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Understanding the Sleep Problems of Young People in Mental Health Services, Their Links to Mental Health Difficulties and Impact on Intervention Effectiveness

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Thesis Portfolio Abstract

Background: Young people face major sleep changes and heightened risk for mental health problems. Due to the bidirectional sleep-mental health link, transdiagnostic sleep interventions report improvements for sleep and mental health. Yet little is known about how insomnia and lesser studied difficulties like nightmares, circadian disruption, sleep paralysis and sleep-related hallucinations present in young people with mental health problems, how they interact with mental health, and affect insomnia treatment response in clinical populations. Understanding these could improve sleep interventions in youth mental health care.

Methods: A systematic review synthesised 36 peer-reviewed studies on impact of comorbid insomnia on youth with mental health difficulties using a narrative synthesis approach. An empirical study was conducted of a secondary analysis of anonymised data from 14–25-year-olds accessing a CBT-I-informed sleep intervention within youth mental health services. It examined the prevalence and correlates of specific sleep disturbances—insomnia, nightmares, circadian rhythm disruptions, and unusual sleep experiences—and explored predictors of treatment response.

Results: This thesis found that comorbid insomnia was consistently associated with worsened mental health severity and functioning yet responded well to treatment using CBT-I among young people with mental health problems, seemingly with effectiveness not affected by co-occurring sleep difficulties or mental health severity. The empirical study found high rates of comorbid sleep disturbances in young people with mental health and insomnia difficulties. Nightmares and unusual sleep experiences were associated with greater clinical severity, with nightmares also linked to worse functioning.

Conclusions: Comorbid insomnia and related sleep disturbances are prevalent and clinically significant among youth with mental health difficulties. CBT-I-informed interventions are effective in reducing insomnia even in the presence of comorbid sleep or mental health problems, supporting their integration into youth services. Future research should investigate mechanisms of comorbidity and expand controlled trials to optimise sleep-focused care in youth mental health.

Access Condition and Agreement

Table of Contents

List of Tables

Chapter 2: Systematic Review

Chapter 4: Empirical Paper

Appendices

List of Figures

Chapter 2: Systematic Review

Appendices

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Chapter One:
General Introduction

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Sleep, a universal human phenomenon, is now understood as an active, physiological brain process (Paterson, 2012). Numerous theories on the precise reason for sleep have been advanced, including hypotheses about its function in information processing, brain efficiency or more recently, regulation of emotions; while evidence supports different purposes and functions of sleep, no one hypothesis has received unequivocal support (Lee-Chiong, 2006; Lockley & Foster, 2012; Paterson, 2012; Vandekerckhove & Wang, 2018). Meanwhile, the importance of sleep for health, overall well-being, including brain functioning is increasingly recognised (Paterson, 2012). Sleep patterns naturally change with age; one of the life-stages where this occurs is during the period of adolescence to early adulthood, a period also called youth (Lockley & Foster, 2012). During this, the homeostatic system driving sleep slows down and the internal body clock (the circadian rhythm system) shifts to later in the night, resulting in young people feeling the need to sleep later than during childhood, but still requiring similar amounts of sleep, around 9 to 11 hours (Crowley et al., 2018; Lee-Chiong, 2006; Paterson, 2012).

Disruptions in sleep duration, quality, and timing, commonly termed sleep disturbances, are closely connected to mental health difficulties in multiple important ways. Reviews of interventional, epidemiological, and experimental studies with clinical and non-clinical populations provide ample evidence to suggest a bidirectional relationship in the development and course of sleep disturbances and mental health problems (Brown et al., 2024; Harvey, 2009; Krystal, 2012; Reeve et al., 2015). For example, they are known to be highly prevalent across mental health problems (Freeman et al., 2020; Reeve et al., 2019; Santiago et al., 2024); among those with depression, sleep disturbances worsen the course of the disorder and are independently linked with worse treatment response and quality of life (Krystal, 2012). Sleep disturbances are therefore considered a causal contributory factor in mental health difficulties (Freeman et al., 2020).

As sleep disturbances appear to impact mental health across disorders, they align particularly well with transdiagnostic models of psychopathology such as the Hierarchical Taxonomy of Psychopathology (HiTOP) or Research Domain Criteria (RDoC; Dalgleish et al., 2020; Harvey, 2009).

Transdiagnostic approaches have arisen out of a recognition that symptoms such as sleep difficulties or low mood appear across diagnostic disorders and that diagnostic criteria are often not reflective of individual difficulties; individual mental health difficulties may often encompass a spectrum of symptoms or include comorbidities that are impactful despite not meeting diagnostic thresholds (Dalgleish et al., 2020). An added advantage of a transdiagnostic approach is the possibility of developing treatment interventions for symptoms occurring across disorders, such as for sleep disturbances, which then may improve part of, or all the difficulty (Harvey, 2009). The development of sleep interventions, particularly cognitive behavioural therapy for insomnia (CBT-I) and its implementation across disorders, are consistent with this principle, and outcomes of improvement in both sleep and mental health symptoms further support a transdiagnostic approach (Hertenstein et al., 2022).

However, despite the benefits of transdiagnostic approaches, the term *sleep disturbance* remains a broad and loosely defined construct, making it difficult to determine the specific nature or mechanism of the underlying problem. The *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 2013) and the *International Classification of Sleep disorders* (American Academy of Sleep Medicine, 2023) define the various sleep disorders which cause sleep disturbances. These include disorders related to insomnia, circadian rhythm, and parasomnias encompassing nightmares and sleep-related hallucinations. ICSD-3-TR (2023) further includes recurrent isolated sleep paralysis within parasomnias, which often involves sleep-related hallucinations also.

The wider sleep disturbance literature does not always distinguish between these disorders, and, where it does, it has focussed on insomnia. More is therefore known about its links with mental health. Insomnia predicts depression, anxiety, and psychosis onset (Hertenstein et al., 2019, 2023) and its treatment also improves mental health symptoms (Wilson et al., 2019). Reviews of literature on nightmares have found associations with poorer mental health and sleep, and higher suicidal risk, and that post-traumatic stress disorder (PTSD), depression, anxiety and psychosis symptoms

improved when nightmares were treated, though methodological limitations were noted (Lemyre et al., 2019; Sheaves et al., 2023). From available research, similarly strong associations between circadian rhythms and mental health are reported (Walker et al., 2020), and evidence has also linked recurrent isolated sleep paralysis with PTSD, and anxiety disorders (Denis et al., 2018; Sharpless, 2016). However, for sleep-related hallucinations alone, evidence remains limited, although high prevalence rate was found among an early psychosis sample (Reeve et al., 2019).

It is recognised that more research is needed on individual sleep disorders outside of insomnia (Harvey, 2009; Reeve et al., 2015). Doing so would help delineate the individual contributions and underlying mechanisms of each disorder with respect to their bidirectional relationship with mental health problems. Within the context of this bidirectional relationship, whilst effective insomnia interventions for people with mental health difficulties have been developed and trialled and shown positive outcomes for both (e.g., Freeman et al., 2015; Manber et al., 2008; Watanabe et al., 2011), understanding the impact of individual type of sleep disturbance could also help develop new or tailored interventions to further improve sleep and mental health.

A key role for youth research

Young people are particularly vulnerable to developing sleep disturbances (Crowley et al., 2018). Coupled with the biological changes outlined above, young people often contend with a societal tendency for early school hours and engage in increased technology use during youth, all of which leads to a reduction in sleep duration and quality (Alonzo et al., 2021; Bartel et al., 2015; Gradisar et al., 2022). Concurrently, young people are also particularly vulnerable from a mental health perspective. Approximately 50% of lifetime mental health difficulties start by mid-teens and 75% by age 25 (Kessler et al., 2007). Similar figures and a peak age of onset at 14.5 years are reported globally (Solmi et al., 2022). Both sleep disturbances and mental health difficulties are highly prevalent in young people (Hysing et al., 2013; Newlove-Delgado et al., 2022; Rollinson et al., 2019). Furthermore, sleep disturbances or disorders have been found to predict consequent mental

disorders and their severity, alongside suicidality among young people in the community (Fan et al., 2017; Kearns et al., 2020; Orchard et al., 2020; Ribeiro et al., 2012).

Despite reportedly having the highest presence of mental illnesses across the lifespan, young people between the age of 12 and 25 represent the age-group with the lowest mental health service access (McGorry et al., 2013). Young people have consistently described stigma such as to terms including 'mental', inaccessibility or unavailability of services, and medicalised models of treatment as barriers to accessing support; they have shown preference for non-medical treatment approaches and expressed valuing self-reliance and a sense of agency (Plaistow et al., 2014; Roberts et al., 2022). Intervening early among young people, prior to the emergence of mental disorder has shown effectiveness in not only reducing the severity and functional consequences of mental disorders such as psychosis and bipolar disorder, but also prevention of onset of disorders such as depression (McGorry & Mei, 2018; Merry et al., 2011). In recognition of these, youth mental health services increasingly emphasise the importance of evidence-based early interventions using transdiagnostic frameworks to target interventions (Colizzi et al., 2020; McGorry et al., 2013; McGorry & Mei, 2018; Vyas et al., 2015; Wilson et al., 2018).

Within this overarching context, sleep interventions represent an important intervention target for young people with mental health problems. Sleep interventions such as CBT-I promote self-efficacy in managing insomnia (Cheng et al., 2022) and it could be hypothesised that the focus on sleep may have greater acceptability among youth due to reduced stigma. For instance, young people who received an adapted CBT-I intervention spoke about enjoying their sleep intervention despite initial negative expectations (Waite et al., 2018). In view of the sleep-mental health link and importance of early interventions, ameliorating sleep difficulties could also prevent development or course of mental health difficulties alongside reducing sleep-related distress. All of this adds impetus for effective sleep interventions in youth (Hertenstein et al., 2019). Importantly, the available evidence to date in youth with mental health difficulties also points to improved insomnia and

reduced mental health symptoms following CBT-I or similar sleep intervention (e.g., Mathews et al., 2023; Rollinson et al., 2024; Waite et al., 2023).

However, much remains unknown within the youth literature, particularly in youth with mental health problems where targeted sleep interventions may be most beneficial.
For example, it is not well understood how young people with mental health problems are affected by comorbid insomnia. There is also limited knowledge about specific sleep disturbances in clinical youth populations, including whether these disturbances frequently co-occur among young people, particularly those with pre-existing mental health problems and insomnia. While sleep interventions appear to benefit young people with mental health difficulties, it remains unclear if those with more severe or milder symptoms experience greater benefit. Being able to understand how different sleep difficulties all individually present and interact with mental health or influence treatment response to sleep interventions has important clinical utility. It could inform which sleep disturbances in addition to insomnia are most in need of targeted intervention. It could also improve overall outcomes by guiding adaptations to existing insomnia interventions for young people with mental health problems. Identifying the level of mental health severity at which insomnia interventions are most beneficial could additionally support more effective targeting of these interventions in clinical practice.

Thesis aims

Therefore, this thesis seeks to initially explore the known effects of comorbid insomnia among a youth mental health population using a systematic review. Following this, anonymised clinical data from a sample of young people with mental health problems and insomnia will be used to explore additional sleep difficulties, the interaction between sleep and mental health, and how both sleep and mental health impact response to a CBT-I–based sleep intervention. Together these two studies aim to advance understanding of how specific sleep disturbances influence mental health and treatment response in clinical youth populations which have implications for both research and clinical practice.

Chapter Two:
Systematic Review -

Comorbid Insomnia in Youth with Mental Health Problems: A Systematic Review

Prepared for submission to PLOS ONE[1]

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[1] Author guidelines are available in Appendix A. Figures and tables are provided within the main body of the text and APA reference style has been followed for the purposes of the thesis. These and line numbering will be amended for journal submission.

Comorbid insomnia in youth with mental health problems: a systematic review

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Abstract

Background: Insomnia is increasingly recognised as a transdiagnostic treatment target among psychiatric populations. However, among youth with mental health difficulties little is known about its effects despite this being a critical developmental period for both sleep and mental health.

Aims of review: This systematic review aimed to synthesise evidence on the effects of comorbid insomnia in 14- to 25-year-olds with mental health problems, including clinical associations, functional impacts, underlying mechanisms, and response to intervention.

Methods: Following PRISMA guidelines, a systematic search of PubMed, PsycINFO and Web of Science was conducted. Eligible studies included peer-reviewed empirical research published from 1994 onwards involving youth with mental health diagnoses or accessing mental health services, and reporting on comorbid insomnia using validated measures. Thirty-six studies were included and quality-assessed using the Mixed Methods Appraisal Tool. A narrative synthesis approach was used.

Results: Insomnia was associated with greater symptom severity, functional impairment, and suicidality. Limited but emerging evidence suggested insomnia may mediate or exacerbate mental health symptoms through indirect psychological pathways. CBT-I, typically adapted for this population, consistently reduced insomnia and showed improvements in mental health, though most studies were small and uncontrolled.

Conclusion: Comorbid insomnia is a prevalent and clinically relevant concern among youth with mental health problems. Given its impact and responsiveness to intervention, targeted sleep treatments should be integrated into youth mental health services. Future research should prioritise longitudinal and controlled intervention studies across a broader range of disorders to clarify mechanisms and optimise treatment approaches.

Keywords: Youth, Mental Health, Insomnia, Comorbidity, Cognitive behavioural therapy for insomnia (CBT-I)

Introduction

Insomnia disorder, defined as dissatisfactory sleep related to either non-restorative sleep, or regular difficulties in early-morning wakening, initiating or maintaining sleep (American Psychiatric Association, 2013), is highly comorbid with psychiatric disorders (Ohayon et al., 1998; Reeve et al., 2019; Seow et al., 2018). It has been identified as a predictor for depression (Li et al., 2016), anxiety, and psychosis (Hertenstein et al., 2019). It is additionally associated with worse quality of life and greater impairments among adult psychiatric populations (McCall et al., 2010; Seow et al., 2018). Given these links, insomnia is increasingly considered an important treatment target for those with mental health problems (Freeman et al., 2017). Systematic reviews among adults have found that cognitive-behavioural therapy for insomnia (CBT-I) shows efficacy as treatment for depression comorbid with insomnia and improves mental health severity for depression, post-traumatic stress disorder (PTSD), psychosis, among others (Cunningham & Shapiro, 2018; Hertenstein et al., 2022).

The 3P behavioural model (Spielman et al., 1987), a highly influential theory of insomnia forming a component of cognitive behavioural therapy for insomnia, outlines biopsychosocial predisposing factors such as genetics or personality traits, precipitating factors such as acute life stressors and perpetuating factors, often unhelpful coping strategies adopted to manage initial sleep problem, that are likely to contribute to ongoing insomnia. While the neurocognitive model expands upon this, highlighting the role of hyperarousal and particularly, cortical arousal in the aetiology of insomnia (Perlis et al., 1997), more recently, instability of REM sleep, often seen with insomnia problems, has been implicated with emotional factors and hypothesised as the pathway leading to development of psychopathology (Riemann et al., 2023). This recent perspective is consistent with hypothesised potential functions of sleep, such as in emotion regulation (Palmer & Alfano, 2017).

However, to date, comparatively little research on this has focussed on the youth population. This represents a missed opportunity as youth, widely understood as adolescence and early adulthood, is a pivotal developmental stage during which most mental disorders emerge, with 75% of lifetime mental health difficulties emerging by age 25 (Kessler et al., 2007) and where there is

increasing demand for mental health support (Cybulski et al., 2021). Alongside many broader neurobiological, psychological, and social changes, it is also a period of profound changes in sleep; during adolescence, biological changes such as delayed circadian timing and a lowered 'need for sleep' combine with societal tendency for early school hours or increased autonomy in bed times, resulting in chronic and frequent sleep-loss (Casey et al., 2008; Crowley et al., 2018; Gradisar et al., 2022). Increased technology use during this life stage further contributes to reduced sleep quality (Alonzo et al., 2021; Bartel et al., 2015). As such, among youth, the prevalence of both sleep disturbances and mental health difficulties is high (Hysing et al., 2013; Newlove-Delgado et al., 2022).

Within this context, poor sleep is reported to be a transdiagnostic risk factor for psychopathology among young people (Lynch et al., 2021) and sleep difficulties have been put forward as a causal contributory factor in the development of mental health difficulties (Freeman et al., 2020). Moreover, transdiagnostic frameworks such as Research Domain Criteria (Kozak & Cuthbert, 2016), which emphasise the underlying psychological and neurobiological systems driving mental health difficulties consider sleep among its core domains. Increasingly, transdiagnostic clinical staging frameworks specifically developed for youth mental health and promoting targeted early interventions also recognise the role of sleep disturbances (McGorry & Mei, 2021) or consider its possible integration for future (Scott et al., 2024). As such, improving sleep in youth may improve mental health outcome trajectories and for this, understanding the relationship between insomnia and mental health in this population is particularly important.

Prospective youth studies to date have found that poor sleep quality and disrupted sleep patterns predict greater subsequent severity and presence of depression and anxiety (Orchard et al., 2020) and are associated with increased risk of developing PTSD symptoms following traumatic events (Fan et al., 2017). Additionally, systematic reviews of youth population studies showed sleep problems to be a unique risk factor for suicidality (Kearns et al., 2020). Cognitive behavioural sleep interventions primarily targeting otherwise healthy adolescents improve sleep and reduce depression and anxiety symptoms (Blake et al., 2017). Together, all suggest close sleep and mental health links.

There are also findings indicative of differential pathways linking various sleep dysfunctions with mental disorders within the literature (Gradisar et al., 2022). For instance, incorporating an intervention targeting circadian dysfunction to CBT-I led to positive improvement in serious mental illness outcomes (Harvey et al., 2021) and different treatment responses to CBT-I were even found for night-and-daytime symptoms of insomnia (Benz et al., 2020). Additionally, among younger adolescents, different aspects of sleep problems related to different types of mental health problems (Hestetun et al., 2018). These emphasise the importance of understanding the impact of specific sleep disorders.

However, the broader literature focusses on sleep quality or sleep disturbances more generally (e.g., A. Scott et al., 2021; J. Scott et al., 2021) with insomnia subsumed within this wider framework, which prevents exploration of the unique impact of insomnia disorder on mental disorders. Further, reviews of insomnia disorder in youth, where available, are among healthy adolescents (de Zambotti et al., 2018; Donskoy & Loghmanee, 2018). These and other individual studies highlight worsening QOL, increased risk of mental disorders, poorer cognitive functioning, and school performance for adolescents with insomnia (Zhao et al., 2019) but cannot inform on how insomnia may interact with mental health among those with pre-existing mental health problems. This requires research within clinical populations.

Therefore, reviewing the available evidence among young people with mental health problems, could elucidate the impact of insomnia on mental disorders at an earlier stage and inform potential preventative or ameliorative measures by meaningfully informing development and improvement of interventions.

To our knowledge, a review of this nature has not been undertaken with a youth mental health sample. Given what is known about the wide impact of insomnia across domains, this review aimed to address the following questions, among youth with pre-existing mental health difficulties:

1. How prevalent is comorbid insomnia, and how does its prevalence vary by demographic factors?

2. What is known about the relationships and potential mechanisms linking comorbid insomnia with psychopathology, including suicidality?
3. What is the impact of comorbid insomnia on functioning, treatment needs, and treatment outcomes?
4. What is known about interventions for comorbid insomnia in this population, and how effective are they?

Methods

The preferred reporting items for systematic reviews and meta-analyses (PRISMA; Page et al., 2021) were adhered to during the systematic review process. The review protocol was pre-registered on the International Prospective Register of Systematic Reviews (PROSPERO, https://www.crd.york.ac.uk/prospero, registration number: CRD42024544286).

Eligibility Criteria

Studies were eligible if they fulfilled the following criteria:

- Participants aged 14-25 years, including youth-focussed studies with average participant age between 14 and 25 or studies with disaggregated data available for this age range.
- Participants with mental health problems, established either by presence of diagnosis or through being currently engaged with a mental health service.
- Peer-reviewed and empirical research available in English.
- Published from 1994 onwards (to align with DSM-IV criteria; APA, 1994).
- Report of presence or severity of co-morbid insomnia established diagnostically or through validated and reliable insomnia questionnaire.
- Examination of effect or impact of co-morbid insomnia on a clinical youth population.

Exclusion criteria were:

- Studies of participants related to a specific physical or neurodevelopmental condition only (e.g. cancer, autism, learning disability), case studies, non-primary research (e.g., reviews, editorials, opinion pieces) and grey literature.

Search Strategy

A search was conducted in June 2023 on PubMed, PsycINFO and Web of Science, using search terms as included in Table 1.

Table 1

Search Terms

Category	Search Terms
Mental Health	Psychiat* or Depress* or Anxi* or Phobi* or "Obsessive compulsive disorder" or OCD or PTSD or "Post-traumatic stress disorder" or Psychos* or Psychotic or Schiz* or Bipolar or Hallucination* or Delusion* or "Eating dis*" or Anorexia or Bulimia or "Binge eating*"
Youth	juvenile OR "young adult*" OR adolescen* OR "young people*" OR "young person*" OR youth OR child* OR "emerging adult*" OR "early adult" OR teen* OR p?ediatric*
Insomnia	Insomnia

Study Selection

The search results were imported to Rayyan (Ouzzani et al., 2016) and de-duplicated. Lead author (AD) then screened titles and abstracts and reviewed full texts as required to determine eligibility for the review. A second author (SR) reviewed a random 20% selection of the full texts for eligibility (achieving a kappa of 0.75, indicating substantial agreement). All disagreements were resolved through review of eligibility criteria and consensus among the authors, as were studies where eligibility was unclear.

Reference lists of included studies and relevant systematic reviews were searched for potential missed papers however, no further studies met eligibility.

Data Extraction

Author (year), country, study design and aims, sample size, participant age, gender and ethnicity, mental disorder(s) and comorbid insomnia including how these were established, measures (mental health, insomnia or other relevant), and study findings relevant to the impact of comorbid insomnia among youth with mental health problems were extracted.

Risk of Bias (Quality) Assessment

The Mixed Methods Appraisal Tool (MMAT; Hong et al., 2018) was employed to assess the quality of included studies due to its applicability with qualitative, mixed methods or quantitative (randomised, non-randomised and descriptive) designs, allowing for the comparison of varying methodological designs (see Appendix B). Lead author (AD) completed the assessments with ambiguous criteria resolved through discussion with a second author (SR).

Data Analysis

A narrative synthesis approach was used to analyse the included papers, aligning with the review's aim of integrating diverse findings across various groups of young people with mental health problems and insomnia. Guidance from Popay et al. (2006) informed this process, where within-study and between-study results were organised and examined to allow emergence of patterns concerning the impact of co-morbid insomnia in a clinical youth population. These were further explored and grouped using tabulation of main findings and study characteristics. The quality assessment informed the weighting of the evidence for synthesis and consideration of the robustness of the review itself.

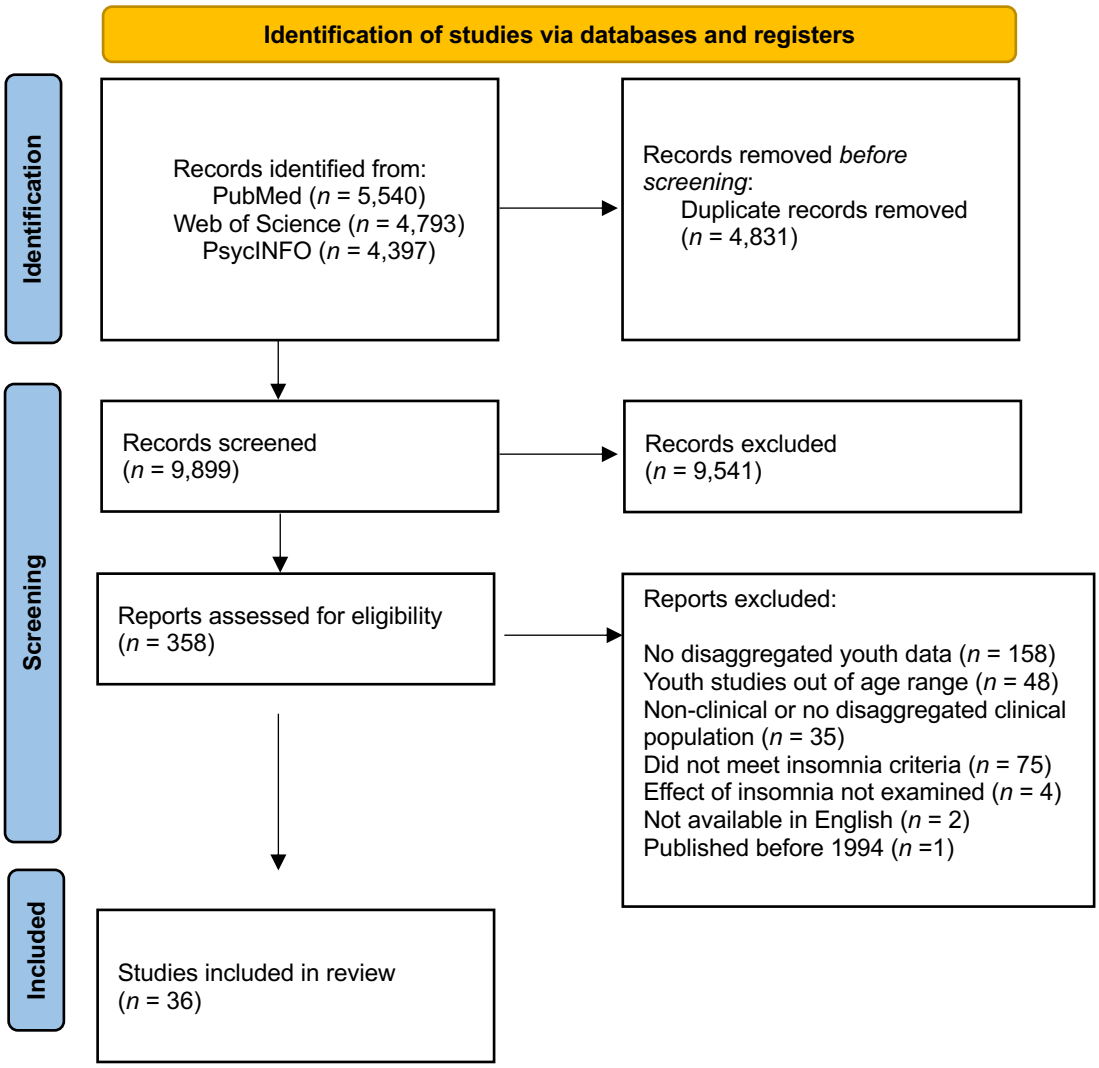
Results

Search Results

14,730 records were identified through database searches, 4,831 were identified as duplicates. After title and abstract screening of the remaining 9,899, 358 papers were retained for full-text review, and 36 studies met the eligibility criteria (see Figure 1 for PRISMA flow diagram of the process).

