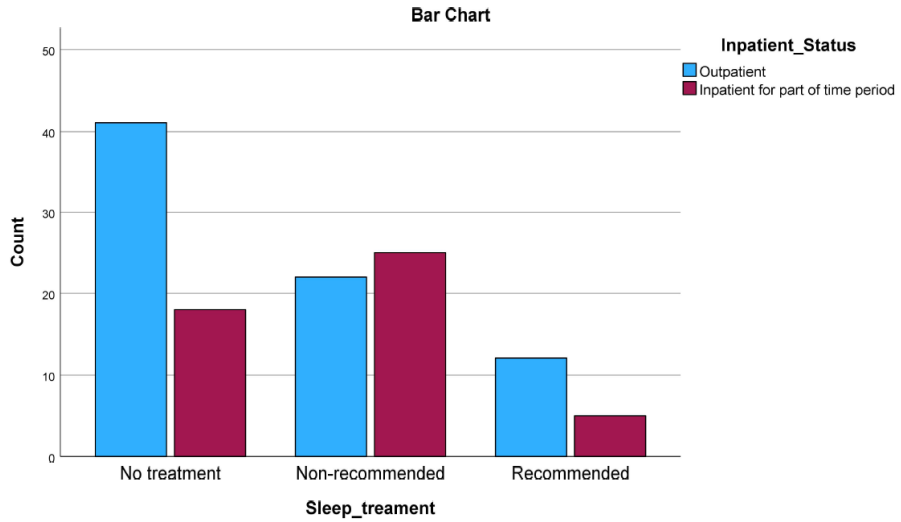
Figure 3.2 Chi-square test output re sleep treatment by inpatient status

Sleep_treament * Inpatient_Status Crosstabulation

			Inpatient Status		
			Outpatient	Inpatient for part of time period	Total
Sleep_treament	No treatment	Count	41$_a$	18$_a$	59
		Expected Count	36.0	23.0	59.0
		% within Sleep_treament	69.5%	30.5%	100.0%
		% within Inpatient_Status	54.7%	37.5%	48.0%
		% of Total	33.3%	14.6%	48.0%
		Residual	5.0	-5.0	
		Standardized Residual	.8	-1.0	
		Adjusted Residual	1.9	-1.9	
	Non-recommended	Count	22$_a$	25$_b$	47
		Expected Count	28.7	18.3	47.0
		% within Sleep_treament	46.8%	53.2%	100.0%
		% within Inpatient_Status	29.3%	52.1%	38.2%
		% of Total	17.9%	20.3%	38.2%
		Residual	-6.7	6.7	
		Standardized Residual	-1.2	1.6	
		Adjusted Residual	-2.5	2.5	
	Recommended	Count	12$_a$	5$_a$	17
		Expected Count	10.4	6.6	17.0
		% within Sleep_treament	70.6%	29.4%	100.0%
		% within Inpatient_Status	16.0%	10.4%	13.8%
		% of Total	9.8%	4.1%	13.8%
		Residual	1.6	-1.6	
		Standardized Residual	.5	-.6	
		Adjusted Residual	.9	-.9	
Total		Count	75	48	123
		Expected Count	75.0	48.0	123.0
		% within Sleep_treament	61.0%	39.0%	100.0%
		% within Inpatient_Status	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%

Each subscript letter denotes a subset of Inpatient_Status categories whose column proportions do not differ significantly from each other at the .05 level.

Figure 3.3 Chi-square test output re sleep treatment by inpatient status



Appendix F

SPSS Outputs re exploratory research question, 'Are SMI patients with sleep problems scheduled more appointments than SMI patients with good sleep?'

The Shapiro-Wilk test showed that for the poor sleep group, the dependent variable 'number of sessions' was not normally distributed (significance value was below 0.05), however for the good sleep group, the dependent variable was normally distributed. The Q-Q plots corroborated this. (See Figures 1, 2, and 3).