Figure 1

PRISMA Flowchart of Study Selection Process



Study Characteristics

All inhabited continents except Africa are represented, with most studies conducted in the United Kingdom (*n* = 8), China (*n* = 7), and the United States (*n* = 6). Additional studies originated from Sweden (*n* = 3), France (*n* = 3), Finland (*n* = 2), Switzerland (*n* = 2), Australia (*n* = 2), Slovakia (*n* = 1), Brazil (*n* = 1), and Turkey (*n* = 1).

Study designs included 20 cross-sectional studies, 3 cohort studies, 1 qualitative study, 1 mixed-methods study and 11 intervention studies comprising 2 case series, 5 uncontrolled feasibility pilots, 2 non-randomised trials and 2 randomised controlled feasibility trials. Study characteristics of non-interventional and interventional studies are presented in Table 2 and 3 respectively.

Over a third of the studies (*n* = 15) examined major depressive disorder (MDD) while 10 studies predominantly recruiting from clinical settings focussed on varied mental health problems. The remainder examined anorexia nervosa (AN, *n* = 3), young people at ultra-high risk of psychosis (UHR, *n* = 3), borderline personality disorder (BPD) features (*n* = 2), PTSD (*n* = 1), body dysmorphic disorder (BDD, *n* = 1), and trichotillomania and excoriation (*n* = 1).

The combined clinical youth sample size was 3,887. Excluding Crevits et al. (2024) who did not report gender ratio, there was a 72% female representation. Both figures exclude Johnson et al. (2006) who only reported proportions of mental disorders within a community sample. While the average sample age across studies was between 14 and 25 years, the participant age range spanned 7 to 25 years. Only 14 of the studies reported ethnicity distribution.

Quality of Evidence

The MMAT was used to evaluate study quality based on variabilities in specific criteria as recommended by the authors (see Table 4 for ratings). All studies met the initial screening criteria about research questions and appropriate methodology.

Most studies scored yes on four (*n* = 12), or all five (*n* = 23) criteria, suggesting minor methodological limitations overall. Johnsen et al. (2024) scored three due to low integration between

qualitative and quantitative elements in their mixed-methods study. Most methodological limitations were related to incomplete data and inadequate accounting for potential confounders. Additionally, many studies did not describe reasons for non-participation or comment upon sample representativeness.

Measurement Tools

Insomnia

Most included studies used the Insomnia Severity Index (ISI; Bastien et al., 2001; *n* = 29). Other scales used included the Athens Insomnia Scale (AIS; Soldatos et al., 2000; *n* = 5), Sleep Condition Indicator (SCI; Espie et al., 2014; *n* = 1) or diagnostic criteria-based assessment (*n* = 1).

Studies employing the ISI characterised insomnia in variable ways. Some reported only average scores (*n* = 10), while others applied thresholds of 8 (*n* = 5), 9 (*n* = 3), or 15 (*n* = 7) either alone or alongside averages. The differences likely reflected varying suggested cut-offs within literature for adolescent (Chung et al., 2011), community or clinical adult populations (Morin et al., 2011). However, variations were not consistently aligned with age-group; only a few studies (*n* = 2) used different approaches for participants under or over 18 years old.

Mental Health Problems

Among studies using diagnostic criteria for psychiatric disorders, 14 used DSM-IV criteria, 12 used DSM-5, and 1 used ICD-10. Diagnostic interviews were conducted using diagnostic schedules such as Kiddie-Schedule for Affective Disorders and Schizophrenia – Present and Lifetime (K-SADS-PL; Kaufman et al., 1997), Mini-International Neuropsychiatric Interview for Children and Adolescents (MINI-KID; Sheehan et al., 2010) or Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) Personality Disorders (SCID-5-PD; First et al., 2016) or within clinical contexts by psychiatrists.

Table 2

Study characteristics of all non-interventional studies

Author (year) *Country*	Design	Sample characteristics	Mean age (SD) years	Mental health inclusion method(s)	Mental health or other relevant measure(s)	Insomnia measure	Relevant findings
Ämmälä et al. (2019) *Finland*	Cross-sectional	All males, aged between 14-18 years a) n = 8, with depression and sleep symptoms b) n = 9, healthy controls	a) 15.95 (0.86) b) 16.16 (0.78)	Recruited from clinical setting; Diagnostic interview for DSM-IV axis I disorders (K-SADS-PL)	BDI-21 [BDI-19 – sleep and tiredness items were excluded used for analysis]	AIS	While separately insomnia (with gene locus RYR, B=0.76, P=0.00041) and mood (with gene locus PLA2G16, B=0.77, P=0.00031) were associated with epigenetic changes in synaptic long term depression pathway (implicated in synaptic plasticity), this was not significant for insomnia once control vs depression cases were controlled for (exact values not reported).
Aspen et al. (2014) *USA*	Cross-sectional	All females, aged between 18-25 years a) N = 40, diagnosed ED b) N = 67, subthreshold ED c) N = 346, at high risk for ED d) N = 96, healthy control group	a) 20.70 (2.00) b) 20.80 (2.00) c) 20.60 (2.00) d) 20.30 (2.00)	Diagnostic interview (EDE and SCID-IV)	WCS; EDE-Q; EDI-2; CES-D; STAI	ISI	Young women with a diagnosed eating disorder had significantly higher insomnia levels (adjusted odds ratio = 7.7 (95% CI = 2.4 – 24.1, p< .05) than healthy controls (5.2%), controlling for age, race/ethnicity and parental education status. Self-reported insomnia among those with subthreshold (mean ISI = 10.7) and clinical eating disorders (mean ISI = 10.8) were significantly higher than healthy controls (mean ISI = 6.8) and those at high-risk for eating disorders (mean ISI = 8.1).

Author (year) *Country*	Design	Sample characteristics	Mean age (SD) years	Mental health inclusion method(s)	Mental health or other relevant measure(s)	Insomnia measure	Relevant findings
Carpine et al. (2022) *France*	Cross-sectional	N = 108, 8- to 18-year-olds with AN with and without problematic physical activity (PPA)	14.80 (2.10)	Recruited from clinical settings, DSM-5 diagnosis (K-SADS-PL DSM-5)	BMI, EDS-R; EDI-2; EDE-Q; BSQ; CDI; STAI-Y; VSP-A	ISI	For the overall sample, insomnia was significantly higher for the subgroup with PPA ($p < .05$), where the subgroup also had significantly worse eating disorder symptoms, worse depression, worse trait anxiety and worse psychological well-being and quality of life. The difference in average insomnia score on ISI was not significant for the standard onset group of 14–18-year-olds based on PPA.
Fan et al. (2024) *China*	Cross-sectional	13- to 25-year-old patients with depressive disorders, a) N = 440, with suicidal ideation (SI) b) N = 136, without SI	a) 18.5 (3.2) b) 19.7 (3.1)	Recruited from mental health service; diagnosis of depressive disorders based on ICD-10.	HAMD; HAMA; C-SSRS	AIS	Nighttime sleep (AIS-nocturnal scores only) was significantly associated with worse daytime dysfunction, more severe anxiety and depressive symptoms and greater risk of SI. After controlling for anxiety (HAMA) and depression (HAMD) scores, insomnia (AIS-total score) was no longer significantly associated with SI. Daytime dysfunction from insomnia (AIS-daytime scores), along with previous hospitalisations was significantly associated with higher risk of SI when age, gender, education level, anxiety depression, age at onset of depression, previous hospitalisations were controlled for ($\beta = 0.145$; OR = 1.156; 95 % CI: 1.02, 1.309; $p = 0.023$).

Author (year) *Country*	Design	Sample characteristics	Mean age (SD) years	Mental health inclusion method(s)	Mental health or other relevant measure(s)	Insomnia measure	Relevant findings
Glenn et al. (2021) *USA*	Cohort	N = 48, 12- to 18-year-old youths who recently received acute psychiatric care for suicide risk	14.96 (1.60)	DSM-IV-TR diagnostic interview (MINI-KID) separately with parent and youth	BDI-Y; Daily sleep and mood ratings	ISI	Baseline insomnia did not significantly predict daily suicidal thinking (p = .506) though daily sleep variability, such as on sleep onset latency, did, including after baseline depression and daily sadness were controlled for.
Jenkins et al. (2022a) *Australia*	Cross-sectional	15–25-year-old youths a) N = 40, with BPD or three or more BPD features b) N = 38, healthy control	a) 19.77 (2.51) b) 20.06 (2.52)	BPD and features group recruited from mental health service; diagnostic interview (SCID-5-PD)	DASS-21; DERS; SCID-5-RV; SCID-5-PD	ISI	Depression, anxiety, stress, and emotional regulation examined as parallel mediators of insomnia among youth with BPD or BPD features showed a significant indirect effect (b = 12.41, 95% BCa CI [6.09, 17.66]), where the indirect effects of impulse control difficulties and anxiety were significant. Separate multiple mediation models for emotion regulation, and depression, anxiety and stress showed that limited access to regulatory strategies, impulse control difficulties and anxiety had significant indirect effect on insomnia among youth with BPD or BPD features.

Author (year) *Country*	Design	Sample characteristics	Mean age (SD) years	Mental health inclusion method(s)	Mental health or other relevant measure(s)	Insomnia measure	Relevant findings
Jenkins et al. (2022b) *Australia*	Cross-sectional	15–25-year-old youths a) N = 40, with BPD or 3 or more BPD features b) N = 38, healthy control c) N = 18, help-seeking youths (clinical comparison)	a) 19.77 (2.51) b) 20.06 (2.52) c) 20.52 (3.14)	BPD and clinical comparison group recruited from a mental health service; diagnostic interview for BPD and features group (SCID-5-PD)	SCID-5-RV; SCID-5-PD	ISI	At prevalence rates of 55%, 0% and 28% respectively, young people with BPD or BPD features reported significantly greater clinical insomnia than their same-age healthy counterparts, and the clinical comparator group (Welch's $F[2, 39.20] = 46.43$, $p < 0.001$, est. $\omega^2 = 0.49$). Among the young people with BPD or BPD features, insomnia severity was not significantly different for those with or without comorbid depression.
Johnsen et al. (2024) *UK*	Mixed methods	N = 100, 11–17-year-old youths with varied mental disorders admitted to a mental health inpatient unit	15.34 (1.41)	Recruited from inpatient psychiatric unit	RCADS; SDQ; HoNOSCA; BPFSC-11; admission length	SCI	Of the youth inpatient sample, 50% scored below 17 on SCI indicating probable insomnia. Insomnia was significantly associated with greater depression when controlling for anxiety (β = -0.23, 95% CI -0.37 to -0.09, p = 0.002) and self-harm (explaining 24% of the variance). Significant moderate associations were also found between insomnia and psychotic experiences, hyperactivity, conduct problems and in a sub-sample, BPD symptoms.

Author (year) *Country*	Design	Sample characteristics	Mean age (SD) years	Mental health inclusion method(s)	Mental health or other relevant measure(s)	Insomnia measure	Relevant findings
Johnson et al. (2006) *USA*	Cross-sectional	N = 1014, 13- to 15-year-old community sample with proportions of youth with anxiety and depressive disorders	14.36 (NR)	Diagnostic interview (CDISC-IV)	CDISC-IV; age at onset	Diagnostic interview (DSM-IV operationalised)	Lifetime prevalence rates of co-morbid insomnia ranging between 30.4% and 42.9% among young people with depression and anxiety disorders were found. Prior anxiety disorder was significantly associated with increased odds of insomnia onset, whilst prior depression was not. Depression was 3.8 times more likely among those with prior insomnia than those without, adjusting for gender, race/ethnicity and prior anxiety disorder, while for anxiety disorders, prior insomnia was not significantly associated with increased odds when prior depression, gender and race/ethnicity were adjusted for.
Li et al. (2023) *China*	Cross-sectional	N = 262, 12- to 18-year-olds with MDD, with or without childhood maltreatment experiences	15.22 (1.70)	Diagnostic interview (SCID-IV for DSM-IV axis 1 disorders)	CES-D; PANSI; TAS-20; CTQ-SF	ISI	Patients with experiences of emotional abuse and physical neglect had significantly higher insomnia. Emotional abuse, physical abuse and physical neglect had significant direct and indirect effects on suicidal ideation when insomnia was used as a mediator and sex and age were controlled for. Externally oriented thinking and insomnia both significantly mediated the relationship to suicidal ideation, from emotional abuse and physical neglect.

Author (year) *Country*	Design	Sample characteristics	Mean age (SD) years	Mental health inclusion method(s)	Mental health or other relevant measure(s)	Insomnia measure	Relevant findings
Liu et al. (2024) *China*	Cross-sectional	12- to 18-year-old youths a) N = 164, with MDD b) N = 67, healthy controls	a) 15.52 (1.46) b) 15.11 (1.76)	Diagnosis of MDD based on DSM-V	CES-D	ISI	Insomnia severity reported by depressed young people were significantly higher compared to healthy controls ($p < .001$). No significant association was found for youth with MDD between insomnia severity and sex ($p = .08$) or age ($p = .55$). There was a significant association between insomnia and depression severity for the clinical sample ($r = .53$, $p < .001$). Among youth with first episode depression only, depression severity and one of the inflammatory markers (TNF-α levels) were significantly associated with insomnia and explained 36.3% of the insomnia severity variance.
Luo et al. (2022) *China*	Cross-sectional	N = 285, youths under 18, with MDD with or without childhood trauma	15.23 (1.71)	Recruited from psychiatric outpatient clinics; diagnosis of MDD based on DSM-V	CES-D; CTQ-SF	ISI	While 75.4% of the total sample scored 9 or more in the ISI, significantly higher levels of insomnia severity were found for those with experience of childhood trauma. Insomnia partially mediated the relationship between childhood trauma and depression severity, accounting for 35.9% of the variance in depression severity.

Author (year) *Country*	Design	Sample characteristics	Mean age (SD) years	Mental health inclusion method(s)	Mental health or other relevant measure(s)	Insomnia measure	Relevant findings
Rautio et al. (2024) *Sweden*	Cohort	N = 63, 9- to 17-year-olds with trichotillomania and/or excoriation	14.40 (2.3)	Recruited from a mental health clinic; DSM-IV diagnostic interview (MINI-KID)	NIMH-TSS; NE-YBOCS; CGI; CGAS, CGI-I; TSC; MGH-HPS; SPS-R; CDI–S; SMFQ-C; WSAS-Y; WSAS-P	ISI	Of those who provided data, 47.2% (n = 25) scored above the cut-off of 9 for clinical insomnia. Multimodal treatment for trichotillomania and excoriation led to significant improvements in insomnia severity ($p < .05$), which did not revert to baseline levels at one year follow-up.
Rossi et al. (2023) *France*	Cross-sectional	7- to 18-year-olds with AN a) N = 50, assessed before covid-19 restrictions b) N = 51, assessed during covid-19 restrictions	a) 14.89 (2.28) b) 14.59 (2.19)	Recruited from an eating disorders service; diagnosis based on K-SADS-PL and DSM-5.	EPN-31; CDI; STAI-Y; EDI-2	ISI	Among young people with AN, 23.7% reported moderate insomnia, as denoted by scores above 14 on ISI. Comparing youth with AN before and during COVID-19 restrictions, significant differences were seen in insomnia severity ($U = 885.5$, $p = 0.04$, $r = 0.21$), with higher proportion of the sample reporting moderate insomnia during restrictions (33%) than before (14%). While a similar pattern was found for quality of sleep and aspects of emotionality, no such differences were found in mood, anxiety and eating disorder severity.

Author (year) *Country*	Design	Sample characteristics	Mean age (SD) years	Mental health inclusion method(s)	Mental health or other relevant measure(s)	Insomnia measure	Relevant findings
Sarigedik et al. (2021) *Turkey*	Cross-sectional	12- to 18-year-old females a) N = 40, with PTSD stemming from sexual abuse b) N = 40, age matched healthy controls	a) 15.29 (1.75) b) 15.06 (1.66)	Diagnostic interview (DSM-V criteria PTSD through K-SADS-PL)	CAPS-CA; PedsQL	ISI	Insomnia was significantly higher among young females with PTSD compared to the control group ($p < .001$). Insomnia severity was significantly associated with worse PTSD symptoms, such as, avoidance, re-experiencing, hyperarousal. For example, the total CAPS-CA score was associated with ISI total score, $\rho = 0.61$, $p < .01$. For those with PTSD, insomnia severity was also significantly associated with worse quality of life, for example, ISI total score was associated with PedsQL total score, $\rho = 0.43$, $p < .01$.

Author (year) *Country*	Design	Sample characteristics	Mean age (SD) years	Mental health inclusion method(s)	Mental health or other relevant measure(s)	Insomnia measure	Relevant findings
Sevilla-Cermeño et al. (2020) *Sweden*	Cohort	N = 66, 10- to 17-year-old youths with BDD	15.4 (1.5)	DSM-IV diagnostic interview (MINI-KID)	BDD-YBOCS-A; CGI-S; CGAS; AAI; CDI-S; SMFQ-P; WSAS-Y; WSAS-P	ISI	Among adolescents with BDD, no significant gender differences were found but, those with insomnia were slightly older, had significantly higher rates of comorbid depression (p = .01) and significantly worse self-reported BDD symptomatology, in total AAI score (p = .03), but not in clinician rated BDD symptomatology (p = .95). Those with insomnia also had worse functioning based on self (p= .005) and parent reports (p = .009). No differences in the number of sessions or provision of medications were found between youths with or without insomnia, however, significantly lower proportion of those with insomnia completely recovered following multimodal treatment for BDD. A significant improvement in insomnia was reported following treatment for the whole sample, however.
Shi et al. (2023) *China*	Cross-sectional	12- to 18-year-old youths with MDD a) N = 113, with insomnia b) N = 184, with no insomnia	a) 15.30 (1.82) b) 15.24 (1.64)	Diagnostic interview (DSM-5 criteria)	CGI-S; number of hospitalisations, medication use, duration of illness, suicidal attempts	ISI	Insomnia was significantly, positively associated with female sex (OR = 1.955, 95% CI = 1.052-3.633, p = .03), suicide attempts (OR = 1.765, 95% CI = 1.037-3.005, p = .04), depression severity (OR=2.031, 95% CI = 1.523-2.709, p < .001). It was also negatively associated with antipsychotics use (OR = 0.433, 95% CI = 0.196-0.952, p = .04).

Author (year) *Country*	Design	Sample characteristics	Mean age (SD) years	Mental health inclusion method(s)	Mental health or other relevant measure(s)	Insomnia measure	Relevant findings
Song et al. (2022) *China*	Cross-sectional	12- to 18-year-olds a) N = 499, with MDD b) N = 499, gender and age matched healthy controls	a) 16.01(1.58) b) 15.89 (1.63)	DSM-IV diagnostic interview (MINI)	HAMD-17; GAD-7; CADSS; NDQ-CV	ISI	Rates of insomnia were higher for youth with MDD than healthy controls. Rates of insomnia were significantly higher among youths with suicidal risk compared to those without. Insomnia was significantly associated with nightmare frequency and distress, daytime sleepiness, depression and anxiety severity. However, logistic regression adjusting for grade, gender, emotional disorder and other sleep variables showed that independently insomnia severity was not significantly associated with suicide risk.
Strumberger et al. (2023) *Switzerland*	Cross-sectional	N = 256, 8- to 17-year-olds with at least moderate severity MDD	15.21 (1.64)	Diagnostic interview (current DSM-IV MDD with K-SADS)	CDRS-R	ISI	No significant association between self-rated insomnia and C-reactive protein, a marker for low-grade inflammation was found, when corrected for multiple testing ($\rho = 0.13$, $p = .04$) or within multiple regression models.

Author (year) *Country*	Design	Sample characteristics	Mean age (SD) years	Mental health inclusion method(s)	Mental health or other relevant measure(s)	Insomnia measure	Relevant findings
Strumberger et al. (2024) *Switzerland*	Cross-sectional	a) N = 29, youth with MDD b) N = 29, healthy youth controls	a) 15.83 (1.74) b) 14.92 (1.81)	Diagnostic interview (current DSM-IV MDD with K-SADS)	CDRS-R	ISI	Depressed youths had significantly higher insomnia severity than healthy controls. For the depressed youths, there was a significant correlation between one inflammatory marker, high-sensitivity C-reactive protein (hsCRP), and self-reported insomnia severity ($r = 0.41$, $p < 0.05$), but once depression severity, BMI and tobacco use were controlled for, this was not significant. Insomnia also did not mediate slow wave sleep and hsCRP.
Tonon et al. (2022) *Brazil*	Cross-sectional	14- to 16-year-olds a) N = 39, with MDD b) N = 31, at high risk of MDD c) N= 26, at low risk of MDD	a) 16.1 (0.7) b) 15.8 (0.9) c) 15.4 (0.8)	DSM-5 diagnostic interview (K-SADS-PL)	MFQ; CDRS-R	AIS	The difference in insomnia severity was statistically significant across groups, being highest for those with MDD, followed by those at high risk of depression and low risk of depression, after controlling for age, gender and chronotype.

Author (year) *Country*	Design	Sample characteristics	Mean age (SD) years	Mental health inclusion method(s)	Mental health or other relevant measure(s)	Insomnia measure	Relevant findings
Urrila et al. (2017) *Finland*	Cross-sectional	All males between 14- to 18-year-old a) N = 9, with depression or sleep problems b) N = 10, healthy controls	a) 15.8 (0.9) b) 16.2 (0.7)	Recruited from psychiatry outpatient clinics; Diagnostic interview (DSM-IV axis I disorders with K-SADS-PL)	BDI-21; HDRS; BAI	AIS	Among adolescents with depression, the correlation between myo-inositol concentration in the anterior cingulate cortex (ACC) and insomnia was not significant. Total creatine concentrations in the ACC were negatively correlated with insomnia ($r = –0.514$; $p = 0.024$).
Waite et al. (2018) *UK*	Qualitative	N = 11, youths at ultra-high risk of psychosis with insomnia	18.27 (1.95)	Recruited from MH services; meeting criteria for ultra-high risk of psychosis based on attenuated psychosis (CAARMS)	WEMWBS; CAARMS	ISI	Youth at ultra-high risk of psychosis and insomnia, in speaking about their experiences, described the reciprocal relationship between difficulties with sleep, mood, anxiety and functioning. With one theme being 'It makes everything a lot worse', one young person noted how insomnia affected their ability to do things which in turned worsened their depression. Young people also described how learning about and understanding sleep helped to implement strategies, despite initial negative expectations. They linked the improvements in sleep improvements to improvements in for example, depression, anxiety, irritability and sub-threshold psychotic symptoms.

Author (year) *Country*	Design	Sample characteristics	Mean age (SD) years	Mental health inclusion method(s)	Mental health or other relevant measure(s)	Insomnia measure	Relevant findings
Yang et al. (2024) *China*	Cross-sectional	12- to 18-year-olds with MDD a) N = 257, with insomnia b) N = 72, with MDD only	15.31 (1.63)	Diagnostic interview by two psychiatrists (DSM-5)	CES-D; TAS-20	ISI	While insomnia was significantly positively correlated with alexithymia, depression severity, perceived academic stress and worse family relationships for all adolescents with depression, in multiple regression models, only the relationship with depression severity was significant (OR = 1.102, 95% CI = 1.066 – 1.139, $p < .001$). For male participants, insomnia was only associated with depression severity while for females, insomnia was significantly associated with depression and alexithymia in multiple regression models.
Zullo et al. (2017) *USA*	Cross-sectional	N = 151, 12 to 17 year olds with a variety of mental disorders (80.1% with MDD)	15.05 (1.4)	Recruited from inpatient psychiatry unit	QIDS-A-SR-17; suicidal history; INQ; ACSS-FAD; CHRT SR	ISI	Self-reported insomnia was significantly associated with suicidal risk. However, regression models testing insomnia symptoms as a predictor to suicide risk found no direct effect of insomnia on suicide risk ($t = -.74$, $p > .05$), instead finding that insomnia affected suicide risk indirectly through perceived burdensomeness and depressive symptoms, but not through acquired capability or thwarted belongingness.

Note. AAI = Appearance Anxiety Inventory (Veale et al., 2014); ACSS-FAD = Acquired Capability for Suicide Scale-Fearlessness About Death (Ribeiro et al., 2014); AIS = Athens Insomnia Scale (Soldatos et al., 2000); AN = anorexia nervosa; BAI = Beck Anxiety Inventory (Beck et al., 1988); BDD = body dysmorphic disorder, BDD-YBOCS-A = Yale-Brown Obsessive–Compulsive Scale Modified for BDD-Adolescent Version (Phillips et al., 1997); BDI-21 = Beck Depression Inventory – 21 items (Beck et al., 1961); BDI-Y = Beck Depression Inventory for Youth (Stapleton et al., 2007); BMI = Body Mass Index; BPFSC-11 = Borderline

Personality Features Scale for Children (Sharp et al., 2014); BSQ = Body Shape Questionnaire (Cooper et al., 1987); CAARMS = Comprehensive Assessment of At-Risk Mental States (Yung et al., 2005); CADSS = Chinese Adolescent Daytime Sleepiness Scale (Liu et al., 2017); CAPS-CA = Clinician-Administered PTSD Scale for Children and Adolescents (Pynoos et al., 2015); CDI = Children's Depression Inventory (Kovacs, 1985); CDI-S = Children's Depression Inventory – Short Version (Allgaier et al., 2012); CDISC-IV = Computerized Diagnostic Schedule for Children, Version Four (Shaffer et al., 2000); CDRS-R = Children's Depression Rating Scale-Revised (Poznanski, & Mokros, 1996); CES-D = Center for Epidemiologic Studies Depression Scale (Radolff, 1977); *CGAS = Children´s Global Assessment Scale (Shaffer et al., 1983); C*GI = Clinical Global Impairment Scale (Busner & Targum, 2007); CGI-I = Clinical Global Impairment-Improvement (Guy, 1976); CGI-S = Clinical Global Impression-Severity (Guy, 1976); CHRT SR= Concise Health Risk Tracking scale Self-Report (Trivedi et al., 2011); CI= confidence interval; C-SSRS = Columbia-Suicide Severity Rating Scale (Posner, et al., 2011); CTQ-SF = Childhood Trauma Questionnaire-Short Form (Bernstein et al., 2003); DASS-21 = Depression Anxiety and Stress Scales-21 items (Lovibond & Lovibond, 1995); DERS = Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004); DSM-5= Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (American Psychiatric Association, 2013); DSM-IV = Diagnostic and Statistical manual of Mental Disorders, Fourth Edition (American Psychiatric Association, 1994); ED = eating disorder; EDE-Q = Eating Disorder Examination Questionnaire (Fairburn & Beglin, 1994); EDI-2 = The Eating Disorder Inventory-2 (Garner, 1991); EDS-R = Exercise Dependence Scale-Revised (Downs et al., 2004); EPN-31 – The Positive and Negative Emotionality Scale (Pélissolo et al., 2007); GAD-7 = Generalized Anxiety Disorder-7 (Spitzer et al., 2006); HAMA = Hamilton Anxiety Rating Scale (Hamilton, 1959); HAMD = Hamilton Depression Rating Scale (Hamilton, 1960); HAMD-17 = Hamilton Depression Scale-17 (Hamilton, 1960); HDRS= Hamilton Depression Rating Scale (Hamilton, 1960); HoNOSCA = The Health of the National Outcome Scale for Children and Adolescents (Gowers et al., 1999); INQ = Interpersonal Needs Questionnaire (Van Orden et al., 2012); ISI = Insomnia Severity Index (Bastien et al., 2001); K-SADS-PL = Kiddie-Schedule for Affective Disorders and Schizophrenia – Present and Lifetime (Kaufman et al., 1997); MDD = Major Depressive Disorder; MFQ = Mood and Feelings Questionnaire (Rosa et al., 2018); MGH-HPS = Massachusetts General Hospital Hairpulling Scale (Keuthen et al., 1995); MINI-KID = Mini International Neuropsychiatric Interview for Children and Adolescents (Duncan et al., 2018); NDQ-CV = Nightmare Distress Questionnaire - Chinese version (Liu et al., 2021); NE-YBOCS = Yale–Brown Obsessive Compulsive Scale Modified for Neurotic Excoriation (Arnold et al., 1999); NIMH-TSS = National Institute of Mental Health Trichotillomania Severity Scale (Diefenbach et al., 2005); PANSI = Positive and Negative Suicide Ideation Inventory (Osman et al., 2002); PedsQL = Pediatric Quality of Life Inventory (Varni et al., 2001); QIDS-A-SR-17 = Quick Inventory of Depressive Symptomatology – Adolescent Version Self-Report (Rush et al., 2006, 2003); RCADS = Revised Children's Anxiety and Depression Scale (Chorpita et al., 2000); SCID-5-PD = Structured Clinical Interview for the DSM-5 Personality Disorders (First et al., 2016); SCID-5-RV = Structured Clinical Interview for DSM-5 Research Version (First et al., 2015); SDQ = Strengths and Difficulties Questionnaire (Goodman, 1997); SMFQ-C = Short Mood and Feelings Questionnaire, Child Version (Rhew et al., 2010); SMFQ-P = Short Mood and Feeling Questionnaire, Parent Version (Rhew et al., 2010); SPS-R – Skin Picking Scale-Revised (Snorrason et al., 2012); STAI = State-Trait Anxiety Inventory (Spielberger et al., 1983); STAI-Y = State-Trait Anxiety Inventory Form Y; TAS-20 =Toronto Alexithymia Scale (Bagby et al., 1994); TSC = Trichotillomania Scale for Children (Tolin et al., 2008); VSP-A = Vécu et Santé Perçue de l'Adolescent (Adolescent Life and Perceived Health, Sapin et al., 2005); WCS = Weight Concerns Scale (Killen et al., 1994); WEMWBS = The Warwick-Edinburgh Mental Wellbeing Scale (Tennant et al.,

2007); WSAS-P = Work and Social Adjustment Scale-Parent Version (Jassi et al., 2020); WSAS-Y = Work and Social Adjustment Scale-Youth Version (Jassi et al., 2020)

Table 3

Study characteristics of all interventional studies

Author (year), Country	Design	Sample characteristics	Mean age (SD) years	Psychopathology inclusion method	Mental Health or other relevant measure(s)	Insomnia measure	Intervention type	Relevant findings
Bradley et al. (2018) UK	Case series	N = 11, youths at ultra-high risk of psychosis with insomnia, aged 14-24 years old	18.5 (1.9)	Recruited from MH services; meeting criteria for ultra-high risk of psychosis (CAARMS)	CAARMS; GPTS; hallucinations subscale of SPEQ; DASS; The WEMWBS, WSAS, intervention uptake	ISI	CBT-I adapted for psychosis symptoms, up to eight hourly sessions	At post-therapy, ISI score reduced by 8.1 (95% CI = -11.4 to -4.8; d = 6.8), DASS-D by 2.9 (95% CI = -5.1 to -0.7; d = 0.5), DASS-S by 4.0 (95% CI = -6.8 to -1.2; d = 0.8), showing significant improvements for insomnia, depression and stress. Wellbeing (d = 0.7) and social functioning (d= 0.7) also improved significantly. Hallucinations, anxiety and paranoia level showed improvements which were not significant. Attendance rate was 89%.

Author (year), Country	Design	Sample characteristics	Mean age (SD) years	Psychopathology inclusion method	Mental Health or other relevant measure(s)	Insomnia measure	Intervention type	Relevant findings
Clarke et al. (2015) USA	Pilot RCT	N= 41 (treatment: 21; control: 20) Youths with MDD or depressive disorder NOS, randomised to treatment or control group, aged 12-20	Treatment: 16.5 (1.9) Control: 15.9 (1.7)	Diagnosed with unipolar depression through KSADS psychiatric interview	CDRS-R; KSADS; LIFE	ISI	Treatment: youth CBT-I with CBT for depression, control: sleep hygiene with CBT for depression	88% (n = 36) completed final 26-week follow up. At post-intervention and follow-up, there were no differences between the two groups on insomnia severity by ISI total score or for reaching 'case-ness' on ISI (≥8), or on depression severity. However, there was a more favourable number needed to treat (NNT) for CBT-I group, with adjusted NNT of 4.1 for recovery of depression diagnosis and 4.8 at 26-week follow-up for insomnia for the CBT-I group.
Cliffe et al. (2020) UK	Feasibility study	N =39, Youth with significant mental health problems, aged 14-17 years old	15.6 (1.21)	Recruited from secondary care mental health service (CAMHS)	RCADS; MFQ; acceptability ratings	ISI	Digital CBT-I (Sleepio), 6 session, self-guided	On average, 3.93 (SD 2.16) sessions were completed, and 19 completed treatments and post-treatment measures. There were significant improvements on insomnia (ISI) and post-intervention reduction in symptoms of depression (MFQ) and anxiety (RCADS), particularly subscales of separation anxiety, panic and depression.

Author (year), Country	Design	Sample characteristics	Mean age (SD) years	Psychopathology inclusion method	Mental Health or other relevant measure(s)	Insomnia measure	Intervention type	Relevant findings
Crevits et al. (2024) France	Non-randomised trial	N= 33, (CBT-I: 22; Control: 11) Youth with AN assigned to receive added CBT-I or usual treatment only, treatment group	CBT-I: 15.41 (1.20) Control: 15.65 (1.52)	Recruited from eating disorder service, diagnosed with AN by a psychiatrist based on DSM	BMI, VSPA, EDI-2, CDI	ISI	CBT-I: 4 one hour group sessions delivered by a psychiatrist, control: treatment as usual	There were significant improvements in BMI, sleep latency, total wake time, sleep efficiency and physical wellness (VSPA – quality of life measure) for CBT-I group, while for those in the control group, only BMI improved significantly.
Hurd et al. (2019) USA	Feasibility pilot	N = 31, youth with moderate to severe unipolar depression or bipolar depression, aged 12 to 17 years old	15.5 (1.0)	Recruited from psychiatric youth inpatient unit	HAMD-17; SCARED-5, CGI; Nurse assessments	ISI	Triple Chronotherapy, combination of sleep deprivation, bright light therapy and sleep phase advancement	29 patients completed the intervention. Depression, severity of illness, anxiety, insomnia and self-harm urges all significantly decreased at the end of treatment ($p < 0.01$). Sixteen patients completed one-month follow-up where scores remained significantly improved compared to baseline for all measures.

Author (year), Country	Design	Sample characteristics	Mean age (SD) years	Psychopathology inclusion method	Mental Health or other relevant measure(s)	Insomnia measure	Intervention type	Relevant findings
Mathews et al. (2023) UK	Feasibility pilot	N = 59, youth with significant mental health problems, aged 13-17 years old	15.1 (1.3)	Recruited from secondary care mental health service (CAMHS)	RCADS; MFQ; acceptability ratings	ISI	Digital CBT-I (Sleepio), 6 session, self-guided	Statistically significant post-intervention improvements in sleep, mood and anxiety were seen, with reductions in proportion of youth still experiencing clinically severe insomnia, depression and anxiety. There were greater improvements in insomnia but not measures of depression or anxiety for those who completed at last half of the intervention than those who did not. Of the 29 who completed all 6 sessions, 15 (51.7%) required no further mental health input. Those under 16 years old were more likely to be non-completers of CBT-I. The 11 adolescents who accepted but never started Sleepio also disengaged with other mental health interventions.
Mlyncekova et al. (2023) Slovakia	Single-arm intervention study	N = 30, youth with major depressive disorder, aged 12-18 years old	15.0 (1.5)	Recruited from inpatient setting, diagnosed using DSM-5 criteria by two independent specialists	CDI	AIS	Vortioxetine (Antidepressant)	There was a significant improvement in insomnia ($p = 0.002$) and depression ($p < 0.001$) scores after the treatment period compared with before.

Author (year), Country	Design	Sample characteristics	Mean age (SD) years	Psychopathology inclusion method	Mental Health or other relevant measure(s)	Insomnia measure	Intervention type	Relevant findings
Rollinson et al. (2021) UK	Case series	N = 15, youth with severe and complex mental health problems, aged 14-23 years old	17.73 (2.81)	Recruited from youth mental health team	RCADS (<18-year-old); CORE-OM (>18-year-old)	ISI	Adapted CBT-I, 6 sessions	On average, 5.53 sessions were provided with 79% attendance rate. There were improvements in insomnia, where, by session 3, 60% no longer had clinical insomnia, with this increasing to 73% by the end of treatment and 80% at one-month follow-up Sleep efficiency rose on average from 64 to 84%. There were improvements in psychological distress, with reductions in the severity of scores from baseline to follow-up. Large effect size estimates for sleep measures, psychological distress and functioning were found from baseline to follow up (*d* = 1.43 to 4.87).

Author (year), Country	Design	Sample characteristics	Mean age (SD) years	Psychopathology inclusion method	Mental Health or other relevant measure(s)	Insomnia measure	Intervention type	Relevant findings
Rollinson et al. (2024) UK	Feasibility trial	N = 56, youth with severe and complex mental health problems, aged 13-25 years old	19.0 (3.25)	Recruited from youth mental health team	RCADS (<18-year-old); CORE-OM (>18-year-old)	ISI	Adapted CBT-I, 6 sessions	There was a 70% (n = 80 started the intervention) completion rate. At the end of treatment, there were statistically significant improvements in insomnia and psychological distress ($p < .001$), that were maintained at follow-up. At the end of treatment 68% ($n = 38$) no longer had clinical insomnia, with a drop from 42% ($n = 23/55$) at baseline to 11% ($n = 4/38$) still experiencing severe insomnia at follow-up. For psychological distress the proportion of service users scoring on clinical or above severe range reduced from 67% and 64.71% at baseline to 29% and 36.36% at endpoint respectively.

Author (year), Country	Design	Sample characteristics	Mean age (SD) years	Psychopathology inclusion method	Mental Health or other relevant measure(s)	Insomnia measure	Intervention type	Relevant findings
Waite et al. (2023) UK	Randomised controlled feasibility trial	N = 40, (Sleep intervention added to usual care = 21, usual care only = 19) youth at ultra-high risk of psychosis randomly assigned to usual care only or usual care with sleep intervention added, aged 14-23 years old	16.9 (2.5)	Recruited from mental health teams, meeting criteria according to CAARMS	CAARMS; R-GPTS; DASS-21	ISI	Targeted CBT-I, 8 hourly sessions over 12 weeks with usual care, usual care = prescription of psychotropic medication, infrequent contact with professionals	Post-intervention 3-month follow-up showed improvements in insomnia severity for the targeted CBT-I group compared with usual care group, which was maintained at 9-month follow-up. The insomnia intervention was linked to reductions in depression, anxiety and paranoia, which were not statistically conclusive at 3-month follow-up, but at 9-month follow-up showed larger effect sizes with confidence intervals not spanning zero, suggesting more reliable improvement in this over time. While small-to-medium effect sizes were found for at-risk mental state measure, the wide confidence intervals suggest unclear intervention effect on this.

Author (year), Country	Design	Sample characteristics	Mean age (SD) years	Psychopathology inclusion method	Mental Health or other relevant measure(s)	Insomnia measure	Intervention type	Relevant findings
Zetterqvist et al. (2021) Sweden	Feasibility trial	N = 21, youth with various mental health diagnosis, aged 13-17 years old	15.48 (1.29)	Recruited from mental health clinic	MADRS-S; SCL-90	ISI	Digital CBT-I, 7 modules.	Insomnia severity significantly improved post-treatment, which was maintained at 4-month follow up, with 67% (n = 14) being in remission and 52% (n = 11) having a clinically significant response to treatment. There were large improvements in sleep efficiency (d = 1.01), sleep onset latency (d = 1.04), and obsessive-compulsive symptoms (d = 0.87). There were moderate improvements in depressive symptoms (d = 0.55, on MADRS-S), paranoid ideation (d = 0.62) and psychoticism (d = 0.53). No significant changes were reported for anxiety.

Note. AIS = Athens Insomnia Scale (Soldatos et al., 2000); AN = anorexia nervosa; BAI = Beck Anxiety Inventory (Beck et al., 1988); BDI-21 = Beck Depression Inventory-21 items (Beck et al., 1961); BMI = Body Mass Index; CAARMS = Comprehensive Assessment of At-Risk Mental States (Yung et al., 2005); CDI = Children's Depression Inventory (Kovacs, 1985); CDRS-R = Children's Depression Rating Scale-Revised (Poznanski, & Mokros, 1996); CES-D = Center for Epidemiologic Studies Depression Scale (Radolff, 1977); CGI = Clinical Global Impairment Scale (Busner & Targum, 2007); CHRT SR= Concise Health Risk Tracking scale Self-Report (Trivedi et al., 2011); CI = Confidence interval; CORE-OM = The Clinical Outcomes in Routine Evaluation - Outcome Measure (Evans et al., 2002); DASS = Depression Anxiety Stress Scale (Lovibond & Lovibond, 1995); DASS-21 = Depression Anxiety and Stress Scales-21 items (Lovibond & Lovibond, 1995); DSM-5= Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (American Psychiatric Association, 2013); ED = eating disorder; GPTS = Green Paranoid Thoughts Scale (Green et al., 2008); HAMD-17 = Hamilton Depression Scale-17 (Hamilton, 1960); HDRS= Hamilton Depression Rating Scale (Hamilton, 1960); INQ= Interpersonal Needs Questionnaire (Van Orden et al., 2012); ISI = Insomnia Severity Index (Bastien et al., 2001); KSADS = Kiddie-Schedule for Affective Disorders and Schizophrenia (Kaufman et al., 1997); K-SADS-PL= Kiddie-Schedule for Affective Disorders and Schizophrenia – Present and Lifetime (Kaufman et al., 1997); LIFE = Longitudinal Interval Follow-Up Evaluation (Keller et al., 1982); MADRS-S = Montgomery-Åsberg

Depression Rating Scale – Self-report (Montgomery & Åsberg, 1979); MDD = major depressive disorder; MFQ = Mood and Feelings Questionnaire (Rosa et al., 2018); QIDS-A-SR-17 = Quick Inventory of Depressive Symptomatology – Adolescent Version Self-Report (Rush et al., 2006, 2003); RCADS = Revised Children's Anxiety and Depression Scale (Chorpita et al., 2000); R-GPTS = Revised Green Paranoid Thoughts Scale (Freeman et al., 2021); SCARED-5 = Screen for Child Anxiety Related Emotional Disorders-5 items (Birmaher et al., 1999); SCL-90 = Symptom Check List 90-items (Bech et al., 1992); SPEQ = Specific Psychotic Experiences Questionnaire (Ronald et al., 2013); TAS-20 =Toronto Alexithymia Scale (Bagby et al., 1994); VSPA = Vécu et Santé Perçue de l'Adolescent (Adolescent Life and Perceived Health, Sapin et al., 2005); WEMWBS = The Warwick-Edinburgh Mental Wellbeing Scale (Tennant et al., 2007); WSAS = Work and Social Adjustment Scale (Mundt et al., 2002).

Impact

The impact of insomnia was examined variably reflecting differing study aims and sample types. In addition to self- and clinician-rated mental health measures appropriate to the setting or the disorder, used either alone or in combination, several studies (*n* = 5) also extracted relevant information from clinical records.

Relationships with depression were explored most frequently with the Centre for Epidemiologic Studies Depression Scale (Radolff, 1977, *n* = 5), Children's Depression Rating Scale-Revised (Poznanski, & Mokros, 1996, *n* = 4), and Children's Depression Inventory (Kovacs, 1985, *n* = 4). Studies recruiting from clinical settings most frequently used the Revised Children's Anxiety and Depression Scale (Chorpita et al., 2000, *n* = 5) to measure symptom severity.

Suicidality was assessed less consistently. Two studies used relevant questions from other questionnaires such as Concise Health Risk Tracking Scale Self-Report (Trivedi et al., 2011), while others used specific tools, such as, the suicide module of the Mini-International Neuropsychiatric Interview (Sheehan et al., 1998, *n* = 1) or the Positive and Negative Suicide Ideation Inventory (Osman et al., 2002, *n* = 1). Functioning was most commonly assessed using Work and Social Adjustment Scale (Mundt et al., 2002, *n* = 3). A full list of all relevant measures is provided in the study characteristics tables (Tables 2 and 3).

Table 4

Summary of MMAT quality assessment

Author	Study type	S1	S2	Q1	Q2	Q3[a]	Q4	Q5	Quality percentage (%)
Ämmälä et al (2019)	3	Y	Y	N	Y	Y	Y	Y	80
Aspen et al. (2014)	3	Y	Y	Y	Y	Y	Y	Y	100
Bradley et al. (2018)	4	Y	Y	Y	Y	Y	Y	Y	100
Carpine et al. (2022)	3	Y	Y	Y	Y	Y	Y	Y	100
Clarke et al. (2015)	2	Y	Y	Y	Y	Y	Y	Y	100
Cliffe et al. (2020)	3	Y	Y	Y	Y	N	Y	Y	80
Crevits et al. (2024)	3	Y	Y	Y	Y	Y	N	Y	80
Fan et al. (2024)	3	Y	Y	Y	Y	Y	Y	Y	100

Glenn et al. (2021)	3	Y	Y	Y	Y	Y	Y	Y	100
Hurd et al. (2019)	3	Y	Y	Y	Y	N	Y	Y	80
Jenkins et al.[a] (2022)	3	Y	Y	Y	Y	Y	Y	Y	100
Jenkins et al.[b] (2022)	3	Y	Y	Y	Y	Y	Y	Y	100
Johnsen et al. (2024)	5	Y	Y	Y	Y	N	N	Y	60
Johnson et al. (2006)	3	Y	Y	Y	Y	Y	Y	Y	100
Li et al. (2023)	3	Y	Y	Y	Y	Y	N	Y	80
Liu et al. (2024)	3	Y	Y	Y	Y	Y	Y	Y	100
Luo et al. (2022)	3	Y	Y	Y	Y	Y	N	Y	80
Mathews et al. (2023)	3	Y	Y	Y	Y	N	Y	Y	80
Mlyncekova et al. (2023)	3	Y	Y	Y	Y	Y	N	Y	80
Rautio et al. (2024)	3	Y	Y	Y	Y	N	Y	Y	80
Rollinson et al. (2021)	4	Y	Y	Y	Y	Y	Y	Y	100
Rollinson et al. (2024)	3	Y	Y	Y	Y	Y	N	Y	80
Rossi et al. (2023)	3	Y	Y	Y	Y	Y	N	Y	80
Sarigedik et al. (2021)	3	Y	Y	Y	Y	Y	Y	Y	100
Sevilla-Cermeño et al. (2020)	3	Y	Y	Y	Y	Y	Y	Y	100
Shi et al. (2023)	3	Y	Y	Y	Y	Y	N	Y	80
Song et al. (2022)	3	Y	Y	Y	Y	Y	Y	Y	100
Strumberger et al. (2024)	3	Y	Y	Y	Y	Y	Y	Y	100
Strumberger et al. (2023)	3	Y	Y	Y	Y	Y	Y	Y	100
Tonon et al. (2022)	3	Y	Y	Y	Y	Y	Y	Y	100
Urrila et al. (2017)	3	Y	Y	N	Y	Y	Y	Y	80
Waite et al. (2023)	2	Y	Y	Y	Y	Y	Y	Y	100
Waite et al. (2018)	1	Y	Y	Y	Y	Y	Y	Y	100
Yang et al. (2024)	3	Y	Y	Y	Y	Y	Y	Y	100
Zetterqvist et al. (2021)	3	Y	Y	Y	Y	Y	Y	Y	100
Zullo et al. (2017)	3	Y	Y	Y	Y	Y	Y	Y	100

Note. Study category 1 = Qualitative study, 2 = Quantitative Randomised control trials, 3 = Quantitative non-randomised studies, 4 = Quantitative descriptive studies, 5 = Mixed methods studies, S1 = Screening question one, S2 = Screening question two, Q1 = question one (for the study type), Q2 = question two (for the study type), Q3 = question three (for the study type), Q4 = question four (for the study type), Q5 = question five (for the study type), Y = yes, N = no, quality percentage = number of questions rated as Yes.