Figure 1. Test of Normality (Group 1 = Poor sleep; Group 2 = Good sleep)

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Group	Statistic	df	Sig.	Statistic	df	Sig.
n_sessions	1	.112	44	.200*	.929	44	.009
	2	.182	10	.200*	.916	10	.325

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Figure 2. Q-Q test (Poor sleep group)

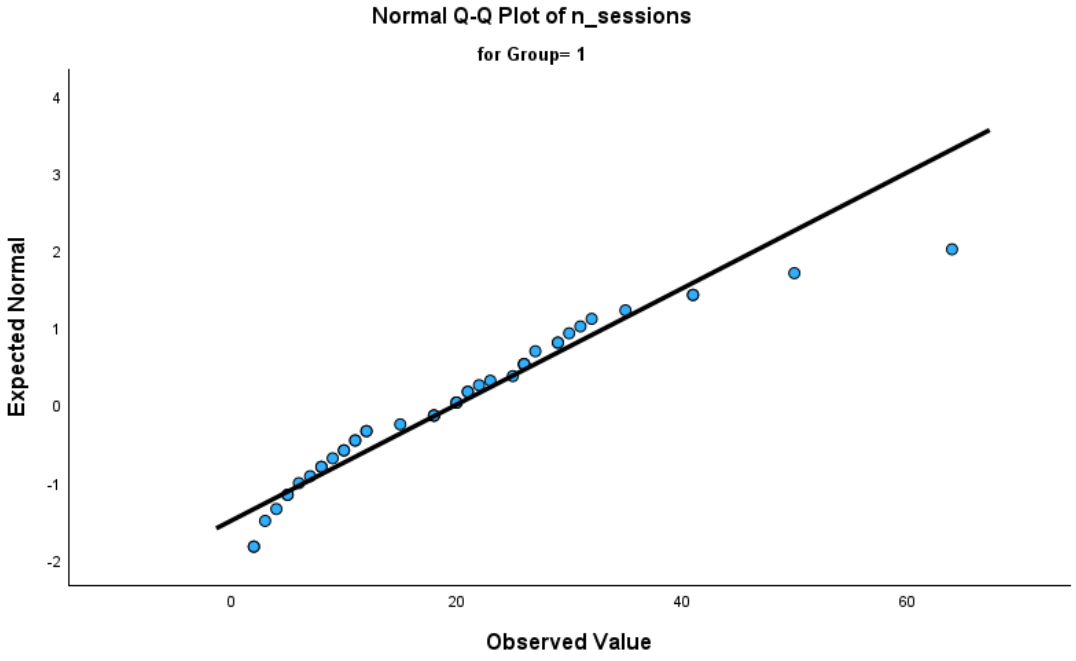


Figure 3. Q-Q test (Good sleep group)