[a] A 20% drop-out rate was deemed acceptable for complete data, following Furlan et al. (2009), though this may be conservative for feasibility studies.

Main Findings

The narrative synthesis findings below first outline the prevalence and demographic patterns of comorbid insomnia in clinical youth, followed by its general clinical associations, including links to

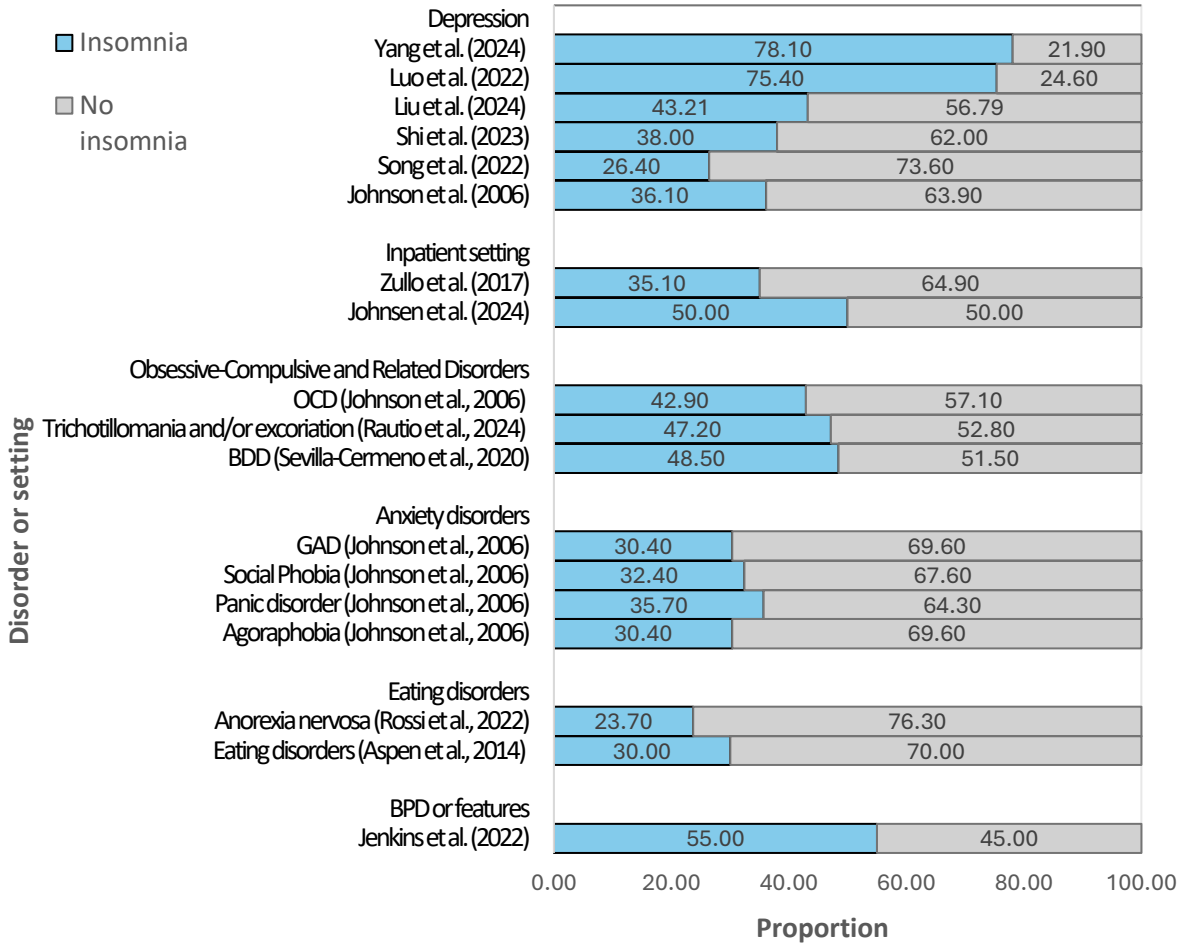
suicidality and self-harm, underlying mechanisms, impact on functioning and treatment, and intervention study findings.

Prevalence and Demographic Patterns

Thirteen studies reported insomnia prevalence among young people with mental health problems, showing comorbidity rates between 23.7% (Aspen et al., 2014) and 78.1% (Yang et al., 2024), see Figure 2).

Figure 2

Proportion of co-morbid insomnia by disorder or service setting



Note. OCD refers to obsessive compulsive disorder while GAD refers to generalised anxiety disorder and BPD refers to borderline personality disorder.

While prevalence rates were in the 30% and 40% range for anxiety disorders and obsessive-compulsive and related disorders respectively, the prevalence was lowest for anorexia nervosa at 23.7%. Among depressed young people, comorbid insomnia was highly variable, likely reflecting differing thresholds used for insomnia; studies applying lower ISI thresholds of eight or nine (Luo et al., 2022; Yang et al., 2024) reported greater prevalence in the 70% range than those using a higher cut-off of 15, where rates were in the 20% to 40% range (Liu et al., 2024; Shi et al., 2023; Song et al., 2022). Similarly, mixed insomnia prevalence rates among inpatient youth populations were based on different insomnia measurement methods.

Regarding demographics, though two studies (Liu et al., 2024; Yang et al., 2024) reported no gender effects, Shi et al. (2023) identified higher insomnia rates for depressed females. From two studies examining age effects, among young people with BDD, those with clinical insomnia were slightly older (15.8 vs. 15.0 years; Sevilla-Cermeño et al., 2020), while no age effects were observed in depressed young people (Liu et al., 2024).

Clinical Associations

Twelve observational studies explored relationships between insomnia and psychopathologies in clinical youth samples, finding links to greater clinical symptom severity, illustrated varyingly.

Eight studies reported positive associations between depression and co-morbid insomnia. This robust finding remained significant when compared to age- and gender-matched healthy controls, when controlling for age and gender among youths with first-episode or recurrent depression (Liu et al., 2024) and when accounting for anxiety in inpatient youths (Johnsen et al., 2024). Insomnia was also associated with greater symptom severity in young people with PTSD and BDD, specifically, clinician-rated PTSD and self-rated BDD symptoms (Sarigedik & Yurteri, 2021; Sevilla-Cermeño et al., 2020).

Beyond this, insomnia was linked to further comorbidities; adolescents with BDD and insomnia had depression more frequently than those without insomnia (Sevilla-Cermeño et al.,

2020). UHR youth with insomnia also described experiences of a reciprocal relationship between mood and insomnia:

‘I'm generally feeling quite low, so that very much affects my sleep”

‘“not being able to get to sleep, not being able to stay asleep, and then being too tired during the day to actually do anything, which was really, really affecting my mood” (Waite et al., 2018).

Comorbid insomnia was also associated to wider psychopathologies such as conduct problems, hyperactivity and psychotic experiences among acutely distressed inpatients (Johnsen et al., 2024), and anxiety severity among depressed youths (Fan et al., 2024; Song et al., 2022). Uniquely, for youth with BPD or BPD features, comorbid insomnia was not associated with co-occurring depression (Jenkins et al., 2022b), suggesting a distinct role for insomnia in BPD.

Moreover, insomnia emerged as a potential early risk indicator; studies on eating disorders and depression found an incremental increase in insomnia severity alongside disorder intensity – highest in diagnosed youth, followed by those at subthreshold or high-risk, and then low-risk or control groups (Aspen et al., 2014; Tonon et al., 2022). In eating disorders, this pattern occurred in parallel for anxiety, depression and emotion regulation (Aspen et al., 2014). Additionally, Carpine et al. (2022) reported higher insomnia among those with anorexia nervosa and problematic excessive exercise, a behaviour also associated with worse depression, trait anxiety and quality of life. Meanwhile, Rossi et al. (2023) found that among a group of adolescents with anorexia assessed during the COVID-19 lockdown, insomnia and subjective experience of tenderness (an aspect of emotionality) were significantly worse compared to those assessed before, even though other clinical markers remained similar. This suggests that insomnia may be closely linked to emotionality and that sleep may be particularly vulnerable to environmental disruptions in this population. Whilst a lack of direct examination of these factors limits wider conclusions, together, these findings corroborate associations between insomnia and worse psychopathology.

Relationship with Suicidality and Self-Harm

Seven studies investigated comorbid insomnia and suicidality in young people with mental health difficulties, while only Johnsen et al. (2024) examined self-harm, finding that insomnia accounted for 24% of the self-harm variance among inpatient adolescents. A nuanced role for insomnia in suicidality in clinical youth was observed.

Comorbid insomnia significantly increased suicidal risk (Song et al., 2022), both ideation (SI; Fan et al., 2024), and attempts (Shi et al., 2023) in depressed young people. However, while insomnia was associated with suicide risk among inpatient adolescents, controlling for age and gender nullified this link (Zullo et al., 2017). Additionally, in a well-controlled model accounting for anxiety, depression, previous hospitalisations, and others, insomnia-related daytime dysfunction, but not overall insomnia severity or night-time symptoms, significantly predicted higher suicidal ideation (Fan et al., 2024). Similarly, though day-to-day sleep variability was relevant, baseline insomnia score did not predict daily suicidal thinking of youth with suicide risk (Glenn et al., 2021). Moreover, comorbid insomnia did not independently predict suicide risk when gender, depressive history and nightmares were controlled for, however, insomnia may influence suicidality indirectly as it highly correlated with the independent risk factors, such as nightmare distress (Song et al., 2022). This was supported as a relationship from insomnia to suicidality was mediated by depressive symptoms and perceived burdensomeness (Zullo et al., 2017).

Mechanisms of Associations and Comorbidities

Ten cross-sectional studies examined potential mechanisms of the relationships between insomnia and mental health difficulties in young people. These comprised explorations of relationships involving insomnia and biological pathways such as inflammation or epigenetic and neurochemical changes, with mixed results. Most studies focussed on depression (n = 8), with only one examining individuals with BPD features.

Using diagnostic interviews of a community adolescent sample and retrospectively reported age of onset corroborated by parents, Johnson et al. (2006) found a complex interplay of temporal

associations; insomnia was associated with increased odds of depression onset (OR = 3.8) after adjusting for prior anxiety disorders, while prior anxiety disorders, but not depression, was associated with subsequent insomnia. This suggests that insomnia may be a risk factor for depression, while its relationship with anxiety disorders could be mediated by depression. In inpatient youth, controlling for depression eliminated the insomnia-anxiety link (Johnsen et al., 2024), further reinforcing depression's potential mediating role.

Two studies explored insomnia as a mediator in youths with depression; insomnia partially mediated between childhood trauma and depression (Luo et al., 2022) and fully mediated between emotional abuse, physical abuse and neglect, and suicidal ideation (Li et al., 2023). However, as Luo et al. (2022) did not fully account for confounders despite a large sample (N = 285), and Li et al. (2023) lacked adjustments for key confounders and multiple testing, cautious interpretation is warranted.

Five studies explored biological pathways among depressed youths. Three studies investigated inflammation. Two of these found no independent links with self-reported insomnia after accounting for confounding variables (Liu et al., 2024; Strumberger et al., 2024); only one symptom, clinician-rated difficulty maintaining sleep, correlated with low-grade inflammation (Strumberger et al., 2023). Comorbid insomnia itself was only associated with depression severity and one inflammation marker after adjusting for near-significant variables in first-episode depression (Liu et al., 2024). One study on epigenetic changes and another on neurochemistry related to insomnia, in depressed boys, found that depression accounted for the association between insomnia and synaptic pathway or frontal lobe neurochemistry (Ämmälä et al., 2019; Urrila et al., 2017). Both were limited by small samples ($n < 10$), potential inclusion of one non-depressed participant, and the use of all-male sample affecting generalisability.

Alternately, one study examined mediating roles of depression, anxiety, stress and emotion regulation on insomnia among youth with BPD features (Jenkins et al., 2022a). Depression, anxiety, and stress were all significant individual mediators, while within emotion regulation subscales, only

impulse control difficulties and emotion regulation strategies mediated between BPD and insomnia. However, when depression, anxiety, stress, and emotion regulation subscales were considered together, only anxiety and impulse control difficulties significantly mediated the relationship between BPD and insomnia.

Functional Outcomes

Five observational studies examining the functional impact of comorbid insomnia in youth with mental health problems all reported that insomnia negatively affected functioning. Comorbid insomnia was associated with educational difficulties in inpatient adolescents (Johnsen et al., 2024), lower quality of life in young females with PTSD (Sarigedik & Yurteri, 2021), poorer self- and parent-reported functioning in those with BDD (Sevilla-Cermeño et al., 2020).

UHR youth with comorbid insomnia also reported that insomnia negatively affected their social functioning (Waite et al., 2018). As one young person described:

'....because I was up at night, I wouldn't be up in the day and I wouldn't go out and see people because I was sleeping, and it was just… I just think it was very unhealthy' (Waite et al., 2018).

However, while depressed young people with comorbid insomnia reported greater academic stress and poorer family relationships, insomnia was no longer significantly associated with these outcomes after controlling for depression and alexithymia (Yang et al., 2024). Only the insomnia-depression relationship remained significant, suggesting that depression may mediate the association between insomnia and these functional outcomes.

Treatment Impact

Three observational studies examined comorbid insomnia effects on treatment provision, yielding mixed findings, while four studies targeting mental health disorders were associated with post-treatment improvements in comorbid insomnia.

Comorbid insomnia was not associated with admission length among adolescent inpatients (Johnsen et al., 2024) or with number of sessions and medication use in youth with BDD (Sevilla-

Cermeño et al., 2020). Moreover, depressed youth with insomnia had lower antipsychotic use than those without insomnia (Shi et al., 2023). It is unclear whether these findings on treatment provision reflect similar treatment needs across groups or limited consideration of insomnia in treatment decisions.

Regarding treatment outcomes, multi-modal treatment targeting obsessive-compulsive and related disorders improved comorbid insomnia symptoms post-treatment, however longer term effects were unclear – either unexamined (Sevilla-Cermeño et al., 2020) or potentially unreliable due to attrition and fluctuating follow-up symptoms (Rautio et al., 2024). Notably, while BDD symptoms improved regardless of insomnia status, remission rates were significantly lower in those with comorbid insomnia (Sevilla-Cermeño et al., 2020). Two studies evaluating different depression interventions in inpatient adolescents, also reported insomnia improvements. A four-day trial of adjunctive triple chronotherapy – combining sleep deprivation, bright light therapy, and sleep phase advancement – showed post-intervention improvements across mental health symptoms and insomnia (Hurd et al., 2019). However, high attrition at 30-day follow-up (45%) limits conclusions on sustained effects. In contrast, Mlyncekova et al. (2023) tested the antidepressant Vortioxetine in depressed adolescents, attributing improvements in depression and insomnia to reduced time to enter and remain in REM sleep. However, methodological issues including lack of first-night control in polysomnography reduce confidence in this finding.

Interventional Approaches for Co-Morbid Insomnia in Clinical Youth

Nine studies investigated adapted CBT-I offered to young people with depression (*n* = 1), UHR (*n* = 2), AN (*n* = 1) and mixed, severe mental disorders (*n* = 5). Adaptations to CBT-I were made for age and clinical presentations such as psychosis risk, with variability in parental support incorporation. Interventions spanned 4-8 sessions, three were delivered digitally.

Six of the nine CBT-I studies were uncontrolled feasibility trials or case series (Bradley et al., 2018; Cliffe et al., 2020; Mathews et al., 2023; Rollinson et al., 2021, 2024; Zetterqvist et al., 2021). All reported significant reductions in insomnia severity, with some observing improvements by

session three, suggesting a rapid treatment response in this population (Mathews et al., 2023; Rollinson et al., 2021). Consistent improvements were also observed in socio-occupational functioning and mental health symptoms including depression, anxiety, paranoia, and hallucinations. Notably, Mathews et al. (2023) found that while insomnia improved by session three, mood and anxiety improved only for those completing all sessions; this intervention was offered *'first line*' to young people referred to mental health services and over half of completers required no further mental health treatment. However, lack of control groups and modest sample sizes ranging from 11 to 56, may limit the broader implications of these findings.

The three remaining studies used comparators to investigate the effects of adding CBT-I to established treatments, with two using randomized allocation (Clarke et al., 2015; Waite et al., 2023). Waite et al. (2023) compared CBT-I added to usual treatment in UHR youth while Clarke et al. (2015) compared CBT-I to sleep hygiene, both delivered alongside CBT for depression and with therapist effects controlled. Waite et al. (2023) reported significant improvements in insomnia, affective, and psychotic symptoms for the CBT-I group. In contrast, Clarke et al. (2015) found no significant between-group differences in insomnia or depression severity, however, did observe trends suggesting faster and higher depression recovery rates in the CBT-I group by 26-week follow-up. Underpowered samples and the overlap between CBT-I and sleep hygiene components may have diluted the contrast between conditions in this study. While both these studies demonstrated favourable CBT-I outcomes, by contrast, among young people with anorexia, adjunctive CBT-I did not significantly improve overall insomnia scores compared to usual care, possibly due to low baseline insomnia levels (mean ISI =9.95). The CBT-I group improved in other sleep-related symptoms and physical well-being however (Crevits et al., 2024).

A qualitative study interviewing patients from Bradley et al. (2018), indicated that patients felt the insomnia intervention improved their mental health symptoms along with their sleep:

'Since I've been sleeping better, my, visual things have like stopped'

'... the depression has been the big step. It's really eased' (Waite et al., 2018).

Discussion

This systematic review explored the effects of comorbid insomnia in a youth population with mental health problems. Insomnia showed high co-morbidity (above 20%) across all reported psychiatric populations, despite variability in characterisation thresholds. Comorbid insomnia was associated with greater symptomatology across all examined disorders. It was also linked to increased suicidal risk, primarily through daytime dysfunction and by influencing depression and feelings of burdensomeness. Insomnia appeared to mediate in relationships between childhood trauma and subsequent depression, or suicidality among depressed adolescents. However, biological mechanisms underlying insomnia in youth mental health remained inconclusive. Young people with comorbid insomnia across psychopathology reported poorer quality of life and socio-occupational functioning than peers with the same mental health condition without insomnia, in concordance with findings in healthy adolescents and adults with depression (de Zambotti et al., 2018; McCall et al., 2010). Encouragingly, insomnia appeared responsive to CBT-I among a clinical youth population, with positive effects on mental health and other domains also consistently reported.

Overall, the high comorbidity of insomnia in clinical youth populations aligns well with adult studies (Ohayon et al., 1998; Reeve et al., 2019; Seow et al., 2018). Variability was observed across disorders and settings which may partly relate to measurement inconsistencies. Additionally, not all disorders or settings were equally represented in the relevant included studies. For example, only Johnson et al. (2006) examined anxiety disorders, and none examined bipolar disorder or psychosis. Notably, although the examined disorders are common in outpatient settings, no included study directly examined comorbidity rates in this context where most young people first seek support.

Moreover, comorbid insomnia was related to worse depression, PTSD and BDD, alongside further symptoms and comorbidities in young people with existing mental disorders. However, the strongest and most frequently examined associations were with depression, with other disorder-specific relationships appearing less consistent, possibly reflecting limited research attention. For instance, in the only study examining BDD, clinician-rated BDD symptomatology was unrelated to co-

morbid insomnia (Sevilla-Cermeño et al., 2020). While insomnia links with anxiety disorders or psychosis are more explored in adults (Palagini et al., 2022), a similar pattern is evident, where insomnia-depression link is most investigated (e.g., Li et al., 2016; O'Brien et al., 2011) and well-defined, while with others appear less firmly established, though support insomnia-mental health link (Hertenstein et al., 2019, 2023; Pigeon et al., 2017). Alongside comorbidity variations (Ohayon et al., 1998), it could be considered whether insomnia relates subtly differently to different severities or conditions, which have not yet been thoroughly examined, or whether it may simply reflect uneven research attention.

The included studies on underlying mechanisms of the insomnia-mental health relationships suggest this is an under-researched area with notable methodological limitations such as small sample sizes or inadequate accounting for confounders. Single studies examined bidirectional and mediatory relationships between insomnia, anxiety, depression, childhood trauma and BPD variably. Emerging evidence suggested insomnia as an independent risk factor for depression onset (Johnson et al., 2006) as has been established among adults (Baglioni et al., 2011). In contrast, as in a large adult cohort study finding no relationship between insomnia and inflammation (Prather et al., 2015), this review found limited evidence of a link between insomnia and inflammation independent of depression. Depression also accounted for associations between insomnia and neurobiological correlates, such as synaptic or frontal lobe changes (Ämmälä et al., 2019; Urrila et al., 2017).

With regards to suicidality, comorbid insomnia consistently associated with increased suicidal risk. While many reviews in this area examine sleep disturbances rather than insomnia alone and typically sample community-based adults or adolescents (Baldini et al., 2024; Goldstein & Franzen, 2022; Malik et al., 2014; Wang et al., 2019), their broad findings of insomnia being associated with higher suicide risk, concurs with this review. For depressed youths, insomnia elevated suicidal ideation through associated daytime dysfunction (Fan et al., 2024), which was also observed in adults with treatment-resistant depression (Maruani et al., 2023). Although comorbid insomnia was one of few modifiable risk factors identified, it was not an independent risk factor for

suicidality in the included studies, when controlling for confounders. In contrast, a systematic review including adults with mental health problems found insomnia was often independently linked to suicidality, while studies supporting indirect links had methodological limitations (Woznica et al., 2015). It is possible therefore that the current findings may be specific to a clinical *youth* population.

CBT-I was broadly effective in clinical youth populations, showing reductions in mental health symptoms, good feasibility and high acceptability across studies. Only one study did not report improvements in insomnia (Crevits et al., 2024). Overall, the findings concur with adult psychiatric literature, where CBT-I yields good effect sizes for insomnia improvement, although outcomes for mental health symptoms are more variable – generally more favourable for disorders such as depression and PTSD, compared with psychosis and bipolar disorder, with limited sustained improvements noted (Hertenstein et al., 2022), particularly when control groups were involved (Jansson-Fröjmark & Norell-Clarke, 2016). However, youth studies were limited by small sample sizes, variations in CBT-I adaptations or treatment delivery, and limited control groups. Evidence-base for clinical youth therefore appears relatively underdeveloped and findings are not entirely comparable to adult studies. While differing mental health populations examined across controlled studies reduce theoretical generalisability, as many studies were conducted in clinical settings, findings hold validity for clinical practice.

Limitations

While the review synthesises available evidence on varied impacts of comorbid insomnia in clinical youth populations, several limitations should be noted. Forward citation searches were not conducted, which may have limited the identification of all relevant studies. Although the review aimed to examine 14-to-25-year-old young people, variations in how youth population is defined across the literature led to the inclusion of studies with mean participant age within this range, resulting in a broader overall age span. This limits the extent to which findings can be interpreted specifically in the context of sleep changes from adolescence onwards, though clinical utility for youth mental health services remains.

To ensure methodological rigour, only studies using valid measures of insomnia were included. As a result, commonly used markers such as sleep onset latency and objective measures were excluded, potentially limiting the comprehensiveness of findings and the review. This also led to studies like Urrila et al. (2014) and Reynolds et al. (2020), which otherwise aligned with the review aims but assessed insomnia using subscales or individual items from broader measures being excluded; these may have added relevant insights.

Clinical Implications

Across the range of disorders and outcomes included within the review, co-morbid insomnia was reliably linked with worse severity and functioning, while inclusion of CBT-I offered positive sleep and mental health outcomes. In line with one of the prevailing perspectives in insomnia literature (Dolsen et al., 2014; Harvey, 2008), these findings support insomnia as a transdiagnostic risk factor in this population. They also suggest that the insomnia and mental health bidirectional relationship emerge earlier in life. For clinicians working with youth with mental health problems, the importance of increased attention to insomnia is therefore strongly supported. Given the preference for transdiagnostic approaches within youth mental health services (Colizzi et al., 2020; McGorry et al., 2013), these findings support the value of embedding targeted insomnia interventions to improve overall outcomes for young people.

Directions for Future Research

Several gaps within the literature have been highlighted which future research could address. Firstly, the need for prospective and longitudinal studies are emphasised as majority of non-intervention studies were cross-sectional. These limit causal inferences or understanding of temporal changes particularly important in a youth sample. Most disorder-specific literature is heavily focused on depression, with conditions like anxiety disorders, and psychosis notably underrepresented and requiring examination. Research into underlying mechanisms—such as emotion regulation or neurobiological pathways —remains limited and methodologically weak, requiring further rigorous attention. The finding regarding the independent role of insomnia in suicidality within this study are

interesting to note and merits further investigation, across a wider population of young people with mental health problems.

Given the limitations of existing evidence on CBT-I effectiveness among a clinical youth population, randomised controlled trials testing CBT-I are now needed in this population. In parallel, findings in adults suggesting differential CBT-I effects across different mental health problems may benefit from exploration in youth mental health settings. For example, such variations may be related to baseline differences in mental health severity which has implications for where interventions should be targeted and therefore requires investigation. Finally, intriguing possibilities of co-occurring sleep difficulties in this young population with mental health problems and insomnia were raised by studies such as Song et al. (2022) examining both insomnia and nightmares. Future studies should explore these unexplored comorbidities to inform adaptations of existing insomnia interventions or deepen understanding of their prevalence and impact in young people with existing mental health problems.

Conclusion

This systematic review highlights comorbid insomnia is common among youth with mental health difficulties and is consistently linked to greater symptom severity, poorer functioning, and heightened suicidality. While most research has focused on depression, preliminary evidence suggests that insomnia exerts similar effects transdiagnostically. Emerging but methodologically limited research into mechanisms linking insomnia and mental health, including its mediating role between trauma and depression or suicidality were identified. Promisingly, CBT-I showed positive effects on both sleep and mental health outcomes. However, the need for more rigorous trials is highlighted based on mainly uncontrolled and small-scale studies. Overall, the findings underscore the importance of recognising and addressing insomnia as a core clinical feature in youth mental health settings. Integrating sleep-focused assessment and intervention into routine care may offer a promising pathway to improving outcomes for young people with mental health problems.

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Chapter Three:
Bridging Chapter

Word count**:** 565

The preceding systematic review identified comorbid insomnia as highly prevalent among youth with mental health difficulties and consistently associated with worse clinical outcomes, including heightened symptom severity, reduced functioning, and increased suicidality. The review also found cognitive-behavioural therapy for insomnia (CBT-I) showed promise in this population, with improvements in insomnia and mental health symptoms both often reported.

While it was out of the scope of the review, some of the studies included in the review reported findings that raised questions about the prevalence and role of other comorbid sleep difficulties in addition to insomnia within this population. For example, Song et al. (2022) found that young people with depression experienced more frequent and more distressing nightmares compared with healthy adolescents. Within this study, insomnia severity, daytime sleepiness and mental health severity were all significantly higher among depressed adolescents with suicide risk, with nightmare-related distress – but not comorbid insomnia – being highlighted as an independent risk factor for suicide risk.

Likewise, examination of inflammation and insomnia relationships among depressed young people showed little evidence, however, other disruptions in sleep were implicated, namely, middle insomnia and slow-wave sleep showed associations with low grade inflammation (Strumberger et al., 2023, 2024). Given that insomnia itself was not related, it raises the possibility that other sleep disturbances, such as nightmares or episodes of sleep-related hallucinations or sleep paralysis, may be behind middle insomnia symptoms or increased disruptions in slow-wave sleep, which is said to be the most restorative element of sleep (Dijk, 2009).

Both the findings above highlight the need to investigate comorbid sleep problems in addition to insomnia in youth with mental health problems. Firstly, they emphasise the possibility that other sleep problems may be more frequent in young people with insomnia and mental health problems. Secondly, the raise the possibility that other sleep problems may create disruptions in sleep which have an impact on mechanisms related to sleep-mental health link, or mental health directly. Importantly, if it is the case that other sleep problems co-occur more frequently in young

people with mental health problems and insomnia and that they have unique impacts on mental health symptoms, then these may influence response to emerging sleep interventions, which currently predominantly target insomnia, as outlined in the review. These, together with the potential questions raised in the review discussion about whether response to CBT-I type interventions differs in different mental health problems or severities, merit investigation as they all have implications for emerging insomnia interventions. These have shown promise in clinical youth mental health settings and whilst randomised control trials are warranted, these are costly and resource-intensive (Hariton & Locascio, 2018), while some of the above questions could be more readily explored and have more immediate clinical relevance or generalisability in developing or adapting interventions or targeting the interventions differently.

The study presented in the next chapter focuses on a youth sample with mental health problems and insomnia. It draws on clinical data to investigate the prevalence and characteristics of other sleep disturbances—such as nightmares, circadian rhythm disruptions, sleep paralysis and sleep-related hallucinations—among young people with mental health difficulties seeking insomnia support. It further examines how these disturbances relate to clinical severity and evaluates whether they influence response to a low-intensity sleep intervention. It is hoped that the study will contribute to understanding about other sleep difficulties in young people with mental health problems and inform sleep intervention delivery.

Chapter Four:
Empirical Paper -

Understanding the Sleep Problems of Young People in Mental Health Services, Their Links to Mental Health Difficulties and Effect on Sleep Intervention Response

Prepared for submission to PLOS ONE[1]

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[1] Author guidelines are available in Appendix A. Figures and tables are provided within the main body of the text and APA reference style has been followed for the purposes of the thesis. These and line numbering will be amended for journal submission.

Understanding the sleep problems of young people in mental health services, their links to mental health difficulties and effect on sleep intervention outcome

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Abstract

Background: With insomnia interventions increasingly recognised as important for young people with mental health problems, little is known about comorbid sleep difficulties present in this population, including their relationship with mental health, or their impact on treatment response. Understanding these may help develop or improve burgeoning sleep interventions in this population.

Aims: This study investigated specific sleep disturbances—insomnia, nightmares, circadian rhythm disruptions (CRD), and unusual sleep experiences (UES, sleep paralysis or sleep-related hallucinations)—in young people with mental health problems seeking insomnia support. It explored their associations with demographic and clinical characteristics and whether baseline sleep characteristics and mental health severity predicted insomnia treatment response.

Methods: A secondary analysis of anonymised data from young people aged 14–25 receiving a CBT-I-informed sleep intervention (Better Sleep Programme) across primary and secondary mental health services, using sleep and mental health measures collected pre- and post-treatment.

Results: Most youth (64.2%) reported additional sleep disturbances. Females, those not in education or employment or only occupied part-time reported nightmares more frequently. Nightmares and UES were more common with secondary care service users. Older youth, females, those not in education or employment and those receiving secondary mental health care reported greater insomnia severity. Only baseline insomnia severity—not comorbidities or mental health severity—predicted response to insomnia intervention.

Conclusion: High comorbid sleep difficulty rates in youth mental health services highlight the need for broader sleep assessments. The intervention improved insomnia regardless of comorbidity or mental health severity, supporting its integration into youth services.

Keywords*:* Youth Mental Health, Insomnia, Nightmares, Circadian Rhythm, Unusual sleep experiences

Introduction

Youth—a transitional period from adolescence to early adulthood—is a time of increased vulnerability to sleep loss, with higher rates of sleep problems, *and* the onset of most life-time mental health problems (Crowley et al., 2018; Hysing et al., 2013; Kessler et al., 2007; McArdle et al., 2020; Roberts et al., 2009; Solmi et al., 2022). Amid growing evidence that sleep disturbance plays a causal role in the development of mental disorders (Freeman et al., 2020; Sun et al., 2022), among youth, it significantly increases first-onset mood and psychotic disorder risk (Scott et al., 2021). Furthermore, sleep disturbances co-occurring with mental disorders are associated with greater clinical severity, heightened suicidality, poorer treatment response and reduced quality of life (Krystal, 2012; Malik et al., 2014; Waite et al., 2020).

In youth mental health services where transdiagnostic early interventions are prioritised, sleep is increasingly recognised as an intervention target for preventing or improving mental health difficulties in young people (Colizzi et al., 2020; McGorry & Mei, 2018; Wade et al., 2025). Sleep interventions such as cognitive behavioural therapy for insomnia (CBT-I), are effective in adults with comorbid mental disorders and improve mental health symptoms; emerging evidence also supports it as an effective early intervention (Hertenstein et al., 2022; Palagini et al., 2024; Schneider et al., 2023). Additionally, patients with mental illness highlight sleep as among their priorities for treatment (Faulkner & Bee, 2016). As stigma is a frequent barrier to mental health support for young people, there is a potential for sleep interventions to be more acceptable and promote engagement (Plaistow et al., 2014; Roberts et al., 2022; Waite et al., 2018).

Although CBT-I shows promise for young people, evidence predominantly comes from non-clinical samples, namely school-based or community populations without recognised mental health problems (Blake et al., 2017). While a few studies have explored adapted CBT-I in clinical youth populations, reporting positive effects on both insomnia and mental health symptoms, they are often limited by small sample sizes or lack of control groups (e.g., Bradley et al., 2018; Clarke et al., 2015; Rollinson et al., 2021, 2024; Waite et al., 2023). Moreover, while one school-based study found

adolescents with higher self-reported depression and anxiety experienced greater benefit from an adapted cognitive-behavioural sleep intervention (Blake et al., 2018), whether mental health symptom severity influences sleep treatment response in young people with pre-existing mental health problems has not been examined.

Importantly, the literature has largely focussed on insomnia or unspecified sleep quality difficulties (Clarke et al., 2021; Stowkowy et al., 2020), overlooking sleep disturbances stemming from circadian rhythm disruptions (CRD), or parasomnias including nightmares, sleep-related hallucinations, and recurrent isolated sleep paralysis (American Academy of Sleep Medicine, 2023; American Psychiatric Association, 2013). These have received little attention altogether, while healthy youth population studies are more prevalent in insomnia research (de Zambotti et al., 2018; Donskoy & Loghmanee, 2018).

Investigations of other sleep problems, when they have occurred, have noted associations with more severe mental health presentation. Adolescents with mental health problems exhibited greater circadian rhythm disruption (delayed sleep-wake phase disorder) than those without, with distinct sleep and mental health profiles suggesting differential patterns of insomnia and CRD across disorders also observed in a large adolescent sample (Hysing et al., 2022). Likewise, among adolescent psychiatric patients, nightmare frequency and distress were associated with depressive symptoms (Wang et al., 2023). Although rarely explored in youth, high prevalence rates for sleep-related hallucinations and sleep paralysis, with high comorbidity of sleep disturbances was noted among adults with early psychosis (Reeve et al., 2019), suggesting that this may be an important line of enquiry requiring examination in young people with mental health problems.

Understanding whether baseline mental health severity affects response to CBT-I-based or other sleep-focused interventions could inform how and where such treatments are best delivered or adapted. Exploring specific sleep disturbances in young people with mental health disorders – including how they interact with mental health – is essential for identifying which other sleep difficulties most urgently require intervention. Evidence of high comorbidity among sleep

disturbances in other mental health populations underscores the importance of examining these patterns in youth with mental health problems and insomnia, and whether these potentially influence sleep intervention outcomes. Together, these insights could guide sleep intervention improvement within youth mental health services.

The Current Study

The Better Sleep Programme is a six-session individual sleep intervention based on CBT-I principles. Treatment components include psychoeducation, sleep hygiene, stimulus control, sleep scheduling, increased daytime activity, relaxation, and cognitive strategies (Rollinson et al., 2024). Acceptance and Commitment Therapy (ACT)-based defusion techniques and mindfulness can be incorporated into the cognitive strategy component. Further intervention details are published elsewhere (Rollinson et al., 2021, 2024).

Using anonymised clinical data from this programme, this study aimed to investigate the prevalence and characteristics of specific sleep disturbances, namely, nightmares, sleep paralysis or sleep-related hallucinations, and circadian rhythm disruptions among youths with mental health difficulties and insomnia. It sought to explore their interactions with mental health, and whether treatment responses may be influenced by the presence of different sleep difficulties, insomnia severity or mental health severity.

Research Questions

1. What sleep disturbances are present among young people accessing a sleep intervention pathway in mental health services?
2. What is the relationship between different sleep disturbances and demographic factors?
3. What is the relationship between different sleep disturbances (including comorbidities) and mental health severity?
4. Do baseline sleep disturbances, insomnia severity and mental health severity affect response to the sleep intervention?

Methods

Design

This study is a quantitative secondary analysis of the Better Sleep Programme (BSP) data.

Procedure

Practitioners across Norfolk and Suffolk primary and secondary mental health services are trained to deliver the BSP intervention to those reporting insomnia and wishing to address it. Clinical measures were collected by trained practitioners at the start and end of the BSP intervention. Anonymised data was shared with the BSP team with client consent. Data included in the current analysis was collected between 27 October 2022 and 12 January 2025.

Ethical Considerations

The Health Research Authority approved the use of anonymised NHS data for this study (reference: 24/HRA/2014; Appendix C). Ethical approval was granted by the Faculty of Medicine and Health Sciences at the University of East Anglia (Appendix D) and the NHS trust where the data was collected.

Participants

The dataset comprised the anonymised assessment and routine outcome data of 192 patients who received the BSP intervention between the above dates. Data of those outside of the 14-25 age range, with no age or sleep measures available were excluded (*n* = 13). Following these exclusions, the final sample consisted of 179 patients. The patients accessing the intervention were seen in NHS talking therapy services, secondary care mental health specialist teams for children and young people, mental health support teams in schools, local authority children's services and voluntary, community or social enterprise services providing interventions including counselling, emotional and mental health support to young people. While each service had their own criteria, experiencing mental health difficulties was a requirement to access all the services.

Measures

Demographic Information

Demographic data comprised age, gender at birth, gender identity, ethnicity, and educational or employment (occupational) status of the patient. Occupational status was aggregated to full-time, part-time and 'none' categories indicating full-time, part-time and no educational or employment engagement respectively.

Service Setting

The service setting for each patient was categorised into primary care (mild to moderate mental health problems) and secondary care (moderate to severe mental health problems) and served as an index of mental health severity. All services other than secondary care mental health teams were considered primary care.

The following measures, used at the start and end of treatments, were available.

Sleep Measures

Sleep Assessment Summary Table. This is a BSP-specific clinician-reported measure (see Appendix E). Using qualitative information from a semi-structured assessment interview, clinicians indicate the probable presence of sleep difficulties, including insomnia disorder, nightmares, CRD, and unusual experiences during sleep (UES), namely sleep-related hallucinations and sleep paralysis. In line with the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 2013), clinician-rated insomnia disorder was considered as present where there was an explicit 'yes' answer to difficulties falling asleep, staying asleep, or waking too early at least three nights per week, with a significant impact on daytime functioning, and a duration of at least three months. Nightmares and UES were identified through indications by clinicians about their presence and associated distress. Similarly, probable CRD was defined as a 'yes' rating that there was a difficulty with sleeping well, but at the wrong time.

Since all young people were presenting for support with insomnia, comorbidity constituted the presence of additional sleep disturbances explicitly indicated by clinicians. It was categorised as having no co-morbidities (insomnia only), one other sleep disturbance, or two or more additional sleep disturbances.

Insomnia Severity Index (ISI). ISI (see appendix F) assesses insomnia using a seven-item self-report questionnaire with total score between 0 and 28 (Bastien et al., 2001). It has been validated in adults and adolescents for detecting insomnia and assessing insomnia treatment response (Chung et al., 2011; Gerber et al., 2016; Morin et al., 2011). Cerri et al. (2023) also found high reliability, with Cronbach's alpha up to 0.92 for ISI.

Sleep Efficiency Quotient (SEQ). SEQ refers to the percentage of time spent asleep out of the total time spent in bed. A low SEQ suggests greater difficulties with sleep onset and duration (Reed & Sacco, 2016). Calculated using contemporaneous weeklong sleep diaries, it is used as an insomnia intervention effectiveness measure (Rossman, 2019; Trauer et al., 2015). The BSP pathway uses a consensus sleep diary (Carney et al., 2012) with language and structure adapted for young people, including sleep onset, sleep disruption and rising times, total sleep duration and nightmares. Clinicians use detailed retrospective sleep analysis over 3 nights to calculate the SEQ if a sleep diary is not available.

Mental Health Measures

Different mental health measures were used based on service and age.

Clinical Outcomes in Routine Evaluation-10 (CORE-10). CORE-10 (see Appendix F, Barkham et al., 2013) assesses psychological distress including depression, anxiety, suicidality and functioning, over the past week using a self-report measure comprising 10 questions with total score between 0 and 40. It has high internal consistency of 0.90 (Barkham et al., 2013), validity for longitudinal use among adults (Rosenström et al., 2022) and reliability for youths of 17-to-25 age range (O'Reilly et al., 2016). Scores above 11 indicate clinically significant psychological distress (Barkham et al., 2013).

Young Person's Clinical Outcomes in Routine Evaluation (YP-CORE). YP-CORE (see Appendix F, Twigg et al., 2009) is validated for young people between 11 and 18 years of age as a measure of psychological distress. It is equivalent to the CORE-10 on number of questions and scoring, with adapted language for youth. It has good internal reliability (alpha = 0.80) among individuals between 11 and 16 years old (O'Reilly et al., 2016).

Data Analytic Plan

All data was analysed using SPSS version 29.0.1.0 (IBM Corp, 2023).

Missing data rates ranged from none (e.g., age and service setting) to up to 40% (e.g., SEQ) for baseline measures. Potential systematic bias related to missing data was assessed by examining relationships between variables with the highest missing rates and variables with complete data. No significant relationships were found between missingness in these variables and complete data (e.g., for SEQ and service setting: $\chi^2(1) = 0.04$, $p = .56$), suggesting no strong evidence of systematic missingness by service setting or age. During analyses, youth with missing data were excluded only from the specific analysis for which their data was missing.

Prior to conducting inferential analyses, normality assumptions for continuous variables were assessed using skewness and kurtosis z-scores, visual inspection of histograms and Q-Q plots, and statistical tests of normality. This then determined the use of parametric or non-parametric tests. Inferential tests were omitted if group sizes were too small ($n < 10$) due to statistical validity concerns.

Across all research questions, as all youth were seeking insomnia support, presence of insomnia would be less informative, and therefore for insomnia, its severity as measured by the ISI, a well validated measure, was investigated.

What Sleep Disturbances are Present Among Youth in Mental Health Services?

To answer the first research question, descriptive statistics were presented on insomnia, other sleep disturbances and comorbidity.

What is the Relationship Between Different Sleep Disturbances and Demographic Factors?

To explore differences in the presence of sleep disturbances across demographics, chi-square, independent samples t-test, one-way ANOVA and Mann-Whitney U tests were undertaken as appropriate to variable type and normality levels. Age, sex and occupational status were used as demographic factors, as ethnicity and gender identity contained subgroups that were too small.

What is the Relationship Between Different Sleep Disturbances (including Comorbidities) and Mental Health Severity?

To examine the relationship between sleep disturbances, comorbidities and mental health severity, chi-square, independent samples t-test and Mann-Whitney U tests were undertaken as appropriate to variable type and normality levels. All sleep disturbances, ISI scores, SEQ and comorbidity data were examined. Service setting and YP-Core scores were used as primary indicators of mental health severity as they encompassed a range of services.

Do Baseline Sleep Disturbances, Insomnia Severity and Mental Health Severity Affect Response to the Sleep Intervention?

Intervention response was defined as change in ISI score from assessment to post-treatment. Pearson's and Spearman's correlations, and independent samples t-tests were undertaken to analyse the relationships between this and baseline sleep and mental health variables. Demographic variables were also tested individually with change in ISI score as they could be potential confounders.

Due to small sub-group size for the category with two or more added sleep disturbances, the categories for comorbidity were aggregated to two categories by combining two groups with additional sleep problems. A t-test was then used to analyse the difference between change in ISI and this variable.

A multivariable linear regression analysis was then conducted using statistically significant variables from above to test if these in combination could significantly predict intervention response, along with suitable tests of assumptions for the model.

Results

Sample Characteristics

The mean sample age was 18.2 years (*SD* = 3.4, range = 14 – 25) at assessment. Of those with known sex (*N* = 165) and gender (*N* = 164), the majority were assigned female at birth (*n* = 126; 76.4%) and identified as female (*n* = 113, 68.9%). Nine individuals (*n* = 9; 5.5%) identified as non-binary or another gender. Most of the sample with available ethnicity data (*N* = 156) were White (*n* = 150, 96.2%). Among those with known occupational status (*N* = 153), 22.9% (*n* = 35) were not in education or employment while 60.1% (*n* = 92) were in full-time, and 17% (*n* = 26) were in part-time employment or education.

Sixty-nine youths (38.5%) were seen in secondary care services while 110 (61.5%) were seen in primary care services.

Table 1

Sleep disturbances among the sample population

Sleep disturbances	N	%
Nightmares [a]		
Yes	65	41.7
No	91	58.3
Circadian rhythm disruptions [b]		
Yes	37	24.7
No	112	75.3
Unusual experiences [c]		
Yes	39	26.9
No	106	73.1
Clinician-reported Insomnia disorder [d]		
Yes	139	85.8
No	23	14.2
Self-reported insomnia (ISI)[e]		
No clinical insomnia (0-7)	1	0.6
Subthreshold insomnia (8-14)	35	20.1
Clinical insomnia (15-28)	138	79.3
Comorbidity [f]		
No other sleep problems	58	35.8
One other sleep problem	69	42.6
Two or more other sleep problems	35	21.6
Insomnia severity	M	SD
ISI	18.0	4.4

SEQ [g]	62.93	18.63

Note. M = mean, SD = standard deviation, ISI = Insomnia Severity Index, SEQ = Sleep Efficiency Quotient

[a] N = 156 (23 missing), [b] N = 149 (30 missing), [c] N = 145 (34 missing), [d] N = 162 (17 missing), [e] N = 174 (6 missing), [f] N = 162 (17 missing), [g] N = 108 (72 missing)

What Sleep Disturbances are Present Among Youth in Mental Health Services?

The average insomnia severity for the sample suggested moderately severe levels of insomnia (Morin et al., 2011). The average SEQ was also much lower than the above 85% considered to be the range for a good sleeper (Hysing et al., 2013; Reed & Sacco, 2016); further results related to the SEQ are presented in Appendix G.

Table 1 presents the patterns and prevalence of nightmares, UES, and CRD among the young people with insomnia alongside insomnia severity. Among those with comorbidity in addition to insomnia, 33 had nightmares (47.8%), 24 had CRD (34.7%) and 12 had UES (17.3%). Multimorbidity, that is, the presence of three or more sleep disturbances, was present for 21.6% of the sample (*n* = 35). For those with insomnia and two other sleep disturbances, the most common combination was nightmares and UES (*n* = 22, 62.8%), followed by nightmares and CRD (*n* = 8, 22.8%) and UES and CRD (*n* = 3, 8.6%). Two young people were experiencing all four sleep disturbances.

What is the Relationship Between Different Sleep Disturbances and Demographic Factors?

As shown in table 2, there was a significant moderate-to-strong positive correlation between insomnia severity (ISI) and age suggesting older youths had higher ISI scores. A significant difference of moderate effect was also found for sex, indicating that females had more severe insomnia. A one-way ANOVA found that insomnia severity was significantly different across occupational status. Based on post-hoc Tukey's HSD tests, participants who were not in any education or employment (*M* = 20.1) had significantly higher ISI scores compared with those in full-time education or employment (*M* = 17.1), p = .003, suggesting lower structured activity levels among those with higher insomnia. No other significant differences were found within occupational status groups.

Regarding nightmares, a significantly higher proportion of females (45.8%, *n* = 49) than males (22.9%, *n* = 8) reported nightmares. A significant association was also found across occupational status; post-hoc analysis of adjusted standardized residuals indicated that individuals with nightmares were less likely to be in full-time education or employment than those without nightmares (*ASR* = -3.0, p < .01). Only 26.3% (*n* = 20) of those engaged full-time reported nightmares, while 57.1% (*n* = 12) and 48.5% (*n* = 16) of those in part-time, or no education or employment experienced nightmares respectively, suggesting a link between nightmares and worse occupational functioning. No other significant differences related to nightmares were found.

The presence of UES and CRD did not significantly differ across demographic factors. Similarly, those with comorbid sleep disturbances were not demographically different to those with fewer or no comorbid sleep disturbances.