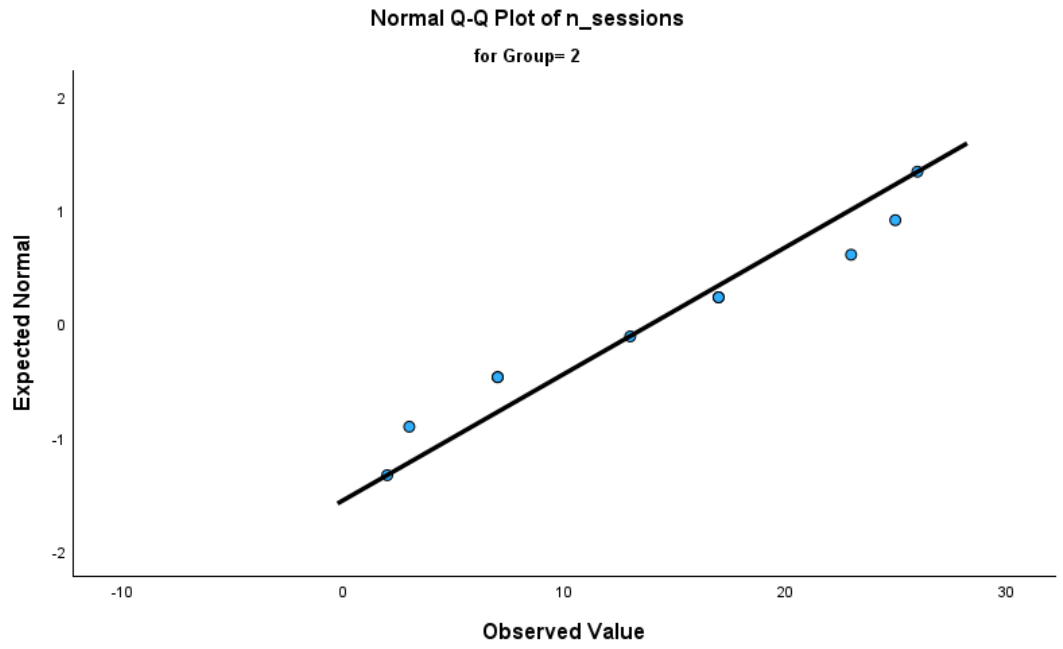


Figure 4. Mann-Whitney U test output re number of appointments scheduled by sleep status

Mann-Whitney Test

Ranks

	Group	N	Mean Rank	Sum of Ranks
n_sessions	1	44	28.90	1271.50
	2	10	21.35	213.50
	Total	54		

Test Statistics[a]

	n_sessions
Mann-Whitney U	158.500
Wilcoxon W	213.500
Z	-1.371
Asymp. Sig. (2-tailed)	.170

a. Grouping Variable: Group

Appendix G

SPSS Outputs re exploratory research question 'Does SMI patients' sleep affect their attendance rates?'

The Shapiro-Wilk test showed that for both the poor sleep and good sleep groups, the dependent variable 'attendance rate' was not normally distributed (significance values were both below 0.05). The Q-Q plots corroborated this. (See Figures 1, 2, and 3).

Figure 1. Test of Normality (Group 1 = Poor sleep; Group 2 = Good sleep)

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Group	Statistic	df	Sig.	Statistic	df	Sig.
Attendance_rate	1	.287	44	<.001	.595	44	<.001
	2	.276	10	.030	.736	10	.002

a. Lilliefors Significance Correction

Figure 2. Q-Q test (Poor sleep group)

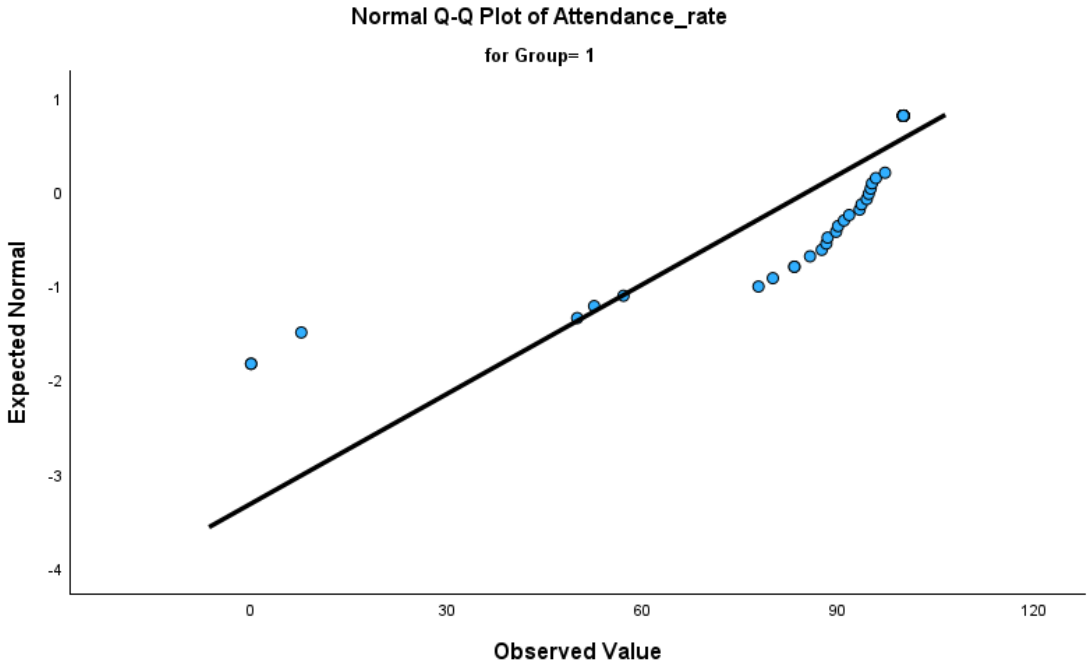


Figure 3. Q-Q test (Good sleep group)

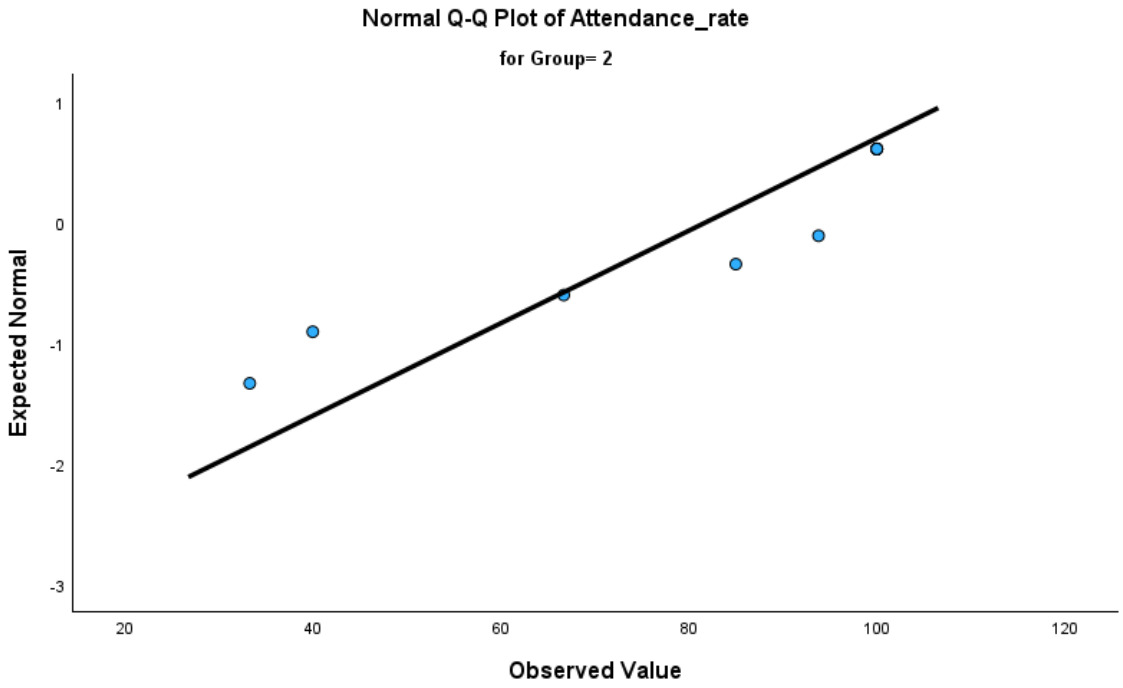


Figure 4. Mann-Whitney U test output re percentage of appointments attended by sleep status

Mann-Whitney Test

Ranks

	Group	N	Mean Rank	Sum of Ranks
Attendance_rate	1	44	27.57	1213.00
	2	10	27.20	272.00
	Total	54		

Test Statistics[a]

	Attendance_rate
Mann-Whitney U	217.000
Wilcoxon W	272.000
Z	-.070
Asymp. Sig. (2-tailed)	.945

a. Grouping Variable: Group

Appendix H

Original Article Author Guidelines (*Sleep Medicine*)

Author guidelines

Your Paper Your Way

We now differentiate between the requirements for new and revised submissions. You may choose to submit your manuscript as a single Word or PDF file to be used in the refereeing process. Only when your paper is at the revision stage, will you be requested to put your paper in to a 'correct format' for acceptance and provide the items required for the publication of your article.

To find out more, please visit the Preparation section below.

Introduction

Sleep Medicine has an open access companion journal, Sleep Medicine: X. Sleep Medicine is published monthly and all manuscripts are peer-reviewed except proceedings of scientific meetings.

Purpose and Procedure

Articles submitted for review should meet the following criteria:
•Studies of prevention or treatment must meet these criteria: random allocation of participants to comparison groups; follow-up of at least 80% of those entering the investigation; outcome measure

of known or probably clinical importance.

•Studies of prognosis must meet these additional criteria: inception cohort of individuals, all initially free of the outcome of interest; follow-up of at least 80% of participants until the occurrence of a major study end point or to the end of the study.