Table 2

Comparison of sleep disturbances across demographics groups

	Insomnia severity (ISI)				
	N=174		Statistic	p	Effect size
	N	M(SD)			
Age (years)	174	-	r(172) = 0.45	**<.001**	r^2 = 0.20
Sex (N=160)					
Female	123	18.5 (4.15)	t(158) = 2.11	**.036**	d = 0.40
Male	37	16.8 (4.98)			
Occupation status (n=148)					
Full-time	90	17.1 (4.32)	F (2, 145) = 5.76	**.004**	η^2 = 0.07
Part-time	25	17.6(4.70)			
None	33	20.1 (3.91)			
	Nightmares				
	Present (n=65)	Not present (n=91)	Statistic	p	Effect size
	N (%)	N (%)			
Mean age (SD) years	18.8 (3.5)	17.99 (3.4)	t(154) = 1.40	.163	d = 0.23
Sex (N=142)					
Female	49 (45.8)	58 (54.2)	χ^2(1, N = 142) = 5.78	**.016**	Φ = 0.20
Male	8 (22.9)	27 (77.1)			
Occupation status (N=130)					

Full-time	20 (26.3)	56 (73.7)	$\chi^2(2, N = 130) = 9.25$	**.010**	V = 0.27
Part-time	12 (57.1)	9 (42.9)			
None	16 (48.5)	17 (51.5)			

Circadian rhythm difficulties (CRD)

	Present (n = 37)	Not present (n = 112)	Statistic	p	Effect size
	N (%)	N (%)			
Mean age (SD) years	17.7 (3.6)	18.4 (3.4)	t(147) = -1.022	.308	d = 0.19
Sex (N=131)					
Female	26 (25.5)	76 (74.5)	$\chi^2(1, N = 136) = 0.05$	.819	φ = 0.01
Male	8 (23.5)	26 (76.5)			
Occupation status (n=122)					
Full-time	20 (26.7)	55 (73.3)	$\chi^2 (2, N = 128) = 2.43$	.296	V = 0.14
Part-time	8 (38.1)	13 (61.9)			
None	6 (18.8)	26 (81.3)			

Unusual Experiences during sleep (UES)

	Present (n = 39)	Not present (n = 106)	Statistic	p	Effect size
	N (%)	N (%)			
Mean age (SD) years	18.7 (3.7)	18.1 (3.3)	t(143) = 0.926	.356	d = 0.17
Sex (N=136)					
Female	25 (25.5)	73 (74.5)	$\chi^2 (1, N = 131) = 0.29$	.590	φ = 0.05
Male	10 (30.3)	23 (69.7)			
Occupation status (n=128)					
Full-time	18 (25.4)	53 (74.6)	Fisher-Freeman-Halton Exact Test[a]	.518	V = 0.18
Part-time	3 (15.8)	16 (84.2)			
None	10 (31.3)	22 (68.8)			

Comorbidity

	None (n=58)	One other sleep problem (n=69)	2+ other sleep problems (n=35)	Statistic	p	Effect size
	N (%)	N (%)	N (%)			
Mean age (SD) years	17.9 (3.2)	18.1 (3.5)	18.9 (3.7)	F(2, 159) = 0.97	.383	η^2 = .012
Sex (N=148)						
Female	40 (35.7)	46 (41.1)	26 (23.2)	$\chi^2(2, N = 148) = 2.55$	.280	φ = 0.13
Male	14 (38.9)	18 (50.0)	4 (11.1)			
Occupation status (n=136)						
Full-time	37 (46.3)	30 (37.5)	13 (16.3)	Fisher-Freeman-Halton Exact Test[a]	.129	V = 0.16
Part-time	5 (21.7)	13 (56.5)	5 (21.7)			

None	11 (33.3)	12 (36.4)	10 (30.3)

Note. CRD = circadian rhythm difficulties, M = mean, SD = standard deviation, ISI = Insomnia Severity Index, SEQ = sleep efficiency quotient, UES = unusual experiences in sleep

[a] Assumption was violated for Chi-square test of independence ($\chi^2(2, N = 122) = 1.50$, $p = 0.518$) as 16.7% of expected counts was less than 5.

[b] Assumption was violated for Chi-square test of independence ($\chi^2(2, N = 136) = 7.15$, $p = 0.128$) as 11.1% of expected counts was less than 5.

P < .05 are presented in bold

What is the Relationship Between Different Sleep Disturbances (including Comorbidities) and Mental Health Severity?

Mental health severity was defined two ways, firstly, in terms of service setting where those in secondary care services represented more severity as they were expected to have moderate-to-severe mental health problems than those in primary care where mild-to-moderate mental health difficulties are expected. Secondly, it was defined in terms of mental health measure scores.

Insomnia severity, as denoted by ISI scores, was significantly higher, with a large effect size (d= 0.71) among those in secondary care services than those in primary care. Significant moderate to large positive associations were also found between insomnia severity and both YP-CORE, and CORE-10.

Both nightmares and UES were significantly more common among youth seen in secondary care services than those within primary care services. However, no significant differences were found between those with and without nightmares or UES for self-reported YP-CORE and CORE-10 scores.

CRD and comorbidity of sleep disturbances were not significantly related to any of the mental health measures (see Table 3).

Table 3

Exploration of relationships between sleep disturbances and mental health severity

	Insomnia severity (ISI)				
	N=174		Statistic	p	Effect size
	N	M(SD)			
Service setting					

Primary care	107	16.9 (4.2)	t(172) = -4.57	**<.001**	d= 0.71
Secondary care	67	19.8 (4.0)			
Mental health severity					
YP-CORE	68	-	r(68) =0.58	**<.001**	r^2 = .34
CORE-10	53	-	r(53) = 0.55	**<.001**	r^2 = .30

Nightmares					
	Present (n=65)	Not present (n=91)	Statistic	p	Effect size
	N (%)	N (%)			
Service setting					
Primary care	30 (30.6)	68 (69.4)	χ^2(1, N = 156) = 13.25	**<.001**	φ = 0.29
Secondary care	35 (60.3)	23 (39.7)			
Mental health severity	N, M(SD)	N, M(SD)			
YP-CORE (N=58)	24, 22.3 (5.5)	34, 21.0 (7.6)	t(56) = 0.71	.483	d = 0.18
CORE-10 (N=51)	32, 26.0 (7.6) [a]	19, 20.0 (16) [a]	U= 218.50	.095	r = 0.23

Circadian rhythm difficulties (CRD)					
	Present (n=37)	Not present (n=112)	Statistic	p	Effect size
	N (%)	N (%)			
Service setting					
Primary care	28 (29.8)	66 (70.2)	χ^2 (1, N = 149) = 3.35	0.067	φ = 0.15
Secondary care	9 (16.4)	46 (83.6)			
Mental health severity	N, M (SD)	N, M (SD)			
YP-CORE (N=56)	17, 19.6 (8.0)	40, 22.1 (6.2)	T(55) = 1.28[a]	.102	d = 0.37
CORE-10 (N=47)	11, 8.6 (4.5)	19, 11.6 (5.7)	T(28) = -1.54	.136	d = 0.58

Unusual Experiences during sleep (UES)					
	UES (N = 39)	No UES (N =106)	Statistic	p	Effect size
	N (%)	N (%)			
Service setting					
Primary care	19 (20.1)	72 (79.1)	χ^2(1, N = 145) = 4.50	**0.034**	φ = 0.18
Secondary care	20 (37.0)	34 (63.0)			
Mental health severity	N, M (SD)	N, M (SD)			
YP-CORE (N=57)	18, 23.1 (5.9)	38, 20.7 (7.2)	t(54) = 1.20	.235	d = 0.34

Comorbidity					
	None (n=58)	One other sleep problem (n=69)	2+ other sleep problems (n=35)	Statistic	p	Effect size
	N (%)	N (%)	N (%)			
Service setting						
Primary care	41 (40.6)	44 (43.6)	16 (15.8)	χ^2 (2, N = 162) = 5.90	.052	V = 0.19

Secondary care	17 (27.9)	25 (41.0)	19 (31.1)			
Mental health severity	N, M (SD)	N, M (SD)	N, M (SD)			
YP-CORE (N=68)	20, 21.2 (6.5)	25, 21.6 (7.6)	16, 22.0 (5.8)	F(2, 58) = 0.06	.940	η^2 = 0.002
CORE-10 (N=53)	13, 22.2 (9.0)	23, 22.1 (8.8)	15, 27.4 (5.8)	F(2, 48) = 2.29	.112	η^2 = 0.087

Note. CORE-10 = Clinical Outcomes in Routine Evaluation – 10, CRD = Circadian Rhythm Difficulties, GAD-7 = Generalized Anxiety Disorder – 7, ISI = Insomnia Severity Index, M = Mean, PHQ-9 = Patient Health Questionnaire – 9, RCADS = Revised Child Anxiety and Depression Scale, SD = Standard Deviation, UES = Unusual Experiences in Sleep, YP-CORE = Young Person's Clinical Outcomes in Routine Evaluation
P < .05 are presented in bold

Do Baseline Sleep Disturbances, Insomnia Severity and Mental Health Severity Affect Response to the Sleep Intervention?

Table 4 illustrates the results of the univariate analyses between baseline demographic, sleep and mental health variables and treatment response. Only age and baseline ISI score significantly predicted change in ISI score, showing small and moderate positive effects respectively.

When both baseline ISI and age were used to predict treatment response in a multivariable model, the overall model accounted for approximately 17.1% of the variance in the treatment response (R^2 = .17, F(2, 151) = 15.60, p < .001). However, only Baseline ISI remained a significant predictor. These suggest that higher baseline ISI alone was associated with greater increases in change in ISI while age was not a reliable predictor.

Table 4

Relationships between baseline variables and treatment response

	Pre-Post ISI score (n=154)		Statistic	P	Effect size
	N	M (SD)			
Age	154	-	F(1,152) = 4.144	**.044**	R^2 = .03
Sex					
Female	110	11.7 (7.1)	t(140) = -0.177	.860	d = -0.04
Male	32	12.0 (6.7)			
Baseline occupational status					

Full-time	77	11.0 (6.6)	F(2,127) = 1.12	.329	η^2= 0.02
Part-time	25	12.4 (6.8)			
None	28	13.1 (7.6)			
Baseline ISI	152	-	F(1,152)=31.192	**.001**	R^2 = .17
Baseline nightmares					
Yes	57	12.1 (7.4)	t(131) = 0.530	.597	d = 0.09
No	76	11.5 (6.6)			
Baseline unusual experiences					
Yes	36	11.6 (8.4)	t(54.9) = -0.303	.763	d = -0.07
No	86	12.1 (6.7)			
Baseline CRD					
Yes	28	11.3 (6.6)	t(124) = -0.611	.543	d = -0.13
No	98	12.2 (7.1)			
Comorbidity					
Yes	88	11.9 (7.3)	t(137) = -0.154	.878	d = -0.03
No	51	11.7 (6.6)			
Service setting					
Primary	90	11.4 (6.2)	t(114.7) = -0.874*	.384	d = -0.15
Secondary	64	12.5 (7.9)			
Baseline YP-Core	55	-	F (1,53) = 1.704	.197	R^2 = .031
Baseline CORE-10	50	-	F (1,48) = 0.257	.615	R^2 = .005

* Levene's test for equality of variances was significant

P < .05 are presented in bold

Discussion

This study aimed to better understand the specific sleep difficulties experienced by young people with mental health problems and insomnia alongside their relationships with demographic and mental health factors. It then investigated whether response to a CBT-I-based intervention would be affected by additional sleep difficulties and severity of insomnia or mental health difficulties. A high comorbidity of sleep disturbances, with some associations with poorer educational or occupational engagement among those with nightmares and greater severity of insomnia were found. Greater prevalence of nightmares and UES among those with more severe mental health difficulties were also noted, although this was not across all mental health measures. Despite these presentations, only insomnia severity predicted treatment response to the sleep intervention,

suggesting that benefits from the intervention occurred regardless of other comorbidities or mental health severity.

Comorbidity of Sleep Problems

Most young people with mental health problems and insomnia experienced comorbid sleep difficulties, with one in five reporting two difficulties in addition to insomnia. This highlights frequent co-occurrences of sleep difficulties which has not been examined before in this population but was found in young adults with psychosis (Reeve et al., 2019).

Given that frequent nightmares (more than once weekly) were prevalent in 16.3% of a representative youth population (Wong et al., 2023), the rate observed in our study (41.2%) suggests substantially more young people with mental health problems and insomnia experience nightmares. The elevated rate indicates that nightmares are clinically significant in this population, yet potentially remain under-recognised (Sheaves et al., 2023). They may also reflect a closer co-occurrence with insomnia as also observed in non-clinical younger adolescents (Schlarb et al., 2025). While measurement differences could also play a role, Wong et al. (2023) used one question from a sleep quality questionnaire which is somewhat comparable to this study.

In concordance with findings from this study, one type of CRD, delayed sleep-wake phase disorder, had prevalence rates of up to 20% in adolescents with psychiatric disorders (Hysing et al., 2022). Both are notably higher than between 2 – 8% reported among general adult population and otherwise healthy adolescents with this CRD type (Hysing et al., 2022; Wilson et al., 2019), despite differences in measurement methods. Little is known of sleep-related hallucinations in comparable clinical or non-clinical youth populations. For sleep paralysis (often involving sleep-related hallucinations), lifetime prevalence of 31.9% and 28.3% are reported for adult psychiatric patients and university students respectively (Sharpless & Barber, 2011), though they did not have insomnia. The findings of this study at 26.9% refer to current difficulty with sleep paralysis or sleep-related hallucinations, rather than lifetime prevalence. However, UES also had one of the higher missing

rates (23.4% missing) suggesting potential underreporting, or challenges in symptom recognition or measurement for these little-understood difficulties.

Sleep Disturbances and Mental Health Severity

Compared to primary care settings, more young people in secondary care experienced nightmares, UES, comprising sleep paralysis or sleep hallucinations, and greater insomnia. Nightmares are common in PTSD (American Psychiatric Association, 2013) or following traumatic experiences. Sleep paralysis is also hypothesised to be linked to trauma exposure (Mellman et al., 2008) and prior research shows higher prevalence of sleep paralysis in adults with anxiety disorders—but not comorbid depression—and an association with bipolar disorder in community samples (Ohayon et al., 1999; Otto et al., 2006). Some of these difficulties, particularly trauma-related presentations and bipolar disorders are supported more within youth secondary care services, alongside other complex or severe mental illnesses which may provide some explanation for these findings (Smith et al., 2018). The effect sizes for these findings indicate clinically meaningful differences in secondary care compared to primary care, where insomnia severity was most pronounced followed by nightmares and UES. Overall, these findings reliably support an association between these specific sleep disruptions and greater mental health severity.

Sleep Disturbances Across Demographic Factors

Whilst the clinical youth literature on insomnia remains inconclusive regarding sex and insomnia severity (Allsopp & Kinderman, 2021; Firth et al., 2008), here, females reported more severe insomnia. Notably, while this sample of help-seeking young people is predominantly female at 76.4%, potentially suggesting a higher female insomnia prevalence, this could instead be linked to sex differences in help-seeking or problem-recognition (Haavik et al., 2019). Consistent with other clinical youth (Wang et al., 2023) and adult insomnia (Ohayon et al., 1997) samples, more females experienced nightmares than males.

Greater insomnia was more likely among individuals fully disengaged from employment or education, supporting findings across clinical and community adults, and young people with mental health problems, where insomnia or insomnia symptoms are associated with worse educational or occupational functioning (Bolge et al., 2009; Johnsen et al., 2024; O'Brien et al., 2011; Sevilla-Cermeño et al., 2020; Stafford et al., 2024). Similarly, the added presence of nightmares occurred more in those working part-time or with no structured activity, compared with those engaged full-time. This aligns with findings of adults with insomnia and comorbid nightmares reporting worse daytime functioning than those without nightmares (Ohayon et al., 1997). The moderate effect sizes suggest that, in mental health services, young people with more severe insomnia and nightmares may have noticeably reduced functioning or engagement in structured activities. However, as these findings, including of this study are predominantly observational, causal inferences regarding mechanisms or directionality remain limited.

Effects of Baseline Presentation on Treatment Response

Baseline insomnia was the only significant predictor of treatment response in both univariate and multivariate models, suggesting that BSP is effective across different demographic and mental health profiles, including individuals with co-occurring sleep difficulties. This is a significant finding highlighting the robustness of this intervention. This contrasted with findings among non-clinical adolescents where greater improvements were associated with higher anxiety and depression self-reports, albeit for an intervention incorporating mindfulness and assessed sleep quality improvement only (Blake et al., 2018). More broadly, findings on predictors of treatment response to CBT-I or other sleep interventions in adults with mental health problems are mixed, possibly related to differences in mental health diagnosis and variations in intervention (Chiu et al., 2018; Maruani et al., 2023; Waters et al., 2020). These inconsistencies may suggest that particularly among young people with mental health problems, CBT-I informed interventions may be useful across severities and sleep comorbidities, and the need to embed sleep intervention offers within youth mental

health services catering to all severities is highlighted though further investigations may give confidence to this interpretation.

Strengths and Limitations

A key strength of this study lies in its use of real-world data across both primary and secondary care, ensuring this youth sample is representative of clinical practice which improves its generalisability. Coupled with the use of validated measures for insomnia and mental health, this enhances the validity of the novel findings reported, providing insight into previously unexplored questions under real-world conditions.

However, some of the limitations also relate to the nature of the data used. Additional sleep difficulties were identified through BSP-specific sleep table, based on practitioner assessment of qualitative data. While clinically meaningful, this measure is not validated, and the ratings may have been subject to individual variability. Across the dataset, missing data was present, with differing proportions of each missingness resulting in inconsistencies in statistical power across analyses. Whilst missingness was compared against complete data, it is unclear whether missingness occurred in a biased way which influenced the findings, as they may also be due to factors irrelevant to this study. Due to the exploratory nature of the study, statistical tests were not corrected for multiple comparisons which may have increased the risk of type one error.

Implications for Clinical Practice and Further Research

Most young people with mental health problems and insomnia appear to also experience other sleep difficulties, suggesting that sleep difficulties should be monitored as routine in youth mental health services across primary and secondary care levels. This could be achieved by including validated sleep measures in routine practice and staff working with this population being trained to assess additional sleep problems such as, nightmares, sleep paralysis or sleep-related hallucinations particularly where insomnia or sleep disturbance is present. This could support a more comprehensive understanding of their needs and inform more tailored treatment planning in youth

mental health settings. However, the unvalidated nature of the primary measure used to determine additional sleep disturbances require consideration when interpreting the findings and their significance. To strengthen confidence in these findings, future studies should include validated measures of additional sleep problems and be powered through prior sample size calculations.

Encouragingly, the effectiveness of the BSP intervention was not affected by the presence of other sleep problems or severity of the mental health problems. This, coupled with previous findings of this intervention, and similar others also improving sleep and mental health symptoms (Cliffe et al., 2020; Mathews et al., 2023; Rollinson et al., 2021, 2024; Waite et al., 2023), suggests that the provision of sleep interventions within youth mental health services across care levels may be equally effective. However, further research with randomised controlled trials examining the efficacy of such interventions is required. While treatment response to sleep intervention was not affected, further research into whether presence of additional sleep difficulties impact on mental health treatment response is needed.

Furthermore, targeted research into nightmares is indicated, as they were associated with reduced engagement in structured activity and greater use of secondary mental health services. In contrast, sleep paralysis and sleep-related hallucinations may benefit from initial qualitative exploration to better understand their experience and impact in this population. Notably, whilst it has been hypothesised that the increased presence of these phenomena—along with nightmares—in secondary care services may reflect associations with specific aspects of mental disorders or transdiagnostic difficulties such as, trauma-response, these require further explorations. Finally, studies exploring staff attitudes and quality improvement initiatives could inform the effective implementation of sleep interventions in routine clinical practice.

Conclusion

This study highlights the high prevalence and clinical relevance of comorbid sleep difficulties among young people with mental health problems and insomnia. Presence of nightmares and greater insomnia severity were associated with being female and having functional impairment.

Multiple sleep problems were more common in secondary youth mental health services when compared to primary care services. These findings underscore the importance of broader sleep assessment in youth mental health services. As only baseline insomnia severity predicted response to the BSP intervention, its robustness to diverse clinical presentations was highlighted. Further research is needed to explore the additional sleep difficulties using validated assessment methods, including their impact on mental health outcomes.

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Chapter Five:
Discussion and Critical Evaluation

Word count**:** 2420

This thesis portfolio aimed to contribute new knowledge to our understanding of sleep difficulties among young people with mental health problems in two different ways. It explored how young people with mental health difficulties are impacted by insomnia through a systematic review and using secondary data analysis of clinical data, the empirical paper investigated the co-occurrence of other sleep difficulties and their impact in young people with mental health difficulties and insomnia, including in treatment response to sleep interventions.

The discussion and critical appraisal below summarise the key findings and include a critical evaluation of both the systematic review and the empirical paper. Clinical and theoretical implications are considered alongside suggestions for future research.

Summary of Findings

Taken together, this thesis found that comorbid insomnia was consistently associated with worsened mental health severity and functioning yet responded well to treatment using CBT-I among young people with mental health problems, seemingly with effectiveness not affected by co-occurring sleep difficulties or mental health severity. The systematic review additionally found that comorbid insomnia was associated with increased suicidal risk, noting that studies into mechanisms within this topic and in this population are in early stages. The empirical paper additionally found that most young people with insomnia and mental health difficulties experienced other sleep difficulties such as nightmares, circadian rhythm disruptions and sleep paralysis or sleep-related hallucinations (unusual sleep experiences). Nightmares and unusual sleep experiences were more frequent in those being seen within secondary care services, with nightmares also being associated with poorer educational or occupational engagement.

Combined Discussion

Both the systematic review and the empirical study found support for insomnia as a transdiagnostic risk factor for mental health problems within clinical youth samples, which is in

accordance with findings both among clinical and community adults and young people without pre-existing mental health problems (Donskoy & Loghmanee, 2018; Freeman et al., 2009; Krystal, 2012). These highlight the need to address insomnia among young people, particularly those with mental health problems.

Emerging evidence from across the two studies also supported insomnia as a viable and effective intervention target within this population, with the empirical study showing its robustness to baseline differences in mental health severity and co-occurring sleep difficulties. This is believed to be a novel finding within clinical youth population. Within adult populations, which are typically more established, there is limited evidence with mixed results in relation to this line of enquiry. For example, comorbid hypersomnia showed good response to adapted CBT-I for those with psychosis while circadian rhythm disruptions appeared to interfere with treatment response among depressed adults (Chiu et al., 2018; Mirchandaney et al., 2022). Nonetheless, this appears to be a relatively novel question within the youth literature, and the current study offers promising findings regarding the feasibility and effectiveness of delivering a CBT-I intervention to this population across a range of severity and settings.

The empirical paper also contributed novel findings showing high comorbid sleep difficulties among young people with insomnia and mental health problems which has implications for clinical practice and theory which are considered below. Within the empirical paper, it was interesting to note the discrepancy between self-reported distress and service setting findings where all sleep difficulties were either significantly, or nearly significantly related to service setting differences, whilst differences in self-reported distress was largely non-significant. While this may simply reflect statistical power limitations, they may also stem from differences in what each measure represents. Self-report measures typically measure recent symptomatology, while acceptance to secondary care services can be needs-based, often requiring functional deterioration, chronic severity and risk or vulnerability beyond distress levels alone (Allsopp & Kinderman, 2021; Firth et al., 2008). These

findings raise questions and highlight potential disparities in how severity is conceptualised in research compared to clinical practice, and the relative ecological validity of each.

Critical Appraisal

Systematic Review

Whilst the review provided a broad synthesis of the literature, more specificity in the question may have, for example, allowed strengths of relationships with insomnia to be quantitatively compared. However, as it is believed that no such review had been undertaken before, the review questions arose from an aim to encapsulate the main effects that may be observed within this population. Integral to the aim of the systematic review were three key constructs which required clear operationalisation, namely, youth, insomnia, and mental health problems. Within literature, variation understandably exists in how all three may be conceptualised and for this thesis, clinical utility combined with empirical rigour were the guiding principles for the conceptualisations chosen.

Whilst the World Health Organisation (WHO) considers 15 to 25 years of age as youth, as seen in the systematic review, variation exists in how different authors represent youth or young people. For the thesis, 14 to 25 was the age range chosen, because this encompasses the WHO definition, is consistent with the population studied for the empirical study, i.e., the age range typically seen in youth mental health services, and due to this being the likely period when biological changes in sleep processes are likely to have occurred. The review included studies explicitly among youth, where the average age was between 14 to 25. However, this approach resulted in the total sample age spanning beyond the age range specified. An alternative approach may have involved only including studies with all participants within this age range. However, the studies still represent findings among a youth sample who were on average between 14 and 25.

With regards to the concept of insomnia, various approaches were possible, for example perhaps incorporating both subjective and objective measures of insomnia. Given known discrepancies between objective and subjective measures of insomnia (Janků et al., 2020), this

approach had the potential to inform on aspects of sleep disruptions which may have provided a richer account of the impact of insomnia. However, use of validated measures of insomnia or diagnostic presence of insomnia were instead chosen. This may give the review findings the most clinical utility given this may be how insomnia is measured in young people with mental health problems in clinical services. It does however mean that overall, subjective measures were relied upon, which may relate to perceptions of difficulty sleeping, rather than actual sleep-loss. The other consequence of the approach used was that, generally, studies on isolated symptoms of insomnia were not captured and a more disorder-based, rather than a transdiagnostic conceptualisation of insomnia underpinned the review.

Similarly, whilst the definition of mental health as being either diagnostic or clinical setting based, is inclusive of both transdiagnostic and disorder-specific approaches, it meant that those symptoms below the threshold for both diagnosis or services were not included, which may have been informative for impact of insomnia at an earlier stage of mental health difficulty development trajectory. Despite this, this criterion ensured that the overall aim of conducting clinically relevant research was adhered to.

A consequence of the search strategy not including limits within the search itself was that many more studies were manually excluded. This may have impacted the available time for the remaining review process meaning that forward citation searches were not completed. This remains a limitation of the study, and a learning point for the researcher.