•Studies of causation must meet these additional criteria: clearly identified comparison group for those at risk for, or having, the outcome of interest (e.g. randomized controlled trial, quasi-randomized controlled trial, nonrandomized controlled trial, cohort analytic study with case-by-case matching or statistical adjustment to create comparable groups, case-control study); blinding of observers of outcome to exposure (criterion assumed to be met if outcome is objective, e.g. all-cause mortality, objective test); blinding of observers of exposure to outcomes for case-control studies OR blinding of subjects to exposure for all to be compared on the basis of both the outcomes produced (effectiveness) and resources consumed (costs); evidence of effectiveness must be from a study (or studies) that meets the above-noted criteria for diagnosis, treatment, quality assurance, or a review article; results should be presented in terms of the incremental or additional costs and outcomes of one intervention over another; where there is uncertainty in the estimates or imprecision in the measurement, a sensitivity analysis should be done.

Article Types

The primary emphasis of the journal will be clinical and to this end,

a number of different types of articles will be published. Each type will be aimed to provide clinically important information needed to keep up to date with the practice of sleep medicine, written in a way to foster interdisciplinary understanding and make clinical information accessible to all practitioners.

Sleep Medicine publishes the following types of articles:

• **Original Articles** dealing with diagnosis, clinical features, pathophysiology, etiology, treatment (by all relevant modalities, including pharmacological, instrumental, surgical, behavioral, nutritional), genetics, epidemiology, natural history and prognosis of human sleep disorders will be considered for publication, provided these have not been previously published except in abstract form or have not been submitted simultaneously elsewhere. Reports may also include technical aspects of sleep medicine, which are relevant for diagnosis, pathophysiology, etiology, treatment and natural history. Basic research articles will also be published where they have a direct impact on or shed considerable light on clinical aspects of sleep. Submission of original articles based on animal or human experimental studies are encouraged, and these articles should include a comment in the abstract and discussion about the potential clinical relevance of the study.

• **Review articles** on all aspects of clinical sleep medicine and related basic science that contribute to understanding clinical sleep medicine will be published. Reviews will be timely, emphasize areas

undergoing new development, and include both state of the art reviews and multi-author discussion of controversial areas.

• **Editorials** on manuscripts published elsewhere in the journal or on a timely and controversial topic will be published occasionally. Editorials may contain up to 1000 words and 20 references.

• **Brief Communications** are preliminary or limited results of investigations (up to 1500 words containing 20 or fewer references, one table and one figure).

• **Letters to the Editor** addressing articles appearing in the journal or on other current topics will be published (up to 300 words and five references).

• **Historical Issues in Sleep Medicine** submissions dealing with sleep-related historical figures, whether leaders from the past or characters from literature or mythology, will be considered for publication.

•**Book Reviews** are also published. Upon reception of a book from the publisher, it is sent to the book review editor.

• **Images in Sleep Medicine** submissions should derive from a specific sleep-related clinical situation. Each submission *must* consist of high-resolution images (e.g. polysomnographic tracing, actigraphic recording, neuroimaging, etc.) and should be accompanied by a very brief clinical impression, significance of the findings and figure legend. Readers will be encouraged to foster discussion of any controversial images.

Submissions may contain up to 500 words and five references, and content must be organized by the following headings: 1. Introduction to the case, 2. Image analysis, 3. Discussion, and 4. References. Submissions not adhering to these guidelines may be rejected without further consideration.

• **Video-Clinical Corners** will deal with interesting and challenging clinical cases and significant original phenomena. Every video submission must consist of high-resolution images and a consent form for publication for educational purposes signed by the patient see form, please see the **Patient Details** section below. The Editors reserve the right to ask for additional video/s or video modifications. Submissions may contain up to 750 words, 10 references and 2 figures, and content must be organized as follows:
1) **Introduction** of the case stating the purpose and unusual and interesting aspects of the video; 2) **Case description** including chief complaint, past and present medications and history and physical findings; 3) **Video analysis** of data including representative examples from the patient's polysomnogram;
4) **Brief discussion** of the differential diagnosis and therapeutic challenge.
For tips on preparing your video for submission, see here.

The journal will publish **special issues** or **supplements** dealing with proceedings of meetings, workshops or special topics.

Submission checklist

You can use this list to carry out a final check of your submission before you send it to the journal for review. Please check the relevant section in this Guide for Authors for more details.

Ensure that the following items are present:

One author has been designated as the corresponding author with contact details:
• E-mail address
• Full postal address

All necessary files have been uploaded:
Manuscript:
• Include keywords
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• All tables (including titles, description, footnotes)
• Ensure all figure and table citations in the text match the files provided
• Indicate clearly if color should be used for any figures in print
Graphical Abstracts / Highlights files (where applicable)
Supplemental files (where applicable)

Further considerations
• Manuscript has been 'spell checked' and 'grammar checked'
• All references mentioned in the Reference List are cited in the text, and vice versa
• Permission has been obtained for use of copyrighted material

from other sources (including the Internet)

• A competing interests statement is provided, even if the authors have no competing interests to declare

• Journal policies detailed in this guide have been reviewed

• Referee suggestions and contact details provided, based on journal requirements

For further information, visit our Support Center.

Before you begin

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If the work involves the use of human subjects, the author should ensure that the work described has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. The manuscript should be in line with the Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals and aim for the

inclusion of representative human populations (sex, age and ethnicity) as per those recommendations. The terms sex and gender should be used correctly.

The author should ensure that the manuscript contains a statement that all procedures were performed in compliance with relevant laws and institutional guidelines and have been approved by the appropriate institutional committee(s). This statement should contain the date and reference number of the ethical approval(s) obtained. Authors should also include a statement in the manuscript that informed consent was obtained for experimentation with human subjects. The privacy rights of human subjects must always be observed.

The journal will not accept manuscripts that contain data derived from unethically sourced organs or tissue, including from executed prisoners or prisoners of conscience, consistent with recommendations by Global Rights Compliance on Mitigating Human Rights Risks in Transplantation Medicine. For all studies that use human organs or tissues authors must provide sufficient evidence that they were procured in line with WHO Guiding Principles on Human Cell, Tissue and Organ Transplantation. The source of the organs or tissues used in clinical research must be transparent and traceable. Authors of manuscripts describing organ transplantation must additionally declare within the manuscript:

1. that autonomous consent free from coercion was obtained from the donor(s) or their next of kin; and

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Statement: During the preparation of this work the author(s) used [NAME TOOL / SERVICE] in order to [REASON]. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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Reporting guidance

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Definitions

Sex generally refers to a set of biological attributes that are associated with physical and physiological features (e.g., chromosomal genotype, hormonal levels, internal and external anatomy). A binary sex categorization (male/female) is usually designated at birth (""sex assigned at birth""), most often based solely on the visible external anatomy of a newborn. Gender generally refers to socially constructed roles, behaviors, and identities of women, men and gender-diverse people that occur in a historical and cultural context and may vary across societies and over time. Gender influences how people view themselves and each other, how they behave and interact and how power is distributed in society. Sex and gender are often incorrectly portrayed as binary (female/male or woman/man) and unchanging whereas these constructs actually exist along a spectrum and include additional sex categorizations and gender identities such as people who are intersex/have differences of sex development (DSD) or identify as non-binary. Moreover, the terms ""sex"" and ""gender"" can be ambiguous—thus it is important for authors to define the manner in which they are used. In addition to this definition guidance and the SAGER guidelines, the resources on this page offer further insight around sex and gender in research studies.

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For transparency, we require corresponding authors to provide co-

author contributions to the manuscript using the relevant CRediT roles. The CRediT taxonomy includes 14 different roles describing each contributor's specific contribution to the scholarly output. The roles are: Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Roles/Writing - original draft; and Writing - review & editing. Note that not all roles may apply to every manuscript, and authors may have contributed through multiple roles. More details and an example.

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Only in exceptional circumstances will the Editor consider the addition, deletion or rearrangement of authors **after** the manuscript

has been accepted. While the Editor considers the request, publication of the manuscript will be suspended. If the manuscript has already been published in an online issue, any requests approved by the Editor will result in a corrigendum.