Finally, the included papers represented studies from across the world, including a proportion from China, Turkey and Brazil. In the undertaking of the review the underlying assumption was that youth across all countries represent the same population. However, it is possible that cultural differences may have affected some of the findings. Very few studies reported ethnicity differences in the sample. Whilst this was not considered within the narrative synthesis, it may have had an impact on the findings observed.

Empirical Paper

Whilst the use of clinical data is a strength, it also means that there is an inherent bias within the sample which is a help-seeking sample. A second strength of the study is that the data was not limited to one service within the region, but across several services, all with different thresholds for acceptance into their service. This may mean that young people represented here may experience a full spectrum of mental health difficulty severity, helping with reliability of the findings across levels of severity.

While most of the research questions relied upon baseline information, it is possible that the final research question may be somewhat biased as measures from those that dropped out of treatment would not have been available. However, as 154 of the 179 people had post-treatment insomnia severity questionnaire scores, the dropout rate was 14.0% (*n* = 25). Within randomised controlled trials, more than 20% of drop-outs are considered concerning (Schulz & Grimes, 2002); considering the nature of this data as being naturalistic, this suggests reduced likelihood of biased sample for this question, and indicates that young people with mental health problems engaged well with this intervention.

Finally, as the BSP treatment incorporates elements of ACT into the intervention where required, rather than being CBT-I only, it raises the possibility of the findings reported here being less generalisable to other adapted CBT-I approaches. However, as the ACT-based element is comparatively small, being one part of cognitive strategies only, the intervention is predominantly CBT-I, ensuring greater generalisability to other similar interventions.

Clinical and Theoretical Implications

The thesis findings suggest a notable likelihood that a young person presenting to mental health services will have insomnia, and if so, then other sleep difficulties such as nightmares may also be present, potentially being linked with further functional impact. Further, findings suggest that for a young person with insomnia and mental health problems, the severity of their difficulties may

be worse, they may be able to function less well, and their risk of suicide might be higher. Given these findings, routine, thorough, assessments of sleep problems and consideration of sleep intervention provision as standard, are likely to be beneficial in clinical practice for young people.

The findings from this thesis support the continued investigation of sleep difficulties in clinical populations from a transdiagnostic perspective, as this may advance the field of sleep and mental health. This approach could also promote the development and broader implementation of interventions targeting various sleep difficulties across diverse groups of young people. However, given the strong influence of disorder-based frameworks in the field, complementing the transdiagnostic framework with some disorder-specific approaches may help ensure parity in research across different types of mental health difficulties.

Theoretically, particularly from a transdiagnostic framework, there are implications for our shared understanding about processes of sleep and emergence of mental health difficulties. For example, emotion regulation is implicated in hypotheses about sleep and its function (Vandekerckhove & Wang, 2018) and it was interesting to note some very tentative findings within the youth population literature in systematic review which also implicated emotionality and emotion regulation. While theory driven studies, particularly considering mechanisms appear to be limited among youth, the novel finding from the empirical study around co-occurring sleep problems further supports transdiagnostic approach. It is hoped that this provides new avenues to consider regarding how particular types of sleep problems may be interacting and what this might tell us about the mechanisms underpinning this finding.

Future Research Directions

A striking finding within both studies was of the predominantly female sample; further exploration as to the reasons for this may help inform generalisability of studies within this field. Previous research into the seemingly higher prevalence of sleep difficulties in females have suggested more research into biological differences (Fatima et al., 2016), however, research into

male engagement in research and mental health settings may also be required with implications for innovative practices to promote inclusion.

Whilst the review evidence strongly supported high co-occurrence of insomnia in this population from the available research, future research across broader settings and disorders using consistent insomnia criteria, would more reliably inform on comorbid insomnia prevalence in clinical youth populations and enable any interventions to be targeted appropriately.

The empirical paper highlighted a high comorbidity of sleep difficulties in those with mental health problems and insomnia, however it would be helpful to compare these other sleep problems among young people in mental health settings without insomnia to consider the extent to which these comorbidity relates to insomnia or mental health, and whether those with other sleep problems inadvertently screen positively for insomnia as this is the sleep aspect they are asked about.

Whilst the use of clinical data to answer previously unexplored research questions is a clear strength of the study, a key question relates to the generalisability of the findings to other young people and whether the findings relating to BSP would translate to other similar sleep interventions. Given that this intervention is primarily CBT-I based with similar adaptations to other youth interventions (e.g., Mathews et al., 2023; Waite et al., 2023) this suggests the findings would be generalisable. However, this is particularly important given the sample ethnicity was predominantly white. Whilst this is representative of the region, research in other, more diverse areas of the UK and more research exploring these in other settings would help validate these findings further.

Based on the empirical study as well as the included studies from the review, the possible social determinants of sleep difficulties appear to be under-explored, yet, socioeconomic disparities appear relevant to sleep, for example by influencing work-patterns, types of neighbourhood of individuals or their family members (Duncan et al., 2019). Incorporating this further within sleep and mental health studies could be more fitting within a biopsychosocial model. It also has the potential to further explicate the sleep disturbances and functioning related findings. For example, are those

experiencing more nightmares, also experiencing added stresses related to their socio-economic status or potentially minority stress? Further studies into these, or initially further reporting of socio-economic or ethnicity status would be beneficial.

Conclusions

This thesis portfolio advances our understanding of the complex interplay between insomnia, co-occurring sleep disturbances, and mental health difficulties in young people. Through a systematic review and empirical investigation, it highlighted insomnia as both a clinically significant concern and a promising treatment target within this population, with emerging evidence suggesting that its treatment effectiveness may be resilient to baseline severity and comorbid sleep issues. Through conducting research with individuals experiencing mental health difficulties including comorbidities and often accessing services who may be excluded in disorder-specific research paradigms, the thesis advocates for and supports more inclusive, transdiagnostic approaches to sleep and mental health research. Under-explored areas such as gender, socio-economic, and cultural influences could be considered further in this rapidly expanding field, to promote young people's engagement by considering how their whole identity may impact their presentation.

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Appendices

Appendix A:
Submission Guidelines for PLOS One

Submission Guidelines

Related information for authors

- PLOS Writing Center
- Submission system
- Journal scope and publication criteria
- Getting started guide
- Guidelines for revisions
- Publication fees
- APC Support

Style and Format

File format	Manuscript files can be in the following formats: DOC, DOCX, or RTF. Microsoft Word documents should not be locked or protected. LaTeX manuscripts must be submitted as PDFs. Read the LaTeX guidelines.
Length	Manuscripts can be any length. There are no restrictions on word count, number of figures, or amount of supporting information. We encourage you to present and discuss your findings concisely.
Font	Use a standard font size and any standard font, except for the font named "Symbol". To add symbols to the manuscript, use the Insert → Symbol function in your word processor or paste in the appropriate Unicode character.
Headings	Limit manuscript sections and sub-sections to 3 heading levels. Make sure heading levels are clearly indicated in the manuscript text.
Layout and spacing	Manuscript text should be double-spaced. Do not format text in multiple columns.
Page and line numbers	Include page numbers and line numbers in the manuscript file. Use continuous line numbers (do not restart the numbering on each page).
Footnotes	Footnotes are not permitted. If your manuscript contains footnotes, move the information into the main text or the reference list, depending on the content.
Language	Manuscripts must be submitted in English. You may submit translations of the manuscript or abstract as supporting information. Read the supporting information guidelines.
Abbreviations	Define abbreviations upon first appearance in the text. Do not use non-standard abbreviations unless they appear at least three times in the text.

Keep abbreviations to a minimum.

Reference style PLOS uses "Vancouver" style, as outlined in the ICMJE sample references.

See reference formatting examples and additional instructions below.

Equations We recommend using MathType for display and inline equations, as it will provide the most reliable outcome. If this is not possible, Equation Editor or Microsoft's Insert→Equation function is acceptable.

Avoid using MathType, Equation Editor, or the Insert→Equation function to insert single variables (e.g., "$a^2 + b^2 = c^2$"), Greek or other symbols (e.g., β, Δ, or ' [prime]), or mathematical operators (e.g., x, ≥, or ±) in running text. Wherever possible, insert single symbols as normal text with the correct Unicode (hex) values.

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Nomenclature Use correct and established nomenclature wherever possible.

Units of measurement	Use SI units. If you do not use these exclusively, provide the SI value in parentheses after each value. Read more about SI units.
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Allergens	The systematic allergen nomenclature of the World Health Organization/International Union of Immunological Societies (WHO/IUIS) Allergen Nomenclature Sub-committee should be used for manuscripts that include the description or use of allergenic proteins. For manuscripts describing new allergens, the systematic name of the allergen should be approved by the WHO/IUIS Allergen Nomenclature Sub-Committee prior to manuscript publication. Examples of the systematic allergen nomenclature can be found at the WHO/IUIS Allergen Nomenclature site.

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Submissions that do not meet the *PLOS ONE* publication criterion for language standards may be rejected.

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Manuscripts should be organized as follows. Instructions for each element appear below the list.

Beginning section	*The following elements are required, in order:* • Title page: List title, authors, and affiliations as first page of the manuscript • Abstract • Introduction
Middle section	*The following elements can be renamed as needed and presented in any order:* • Materials and Methods • Results • Discussion • Conclusions (optional)
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Other elements	• Figure captions are inserted immediately after the first paragraph in which the figure is cited. Figure files are uploaded separately. • Tables are inserted immediately after the first paragraph in which they are cited. • Supporting information files are uploaded separately.

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The compiled submission PDF includes low-resolution preview images of the figures after the reference list. The function of these previews is to allow you to download the entire submission as quickly as possible. Click the link at the top of each preview page to download a high-resolution version of each figure. Links to download Supporting Information files are also available after the reference list.

Parts of a Submission

Title

Include a full title and a short title for the manuscript.

Title	Length	Guidelines	Examples
Full title	250 characters	Specific, descriptive, concise, and comprehensible to readers outside the field	Impact of cigarette smoke exposure on innate immunity: A *Caenorhabditis elegans* model Solar drinking water disinfection (SODIS) to reduce childhood diarrhoea in rural Bolivia: A cluster-randomized, controlled trial
Short title	100 characters	State the topic of the study	Cigarette smoke exposure and innate immunity SODIS and childhood diarrhoea

Titles should be written in sentence case (only the first word of the text, proper nouns, and genus names are capitalized). Avoid specialist abbreviations if possible. For clinical trials, systematic reviews, or meta-analyses, the subtitle should include the study design.

Author list

Authorship requirements

All authors must meet the criteria for authorship as outlined in the authorship policy. Those who contributed to the work but do not meet the criteria for authorship can be mentioned in the Acknowledgments. Read more about Acknowledgments.

The corresponding author must provide an ORCID iD at the time of submission by entering it in the user profile in the submission system. Read more about ORCID.

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Enter author names on the title page of the manuscript and in the online submission system.

On the title page, write author names in the following order:

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If a manuscript is submitted on behalf of a consortium or group, include its name in the manuscript byline. Do not add it to the author list in the submission system. You may include the full list of members in the Acknowledgments or in a supporting information file.

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Provide at minimum one contribution for each author in the submission system. Use the CRediT taxonomy to describe each contribution. Read the policy and the full list of roles.

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The Abstract should:

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- Not exceed 300 words

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The introduction should:

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- Define the problem addressed and why it is important
- Include a brief review of the key literature
- Note any relevant controversies or disagreements in the field
- Conclude with a brief statement of the overall aim of the work and a comment about whether that aim was achieved

Materials and Methods

The Materials and Methods section should provide enough detail to allow suitably skilled investigators to fully replicate your study. Specific information and/or protocols for new methods should be included in detail. If materials, methods, and protocols are well established, authors may cite articles where those protocols are described in detail, but the submission should include sufficient information to be understood independent of these references.

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These sections may all be separate, or may be combined to create a mixed Results/Discussion section (commonly labeled "Results and Discussion") or a mixed Discussion/Conclusions section (commonly labeled "Discussion"). These sections may be further divided into subsections, each with a concise subheading, as appropriate. These sections have no word limit, but the language should be clear and concise.

Together, these sections should describe the results of the experiments, the interpretation of these results, and the conclusions that can be drawn.

Authors should explain how the results relate to the hypothesis presented as the basis of the study and provide a succinct explanation of the implications of the findings, particularly in relation to previous related studies and potential future directions for research.

PLOS ONE editorial decisions do not rely on perceived significance or impact, so authors should avoid overstating their conclusions. See the *PLOS ONE* Criteria for Publication for more information.

Acknowledgments

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References

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References are listed at the end of the manuscript and numbered in the order that they appear in the text. In the text, cite the reference number in square brackets (e.g., "We used the techniques developed by our colleagues [19] to analyze the data"). PLOS uses the numbered citation (citation-sequence) method and first six authors, et al.

Do not include citations in abstracts.

Make sure the parts of the manuscript are in the correct order *before* ordering the citations.

Formatting references

Because all references will be linked electronically as much as possible to the papers they cite, proper formatting of references is crucial.

PLOS uses the reference style outlined by the International Committee of Medical Journal Editors (ICMJE), also referred to as the "Vancouver" style. Example formats are listed below. Additional examples are in the ICMJE sample references.

A reference management tool, EndNote, offers a current style file that can assist you with the formatting of your references. If you have problems with any reference management program, please contact the source company's technical support.

Journal name abbreviations should be those found in the National Center for Biotechnology Information (NCBI) databases.

Source	Format
Published articles	Hou WR, Hou YL, Wu GF, Song Y, Su XL, Sun B, et al. cDNA, genomic sequence cloning and overexpression of ribosomal protein gene L9 (rpL9) of the giant panda (Ailuropoda melanoleuca). Genet Mol Res. 2011;10: 1576-1588. Devaraju P, Gulati R, Antony PT, Mithun CB, Negi VS. Susceptibility to SLE in South Indian Tamils may be influenced by genetic selection pressure on TLR2 and TLR9 genes. Mol Immunol. 2014 Nov 22. pii: S0161-5890(14)00313-7. doi: 10.1016/j.molimm.2014.11.005. Note: A DOI number for the full-text article is acceptable as an alternative to or in addition to traditional volume and page numbers. When providing a DOI, adhere to the format in the example above with both the label and full DOI included at the end of the reference (doi: 10.1016/j.molimm.2014.11.005). Do not provide a shortened DOI or the URL.
Accepted, unpublished articles	Same as published articles, but substitute "Forthcoming" for page numbers or DOI.
Online articles	Huynen MMTE, Martens P, Hilderlink HBM. The health impacts of globalisation: a conceptual framework. Global Health. 2005;1: 14. Available from: http://www.globalizationandhealth.com/content/1/1/14
Books	Bates B. Bargaining for life: A social history of tuberculosis. 1st ed. Philadelphia: University of Pennsylvania Press; 1992.
Book chapters	Hansen B. New York City epidemics and history for the public. In: Harden VA, Risse GB, editors. AIDS and the historian. Bethesda: National Institutes of Health; 1991. pp. 21-28.
Deposited articles (preprints, e-prints, or arXiv)	Krick T, Shub DA, Verstraete N, Ferreiro DU, Alonso LG, Shub M, et al. Amino acid metabolism conflicts with protein diversity. arXiv:1403.3301v1 [Preprint]. 2014 [cited 2014 March 17]. Available from: https://128.84.21.199/abs/1403.3301v1 Kording KP, Mensh B. Ten simple rules for structuring papers. BioRxiv [Preprint]. 2016 bioRxiv 088278 [posted 2016 Nov 28; revised 2016 Dec 14; revised 2016 Dec 15; cited 2017 Feb 9]: [12 p.]. Available from: https://www.biorxiv.org/content/10.1101/088278v5 doi: 10.1101/088278
Published media (print or online newspapers and magazine articles)	Fountain H. For Already Vulnerable Penguins, Study Finds Climate Change Is Another Danger. The New York Times. 2014 Jan 29 [Cited 2014 March 17]. Available from: http://www.nytimes.com/2014/01/30/science/earth/climate-change-taking-toll-on-penguins-study-finds.html
New media (blogs, web sites, or other written works)	Allen L. Announcing PLOS Blogs. 2010 Sep 1 [cited 17 March 2014]. In: PLOS Blogs [Internet]. San Francisco: PLOS 2006 - . [about 2 screens]. Available from: http://blogs.plos.org.uea.idm.oclc.org/plos/2010/09/announcing-plos-blogs/.

Source	Format
Masters' theses or doctoral dissertations	Wells A. Exploring the development of the independent, electronic, scholarly journal. M.Sc. Thesis, The University of Sheffield. 1999. Available from: http://cumincad.scix.net/cgi-bin/works/Show?2e09
Databases and repositories (Figshare, arXiv)	Roberts SB. QPX Genome Browser Feature Tracks; 2013 [cited 2013 Oct 5]. Database: figshare [Internet]. Available from: http://figshare.com/articles/QPX_Genome_Browser_Feature_Tracks/701214
Multimedia (videos, movies, or TV shows)	Hitchcock A, producer and director. Rear Window [Film]; 1954. Los Angeles: MGM.

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Authors can submit essential supporting files and multimedia files along with their manuscripts. All supporting information will be subject to peer review. All file types can be submitted, but files must be smaller than 20 MB in size.

Authors may use almost any description as the item name for a supporting information file as long as it contains an "S" and number. For example, "S1 Appendix" and "S2 Appendix," "S1 Table" and "S2 Table," and so forth.

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Example caption

S1 Text. Title is strongly recommended. Legend is optional.

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Read the supporting information guidelines for more details about submitting supporting information and multimedia files.

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Manuscripts submitted to *PLOS ONE* are expected to report statistical methods in sufficient detail for others to replicate the analysis performed. Ensure that results are rigorously reported in accordance with community standards and that statistical methods employed are appropriate for the study design.

Consult the following resources for additional guidance:

- SAMPL guidelines, for general guidance on statistical reporting
- *PLOS ONE* guidelines, for clinical trials requirements
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- EQUATOR, for specific reporting guidelines for a range of other study types

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In the methods, include a section on statistical analysis that reports a detailed description of the statistical methods. In this section:

- List the name and version of any software package used, alongside any relevant references
- Describe technical details or procedures required to reproduce the analysis
- Provide the repository identifier for any code used in the analysis (See our code-sharing policy.)

Statistical reporting guidelines:

- Identify research design and independent variables as being between- or within-subjects
- For pre-processed data:
    - Describe any analysis carried out to confirm the data meets the assumptions of the analysis performed (e.g. linearity, co-linearity, normality of the distribution).
    - If data were transformed include this information, with a reason for doing so and a description of the transformation performed
- Provide details of how outliers were treated and your analysis, both with the full dataset and with the outliers removed
- If relevant, describe how missing/excluded data were handled
- Define the threshold for significance (alpha)
- If appropriate, provide sample sizes, along with a description of how they were determined. If a sample size calculation was performed, specify the inputs for power, effect size and alpha. Where relevant, report the number of independent replications for each experiment.
- For analyses of variance (ANOVAs), detail any post hoc tests that were performed
- Include details of any corrections applied to account for multiple comparisons. If corrections were not applied, include a justification for not doing so
- Describe all options for statistical procedures. For example, if t-tests were performed, state whether these were one- or two-tailed. Include details of the type of t-test conducted (e.g. one sample, within-/between-subjects).
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    - Report the alpha level used
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    - Describe the variable selection process by which the final model was developed (e.g., forward-stepwise; best subset). See SAMPL guidelines.
- For Bayesian analysis explain the choice of prior trial probabilities and how they were selected. Markov chain Monte Carlo settings should be reported.

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Results must be rigorously and appropriately reported, in keeping with community standards.

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- Enter the given data DOI into the full Data Availability Statement, which is requested in the Additional Information section of the PLOS submission form. Then provide the URL passcode in the Attach Files section.

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- FlyBase
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This information should not be in your manuscript file; you will provide it via our submission system.

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Upon submission, authors must confirm that the manuscript, or any related manuscript, is not currently under consideration or accepted elsewhere. If related work has been submitted to *PLOS ONE* or elsewhere, authors must include a copy with the submitted article. Reviewers will be asked to comment on the overlap between related submissions.

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Study design, reporting, and analyses are assessed against all relevant research and methodological technique standards held by the community. Guidelines for specific study types are outlined below.

Registered Reports

Submission and format requirements for Registered Report Protocols and Registered Reports are similar to those for a regular submission and may be specific to your study type. For instance, if your Registered Report Protocol submission is about a Clinical Trial or a Systematic Review, follow the appropriate guidelines.

For Registered Report Protocols:

- Provide enough methodological detail to make the study reproducible and replicable
- Confirm that data will be made available upon study completion in keeping with the PLOS Data policy
- Include ethical approval or waivers, if applicable
- Preliminary or pilot data may be included, but only if necessary to support the feasibility of the study or as a proof of principle
- For meta-analyses or Clinical Trials, use the protocol-specific reporting guidelines PRISMA-P or SPIRIT respectively

For more guidance on format and presentation of a protocol, consult the sample template hosted by the Open Science Framework. Discipline-specific and study-specific templates are also available.

If data need to be collected, modified or processed specifically for your study, or if participants need to be recruited specifically for your study, then it should occur only after your Registered Report Protocol is accepted for publication.

For Registered Report Research Articles:

- Report the results of all planned analyses and, if relevant, detail and justify all deviations from the protocol.
- The manuscript may also contain exploratory, unplanned analyses.

Read more about Registered Report framework.

Human subjects research

All research involving human participants must have been approved by the authors' Institutional Review Board (IRB) or by equivalent ethics committee(s), and must have been conducted according to the principles expressed in the Declaration of Helsinki. Authors should be able to submit, upon request, a statement from the IRB or ethics committee indicating approval of the research. We reserve the right to reject work that we believe has not been conducted to a high ethical standard, even when formal approval has been obtained.

Subjects must have been properly instructed and have indicated that they consent to participate by signing the appropriate informed consent paperwork. Authors may be asked to submit a blank, sample copy of a subject consent form. If consent was verbal instead of written, or if consent could not be obtained, the authors must explain the reason in the manuscript, and the use of verbal consent or the lack of consent must have been approved by the IRB or ethics committee.

All efforts should be made to protect patient privacy and anonymity. Identifying information, including photos, should not be included in the manuscript unless the information is crucial and the individual has provided written consent by completing the Consent Form for Publication in a PLOS Journal (PDF). Download additional translations of the form here. More information about patient privacy, anonymity, and informed consent can be found in the International Committee of Medical Journal Editors (ICMJE) Privacy and Confidentiality guidelines.

Manuscripts should conform to the following reporting guidelines:

- Studies of diagnostic accuracy: STARD
- Observational studies: STROBE

- Microarray experiments: MIAME
- Other types of health-related research: Consult the EQUATOR web site for appropriate reporting guidelines

Methods sections of papers on research using human subjects or samples must include ethics statements that specify:

- **The name of the approving institutional review board or equivalent committee(s)**. If approval was not obtained, the authors must provide a detailed statement explaining why it was not needed
- **Whether informed consent was written or oral**. If informed consent was oral, it must be stated in the manuscript:
    - Why written consent could not be obtained
    - That the Institutional Review Board (IRB) approved use of oral consent
    - How oral consent was documented

For studies involving humans categorized by race/ethnicity, age, disease/disabilities, religion, sex/gender, sexual orientation, or other socially constructed groupings, authors should:

- Explicitly describe their methods of categorizing human populations
- Define categories in as much detail as the study protocol allows
- Justify their choices of definitions and categories, including for example whether any rules of human categorization were required by their funding agency
- Explain whether (and if so, how) they controlled for confounding variables such as socioeconomic status, nutrition, environmental exposures, or similar factors in their analysis

In addition, outmoded terms and potentially stigmatizing labels should be changed to more current, acceptable terminology. Examples: “Caucasian” should be changed to “white” or “of [Western] European descent” (as appropriate); “cancer victims” should be changed to “patients with cancer.”

For papers that include identifying, or potentially identifying, information, authors must download the Consent Form for Publication in a PLOS Journal, which the individual, parent, or guardian must sign once they have read the paper and been informed about the terms of PLOS open-access license. The signed consent form should not be submitted with the manuscript, but authors should securely file it in the individual's case notes and the methods section of the manuscript should explicitly state that consent authorization for publication is on file, using wording like:

The individual in this manuscript has given written informed consent (as outlined in PLOS consent form) to publish these case details.

For more information about *PLOS ONE* policies regarding human subjects research, see the Publication Criteria and Editorial Policies.

Manuscripts describing observational clinical studies are subject to all policies regarding human research and community standards for reporting observational research as outlined by the STROBE statement. Furthermore, authors submitting work of this nature should pay special attention to the following requirements:

- If the submitted manuscript is very similar to previous work, authors must provide a sound scientific rationale for the submitted work and clearly reference and discuss the existing literature.
- The sampling strategy and eligibility criteria of enrolled subjects should be described in sufficient detail.
- Sample size calculations should be justified with relevant inputs defined.