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Randomized controlled trials should be presented according to the CONSORT guidelines. At manuscript submission, authors must provide the CONSORT checklist accompanied by a flow diagram that illustrates the progress of patients through the trial, including recruitment, enrollment, randomization, withdrawal and completion, and a detailed description of the randomization procedure.
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Registration in a public trials registry is a condition for publication of clinical trials in this journal in accordance with International Committee of Medical Journal Editors recommendations. Trials must register at or before the onset of patient enrolment. The clinical trial registration number should be included at the end of the abstract of the article. A clinical trial is defined as any research study that prospectively assigns human participants or groups of humans to one or more health-related interventions to evaluate the effects of health outcomes. Health-related interventions include any intervention used to modify a biomedical or health-related outcome (for example drugs, surgical procedures, devices, behavioural treatments, dietary interventions, and process-of-care changes).

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References

There are no strict requirements on reference formatting at submission. References can be in any style or format as long as the style is consistent. Where applicable, author(s) name(s), journal title/book title, chapter title/article title, year of publication, volume number/book chapter and the article number or pagination must be

present. Use of DOI is highly encouraged. The reference style used by the journal will be applied to the accepted article by Elsevier at the proof stage. Note that missing data will be highlighted at proof stage for the author to correct.

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There are no strict formatting requirements but all manuscripts must contain the essential elements needed to convey your manuscript, for example Abstract, Keywords, Introduction, Materials and Methods, Results, Conclusions, Artwork and Tables with Captions. If your article includes any Videos and/or other Supplementary material, this should be included in your initial submission for peer review purposes.

Divide the article into clearly defined sections.

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Please ensure the figures and the tables included in the single file are placed next to the relevant text in the manuscript, rather than at the bottom or the top of the file. The corresponding caption should be placed directly below the figure or table.

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This journal operates a single anonymized review process. All contributions will be initially assessed by the editor for suitability for the journal. Papers deemed suitable are then typically sent to a minimum of two independent expert reviewers to assess the scientific quality of the paper. The Editor is responsible for the final decision regarding acceptance or rejection of articles. The Editor's

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Regardless of the file format of the original submission, at revision you must provide us with an editable file of the entire article. Keep the layout of the text as simple as possible. Most formatting codes will be removed and replaced on processing the article. The electronic text should be prepared in a way very similar to that of conventional manuscripts (see also the Guide to Publishing with Elsevier). See also the section on Electronic artwork.
To avoid unnecessary errors you are strongly advised to use the 'spell-check' and 'grammar-check' functions of your word processor.

Article structure

Subdivision - numbered sections

Divide your article into clearly defined and numbered sections. Subsections should be numbered 1.1 (then 1.1.1, 1.1.2, ...), 1.2, etc. (the abstract is not included in section numbering). Use this numbering also for internal cross-referencing: do not just refer to 'the text'. Any subsection may be given a brief heading. Each heading should appear on its own separate line.

Introduction

State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.

Material and methods

Provide sufficient details to allow the work to be reproduced by an independent researcher. Methods that are already published should be summarized, and indicated by a reference. If quoting directly from a previously published method, use quotation marks and also cite the source. Any modifications to existing methods should also be described.

Results

Results should be clear and concise.

Discussion

This should explore the significance of the results of the work, not repeat them. A combined Results and Discussion section is often appropriate. Avoid extensive citations and discussion of published literature.

Conclusions

The main conclusions of the study may be presented in a short Conclusions section, which may stand alone or form a subsection of a Discussion or Results and Discussion section.

Appendices

If there is more than one appendix, they should be identified as A, B, etc. Formulae and equations in appendices should be given

separate numbering: Eq. (A.1), Eq. (A.2), etc.; in a subsequent appendix, Eq. (B.1) and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc.

Essential title page information

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Highlights are mandatory for this journal as they help increase the discoverability of your article via search engines. They consist of a short collection of bullet points that capture the novel results of your research as well as new methods that were used during the study (if any). Please have a look at the example Highlights.

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Abstract

A concise and factual abstract is required. The abstract should state briefly the purpose of the research, the principal results and major conclusions. An abstract is often presented separately from the article, so it must be able to stand alone. For this reason, References should be avoided, but if essential, then cite the author(s) and year(s). Also, non-standard or uncommon abbreviations should be avoided, but if essential they must be defined at their first mention in the abstract itself.