- Independent and dependent variables considered for statistical analysis should be clearly defined and justified.
- The validity and reliability testing of self-developed data collection tools should be reported.
- Conclusions should be appropriate for the study design, with indications on how the study results will contribute to the base of academic knowledge.

Observational and field studies

Methods sections for submissions reporting on any type of field study must include ethics statements that specify:

- Permits and approvals obtained for the work, including the full name of the authority that approved the study; if none were required, authors should explain why
- Whether the land accessed is privately owned or protected
- Whether any protected species were sampled
- Full details of animal husbandry, experimentation, and care/welfare, where relevant

Systematic reviews and meta-analyses

A systematic review paper, as defined by The Cochrane Collaboration, is a review of a clearly formulated question that uses explicit, systematic methods to identify, select, and critically appraise relevant research, and to collect and analyze data from the studies that are included in the review. These reviews differ substantially from narrative-based reviews or synthesis articles. Statistical methods (meta-analysis) may or may not be used to analyze and summarize the results of the included studies.

Reports of systematic reviews and meta-analyses should include a completed PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist and flow diagram to accompany the main text. Blank templates are available here:

- Checklist: PDF or Word document
- Flow diagram: PDF or Word document

Authors must also state in their "Methods" section whether a protocol exists for their systematic review, and if so, provide a copy of the protocol as supporting information and provide the registry number in the abstract.

If your article is a systematic review or a meta-analysis you should:

- State this in your cover letter
- Select "Research Article" as your article type when submitting
- Include the PRISMA flow diagram as Fig 1 (required where applicable)
- Include the PRISMA checklist as supporting information

Personal data from third-party sources

For all studies using personal data from internet-based and other third-party sources (e.g., social media, blogs, other internet sources, mobile phone companies), data must be collected and used according to company/website Terms and Conditions, with appropriate permissions. All data sources must be acknowledged clearly in the Materials and Methods section.

Read our policy on data availability.

In the Ethics Statement, authors should declare any potential risks to individuals or individual privacy, or affirm that in their assessment, the study posed no such risks. In addition, the following Ethics and Data Protection requirements must be met.

For interventional studies, which impact participants' experiences or data, the study design must have been prospectively approved by an Ethics Committee, and informed consent is required. The Ethics Committee may waive the requirement for approval and/or consent.

For observational studies in which personal experiences and accounts are not manipulated, consultation with an Ethics or Data Protection Committee is recommended. Additional requirements apply in the following circumstances:

- If information used could threaten personal privacy or damage the reputation of individuals whose data are used, an Ethics Committee should be consulted and informed consent obtained or specifically addressed.
- If authors accessed any personal identifying information, an Ethics or Data Protection Committee should oversee data anonymization. If data were anonymized and/or aggregated before access and analysis, informed consent is generally not required.

Note that Terms of Use contracts do not qualify as informed consent, even if they address the use of personal data for research.

See our reporting guidelines for human subjects research.

You may be eligible for APC support

Many institutional partners globally have publishing agreements with PLOS to allow their corresponding authors to publish with reduced or no APCs. To determine if your corresponding author is eligible, please visit our institutional partners page to determine what kind of agreement your institution has with PLOS.

If your corresponding author is affiliated with a participating institution, they must follow the instructions below to demonstrate eligibility.

Read the full instructions for submitting to a journal with the Flat Fee Agreement.

If your corresponding author is not from a participating institution and requires assistance paying publishing fees, please consider applying for a fee waiver at submission.

Appendix B:
Questions from Mixed Methods Appraisal Tool (MMAT; Hong et al., 2018)

Category of study designs	**Methodological quality criteria**	**Responses**			
		Yes	No	Can't tell	Comments
Screening questions (for all types)	S1. Are there clear research questions?				
	S2. Do the collected data allow to address the research questions?				
	Further appraisal may not be feasible or appropriate when the answer is 'No' or 'Can't tell' to one or both screening questions.				
1. Qualitative	1.1. Is the qualitative approach appropriate to answer the research question?				
	1.2. Are the qualitative data collection methods adequate to address the research question?				
	1.3. Are the findings adequately derived from the data?				
	1.4. Is the interpretation of results sufficiently substantiated by data?				
	1.5. Is there coherence between qualitative data sources, collection, analysis and interpretation?				
2. Quantitative randomized controlled trials	2.1. Is randomization appropriately performed?				
	2.2. Are the groups comparable at baseline?				
	2.3. Are there complete outcome data?				
	2.4. Are outcome assessors blinded to the intervention provided?				
	2.5 Did the participants adhere to the assigned intervention?				
3. Quantitative non-randomized	3.1. Are the participants representative of the target population?				
	3.2. Are measurements appropriate regarding both the outcome and intervention (or exposure)?				
	3.3. Are there complete outcome data?				
	3.4. Are the confounders accounted for in the design and analysis?				
	3.5. During the study period, is the intervention administered (or exposure occurred) as intended?				
4. Quantitative descriptive	4.1. Is the sampling strategy relevant to address the research question?				
	4.2. Is the sample representative of the target population?				
	4.3. Are the measurements appropriate?				
	4.4. Is the risk of nonresponse bias low?				
	4.5. Is the statistical analysis appropriate to answer the research question?				
5. Mixed methods	5.1. Is there an adequate rationale for using a mixed methods design to address the research question?				
	5.2. Are the different components of the study effectively integrated to answer the research question?				
	5.3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?				
	5.4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?				
	5.5. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?				

Appendix C:
HRA Approval Letter for the Study

Ymchwil Iechyd a Gofal Cymru
Health and Care Research Wales

NHS
Health Research Authority

Miss Asmita Dhungana
Department of Clinical Psychology and Psychological Therapies
Norwich Medical School
University of East Anglia, Norwich
NR4 7TJN/A

Email: approvals@hra.nhs.uk
HCRW.approvals@wales.nhs.uk

21 May 2024

Dear Miss Dhungana

HRA and Health and Care Research Wales (HCRW) Approval Letter

Study title:	**Understanding the sleep problems of young people in mental health services, their links to mental health difficulties and impact on sleep intervention effectiveness**
IRAS project ID:	**336384**
Protocol number:	**N/A**
REC reference:	**24/HRA/2014**
Sponsor	**University of East Anglia**

I am pleased to confirm that **HRA and Health and Care Research Wales (HCRW) Approval** has been given for the above referenced study, on the basis described in the application form, protocol, supporting documentation and any clarifications received. You should not expect to receive anything further relating to this application.

Please now work with participating NHS organisations to confirm capacity and capability, in line with the instructions provided in the "Information to support study set up" section towards the end of this letter.

How should I work with participating NHS/HSC organisations in Northern Ireland and Scotland?
HRA and HCRW Approval does not apply to NHS/HSC organisations within Northern Ireland and Scotland.

If you indicated in your IRAS form that you do have participating organisations in either of these devolved administrations, the final document set and the study wide governance report

(including this letter) have been sent to the coordinating centre of each participating nation. The relevant national coordinating function/s will contact you as appropriate.

Please see IRAS Help for information on working with NHS/HSC organisations in Northern Ireland and Scotland.

How should I work with participating non-NHS organisations?
HRA and HCRW Approval does not apply to non-NHS organisations. You should work with your non-NHS organisations to obtain local agreement in accordance with their procedures.

What are my notification responsibilities during the study?

The *"After HRA Approval – guidance for sponsors and investigators"* document on the HRA website gives detailed guidance on reporting expectations for studies with HRA and HCRW Approval, including:

- Registration of Research
- Notifying amendments
- Notifying the end of the study

The HRA website also provides guidance on these topics and is updated in the light of changes in reporting expectations or procedures.

Who should I contact for further information?
Please do not hesitate to contact me for assistance with this application. My contact details are below.

Your IRAS project ID is **336384**. Please quote this on all correspondence.

Yours sincerely,
Andrea Bell

Approvals Specialist

Email: approvals@hra.nhs.uk

Copy to: *Ms Tracy Moulton*

List of Documents

The final document set assessed and approved by HRA and HCRW Approval is listed below.

Document	*Version*	*Date*
Contract/Study Agreement template [PIC Agreement Form]	1.0	26 April 2024
Evidence of Sponsor insurance or indemnity (non-NHS Sponsors only) [Insurance Certificate]	1	01 May 2024
IRAS Application Form [IRAS_Form_08052024]		08 May 2024
IRAS Application Form XML file [IRAS_Form_08052024]		08 May 2024
IRAS Checklist XML [Checklist_21052024]		21 May 2024
Letter from sponsor [Sponsor Letter]	1	01 May 2024
Other [CV for Second Supervisor]	1.0	26 April 2024
Research protocol or project proposal [Research Protocol]	1.2	17 May 2024
Summary CV for Chief Investigator (CI) [CV for CI]	1.0	26 April 2024
Summary CV for supervisor (student research) [CV for Supervisor]	1	01 May 2024

IRAS project ID	336384

Information to support study set up

The below provides all parties with information to support the arranging and confirming of capacity and capability with participating NHS organisations in England and Wales. This is intended to be an accurate reflection of the study at the time of issue of this letter.

Types of participating NHS organisation	Expectations related to confirmation of capacity and capability	Agreement to be used	Funding arrangements	Oversight expectations	HR Good Practice Resource Pack expectations
Activities at NHS organisations will involve PIC activity only, including the anonymisation of clinically collected data.	Research activities should not commence at participating NHS organisations in England or Wales prior to their formal confirmation of capacity and capability to deliver the study in accordance with the contracting expectations detailed. Due to the nature of the activities involved, organisations will be expected to provide that confirmation to the sponsor: • Within 35 days of receipt of the local information pack • After HRA/HCRW Approval has been issued.	The sponsor has provided the appropriate model commercial PIC agreement that it intends to use as a subcontract between participating organisations and NHS organisations acting as their Participant Identification Centres (PICs).	Sponsor is not providing funding to PICs.	The Chief Investigator will be responsible for all study activities performed at PICs.	Where an external individual is conducting only research activities that are limited to access to anonymised patient data then a Letter of Access is required only if these activities will take place in NHS facilities. This should be issued be on the basis of a Research Passport (if university employed) or an NHS-to-NHS confirmation of pre-engagement checks letter (if NHS employed).

	If the organisation is not able to formally confirm capacity and capability within this timeframe, they must inform the sponsor of this and provide a justification. If the sponsor is not satisfied with the justification, then the sponsor may escalate to the National Coordinating Function where the participating NHS organisation is located.				

Other information to aid study set-up and delivery

This details any other information that may be helpful to sponsors and participating NHS organisations in England and Wales in study set-up.
The applicant has indicated they do not intend to apply for inclusion on the NIHR CRN Portfolio.

Appendix D:
UEA Ethical Approval for the Study

University of East Anglia
Norwich Research Park
Norwich. NR4 7TJ

Email: ethicsmonitor@uea.ac.uk
Web: www.uea.ac.uk

Study title: Understanding the sleep problems of young people in mental health services, their links to mental health difficulties and impact on sleep intervention effectiveness

Application ID: ETH2324-0265

Dear Asmita,

Your application was considered on 8th February 2024 by the FMH S-REC (Faculty of Medicine and Health Sciences Research Ethics Subcommittee).

The decision is: **approved**.

You are therefore able to start your project subject to any other necessary approvals being given.

If your study involves NHS staff and facilities, you will require Health Research Authority (HRA) governance approval before you can start this project (even though you did not require NHS-REC ethics approval). Please consult the HRA webpage about the application required, which is submitted through the IRAS system.

This approval will expire on **30th September 2025**.

Please note that your project is granted ethics approval only for the length of time identified above. Any extension to a project must obtain ethics approval by the FMH S-REC (Faculty of Medicine and Health Sciences Research Ethics Subcommittee) before continuing.

It is a requirement of this ethics approval that you should report any adverse events which occur during your project to the FMH S-REC (Faculty of Medicine and Health Sciences Research Ethics Subcommittee) as soon as possible. An adverse event is one which was not anticipated in the research design, and which could potentially cause risk or harm to the participants or the researcher, or which reveals potential risks in the treatment under evaluation. For research involving animals, it may be the unintended death of an animal after trapping or carrying out a procedure.

Any amendments to your submitted project in terms of design, sample, data collection, focus etc. should be notified to the FMH S-REC (Faculty of Medicine and Health Sciences Research Ethics Subcommittee) in advance to ensure ethical compliance. If the amendments are substantial a new application may be required.

Approval by the FMH S-REC (Faculty of Medicine and Health Sciences Research Ethics Subcommittee) should not be taken as evidence that your study is compliant with the UK General Data Protection Regulation (UK GDPR) and the Data Protection Act 2018. If you need guidance on how to make your study UK GDPR compliant, please contact the UEA Data Protection Officer (dataprotection@uea.ac.uk).

Please can you send your report once your project is completed to the FMH S-REC (fmh.ethics@uea.ac.uk).

I would like to wish you every success with your project.

On behalf of the FMH S-REC (Faculty of Medicine and Health Sciences Research Ethics Subcommittee)

Yours sincerely,

Dr Paul Linsley

Appendix E:
The Better Sleep Programme Sleep Assessment Summary Table

The Better Sleep Programme
Initial assessment

Assessment summary table

This summary table helps us provide a clearer description of the sleep difficulties young people face. Please tick the boxes that apply based on the responses to the interview.

Sleep disorder	Experience	Present
Insomnia	Do they report difficulty *falling* asleep?	Select
	If **YES** – How long does it typically take?	Select
	Do they report difficulty *staying* asleep?	Select
	Do they wake too early (i.e., before alarm)?	Select
	Does their sleep problem significantly affect daytime functioning?	Select
	Has sleep been problematic for more than three months?	Select
	Is their sleep currently affected 3 or more nights a week?	Select
	What is their total average daily sleep duration, roughly?	Select
Circadian	Are they sleeping well but at the wrong time? (i.e., no awakenings, refreshed if can sleep freely)	Select
Nightmares	**Are they present and causing distress?**	Select
	If **YES…**	
	- Is the content of nightmares remembered?	Select
	- Are they experienced at least once a week?	Select
	- Roughly, how often do nightmares occur?	
Unusual experiences	**Are they present and causing distress?**	Select
	If **YES** do they experience…	Select
	- Visual phenomena (distortions, hallucinations)?	
	- Auditory phenomena (whispers, voices, noises)	Select
	- Sleep paralysis?	Select
	- Vivid experiences when waking/falling asleep?	Select
	Other (please specify)	
	Roughly, how often do they have these experiences?	
Narcolepsy	Do they report falling asleep without warning? (question 15)	Select

Note. This summary table illustrates the form completed by Better Sleep Programme practitioners following a semi-structured assessment interview encompassing current sleep problems and sleep patterns, sleep quality, daytime effects of sleep, nightmares and unusual experiences during sleep, development of sleep problems including family history of difficulties and strategies applied to manage sleep difficulties so far.

Appendix F:
Copy of Questionnaire Measures Used by the Better Sleep Programme

Figure F1

Insomnia Severity Index (ISI)

1. Please rate the current (i.e., last 2 weeks) **SEVERITY** of your insomnia problem(s).

	None	Mild	Moderate	Severe	Very
Difficulty falling asleep:	0	1	2	3	4
Difficulty staying asleep:	0	1	2	3	4
Problem waking up too early:	0	1	2	3	4

2. How **SATISFIED**/dissatisfied are you with your current sleep pattern?

Very Satisfied				Very Dissatisfied
0	1	2	3	4

3. To what extent do you consider your sleep problem to **INTERFERE** with your daily functioning (e.g. daytime fatigue, ability to function at work/daily chores, concentration, memory, mood, etc.).

Not at all Interfering	A Little	Somewhat	Much	Very Much Interfering
0	1	2	3	4

4. How **NOTICEABLE** to others do you think your sleeping problem is in terms of impairing the quality of your life?

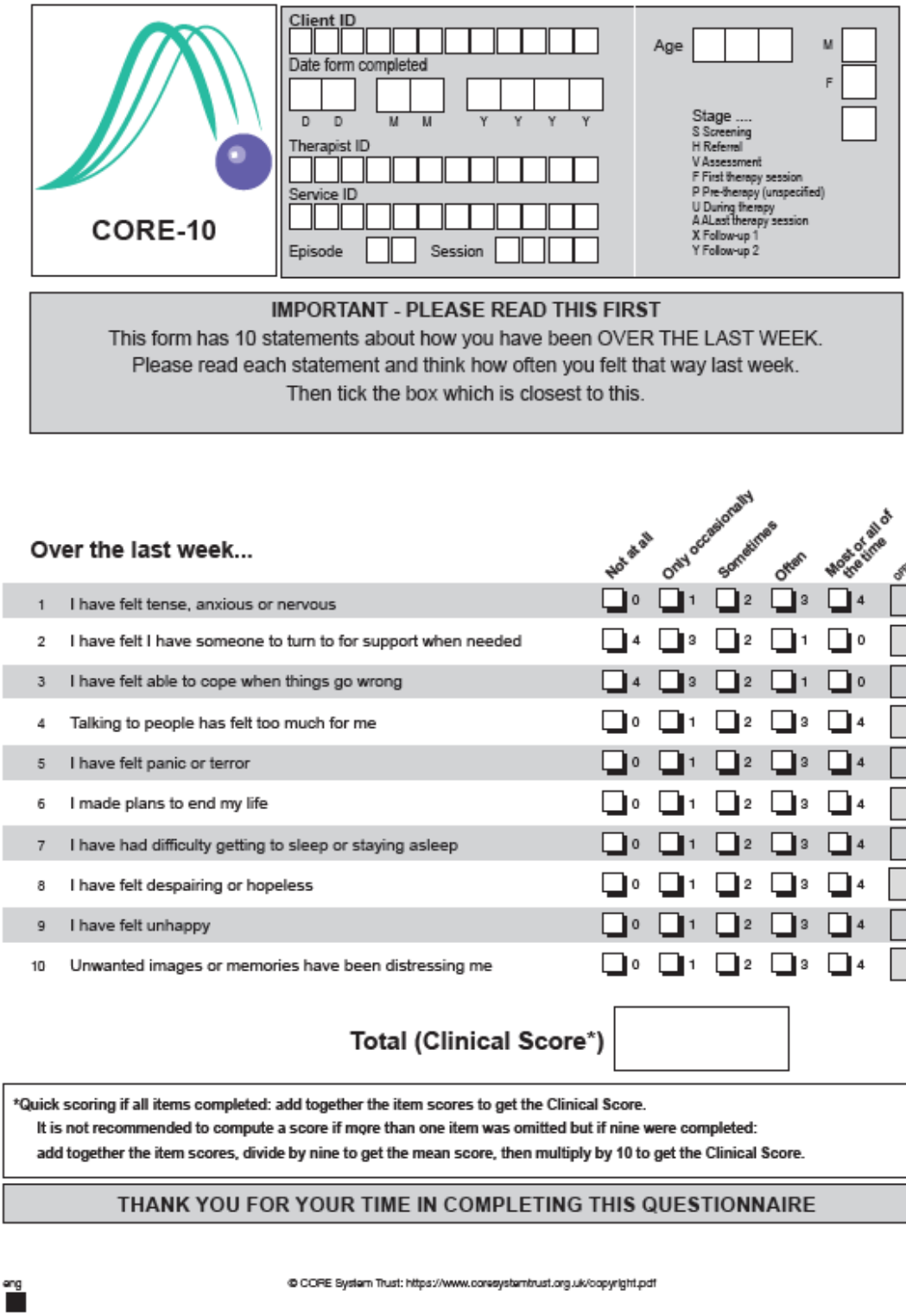
Not at all Noticeable	Barely	Somewhat	Much	Very Much Noticeable
0	1	2	3	4

5. How **WORRIED**/distressed are you about your current sleep problem?

Not at all	A Little	Somewhat	Much	Very Much
0	1	2	3	4

Figure F2

Clinical Outcomes in Routine Evaluation-10 (CORE-10)



CORE-10

Client ID

Date form completed

D D M M Y Y Y Y

Therapist ID

Service ID

Episode Session

Age M F

Stage ....
S Screening
H Referral
V Assessment
F First therapy session
P Pre-therapy (unspecified)
U During therapy
A ALast therapy session
X Follow-up 1
Y Follow-up 2

IMPORTANT - PLEASE READ THIS FIRST

This form has 10 statements about how you have been OVER THE LAST WEEK.
Please read each statement and think how often you felt that way last week.
Then tick the box which is closest to this.

Over the last week...	Not at all	Only occasionally	Sometimes	Often	Most or all of the time	OFFICE USE ONLY
1 I have felt tense, anxious or nervous	0	1	2	3	4	
2 I have felt I have someone to turn to for support when needed	4	3	2	1	0	
3 I have felt able to cope when things go wrong	4	3	2	1	0	
4 Talking to people has felt too much for me	0	1	2	3	4	
5 I have felt panic or terror	0	1	2	3	4	
6 I made plans to end my life	0	1	2	3	4	
7 I have had difficulty getting to sleep or staying asleep	0	1	2	3	4	
8 I have felt despairing or hopeless	0	1	2	3	4	
9 I have felt unhappy	0	1	2	3	4	
10 Unwanted images or memories have been distressing me	0	1	2	3	4	

Total (Clinical Score*)

*Quick scoring if all items completed: add together the item scores to get the Clinical Score.
It is not recommended to compute a score if more than one item was omitted but if nine were completed:
add together the item scores, divide by nine to get the mean score, then multiply by 10 to get the Clinical Score.

THANK YOU FOR YOUR TIME IN COMPLETING THIS QUESTIONNAIRE

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Figure F3

The Young Person's Clinical Outcomes in Routine Evaluation (YP-CORE) Scale

YP-CORE

Client ID

Age

Male ☐
Female ☐

Date form given
D D M M Y Y Y Y

Stage completed

S Screening
R Referral
A Assessment
F First Therapy Session
P Pre-therapy (unspecified)
D During Therapy
L Last Therapy Session
X Follow up 1
Y Follow up 2

Site/service ID

Therapist ID

Episode

Subcodes

Assistance given? ☐
(If yes, please tick)

These questions are about how you have been feeling – OVER THE LAST WEEK.
Please read each question carefully.
Think how often you have felt like that in the last week and then put a cross in the box you think fits best.

OVER THE LAST WEEK...	Not at all	Only occasionally	Sometimes	Often	Most or all of the time
1 I've felt edgy or nervous	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4
2 I haven't felt like talking to anyone	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4
3 I've felt able to cope when things go wrong	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
4 I've thought of hurting myself	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4
5 There's been someone I felt able to ask for help	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0
6 My thoughts and feelings distressed me	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4
7 My problems have felt too much for me	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4
8 It's been hard to go to sleep or stay asleep	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4
9 I've felt unhappy	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4
10 I've done all the things I wanted to	☐ 4	☐ 3	☐ 2	☐ 1	☐ 0

THANK YOU FOR ANSWERING THESE QUESTIONS

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Appendix G:
Sleep efficiency quotient (SEQ) Results

Results related to the sleep efficiency quotient for research questions two and three of the empirical paper are presented below.

What is the Relationship Between Sleep Efficiency Quotient (SEQ) and Demographic Factors?

As shown in Table G1, SEQ did not significantly differ across demographic factors of age, gender at birth and occupational status.

Table G1

Comparison of Sleep Efficiency Quotient across demographics groups

	SEQ (N=108)		Statistic	p	Effect size
	N	Mdn (IQR)			
Age (years)	108	-	ρ(108) = .067	.494	0.067
Sex (N=102)					
Female	80	63.85 (21.63)	U = 1072.50	.117	r = 0.16
Male	22	73.01 (27.38)			
Occupation status (n=92)					
Full-time	57	64.52 (17.18)	H(2) = 2.12	.347	η^2 = 0.001
Part-time	14	56.79 (22.70)			
None	21	67.07 (13.61)			

Note. IQR = interquartile range, Mdn = median, SEQ = sleep efficiency quotient

What is the Relationship Between SEQ and Mental Health Severity?

SEQ, an insomnia severity indicator, was not significantly different across service settings. Due to SEQ not meeting the assumptions of normality, non-parametric tests were utilised to assess the relationships with other mental health measures and a significant relationship was only found with one of the mental health measures, CORE-10, ρ (35) = -.37, *p* =.030. No other significant relationships found (see Table G2).

Table G2

Exploration of relationships between SEQ and mental health severity

	SEQ (N=108)		Statistic	p	Effect size
	N	Mdn (IQR)			
Service setting					
Primary care	66	68.94 (25.67)	U = 1112.00	.084	r = 0.17
Secondary care	42	62.50 (19.95)			
Mental health severity					
YP-CORE	70	-	ρ (70) = -.29	.083	-
CORE-10	35	-	ρ (35) = -.37	**.030**	-

Note. CORE-10 = Clinical Outcomes in Routine Evaluation – 10, IQR = interquartile range, Mdn = median, SD = Standard Deviation, SEQ = sleep efficiency quotient, YP-CORE = Young Person's Clinical Outcomes in Routine Evaluation