For Original Articles and Brief Communications a structured abstract should be provided of not more than 250 words. The abstract should be organized by: Objective/Background, Patients/Methods, Results and Conclusions. No abstract is required for Images in Sleep Medicine or Video-Clinical Corners.

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Immediately after the abstract, provide a maximum of 6 keywords, using American spelling and avoiding general and plural terms and multiple concepts (avoid, for example, 'and', 'of'). Be sparing with abbreviations: only abbreviations firmly established in the field may be eligible. These keywords will be used for indexing purposes.

Abbreviations

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Acknowledgements

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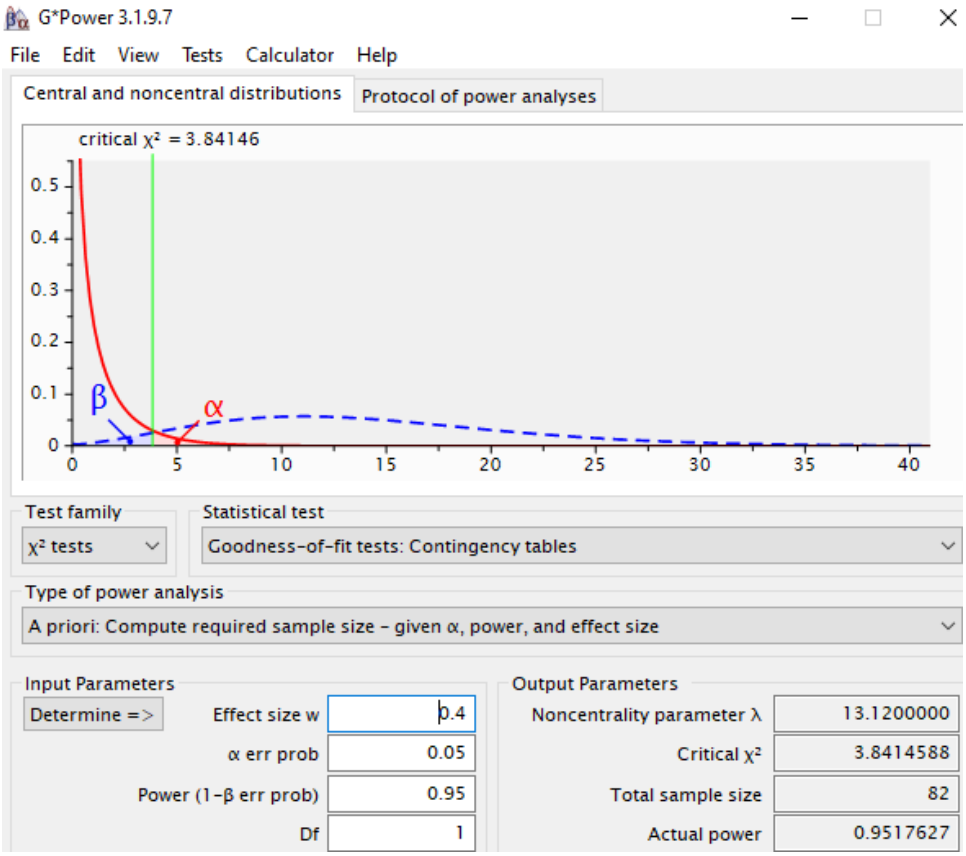
Appendix I

Original G*power analyses

*G*power analysis regarding required n for analysis of attendance rate differences by sleep status (chi-square)*

An a priori G*power analysis was conducted (Faul et al., 2007). Based on an effect size (phi) of 0.4, an error probability of 0.05, and power of 0.95, it was determined that for a chi-square test, a total sample size of 82 was required. If this participant sample and effect size is met, there is an 95% chance of correctly rejecting the null hypothesis.



*G*power analysis regarding required n for analysis of differences in number of appointments offered (t-test)*

An a priori G*power analysis was conducted (Faul et al., 2007). Based on an effect size (partial eta squared) of 0.7, an error probability of 0.05, a power of 0.9 in line with Cohen's (1992) guidance, it

was determined that for a t-test testing the difference between two independent means , a total sample size of 72 was required. If this participant sample and effect size is met, there is a 90% chance of correctly rejecting the null hypothesis.