
| RESEARCH ARTICLE**Sleep Disturbance, Circadian Health And Mental Well-Being****Festus Uwakhemen Asikhia***LLM, MSc MBA, PhD, Post Doctorate Fellow School of Social and Human Studies, Atlantic International University***Corresponding Author:** Festus Uwakhemen Asikhia, **E-mail:** drfestusasikhia@gmail.com**| ABSTRACT**

There is a growing recognition of sleep disturbance as both a risk factor and a consequence of poor mental health and several studies have shown that sleep disturbance has a significant effect on emotional, cognitive and physical wellbeing. This journal explores the link between sleep disturbance, circadian health and mental wellbeing, with three major aims: to explore the bidirectional link between sleep disruption and mood disorders, to study and examine chronotherapy and light-based interventions for mood regulation, and to investigate the new emerging field of personalised sleep interventions with wearable technology. A thorough review of literature published in the past 12 years (2015–2026) was conducted, which comprised peer-reviewed journal articles, clinical guidelines and government reports, to guide the evaluation of existing evidence and identify best practice. The results suggest a close relationship between disturbed sleep and disrupted circadian rhythm and depression, anxiety and bipolar disorder based on shared neurobiological and psychobiological pathways. There is also evidence that chronotherapy, bright light therapy and cognitive behavioural therapy for insomnia are effective when administered as part of a regular mental health treatment. While wearable technologies have the potential to provide valuable tools for individual sleep monitoring and intervention, there are concerns about accuracy, privacy and accessibility. The authors conclude that increasing the health of sleep should be a key part of mental health promotion, coordinated by health care providers, researchers and policy makers. There are opportunities to improve mental health prevention and treatment through the strengthening of evidence-based sleep interventions and extending the personalised use of digital approaches.

| KEYWORDS

Sleep disturbance; Circadian health; Mental wellbeing; Mood disorders; Chronotherapy; Bright light therapy; Wearable technology.

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1. Introduction

Sleep is a basic function of life which is crucial to physical health, mental performance and mental wellbeing. The body restores itself, consolidates memory, regulates the immune system and deals with emotions during sleep, which is essential for optimal functioning. Although it is crucial, sleep disturbance has become a more prevalent problem in modern times globally due to long screen time, shift work and increasing psychological stress. Good sleep and sleep adequacy have become a public health problem as they affect quality of life, functioning in daily life and, as a consequence, healthcare expenditure (Riemann et al., 2022). Therefore, Healthy Sleep is a critical element of mental health prevention and treatment.

Circadian health is about the proper regulation of the internal biological clock that governs the 24-hour sleep–wake rhythm and coordinates physiological processes with the lighting and darkness of the environment. Signals sent by the SCN of the hypothalamus regulate hormone secretion, body temperature, metabolism, and cognitive function and emotional control (circadian system). This biological rhythm may be disturbed due to shift work, jet lag, late night routines or exposure to artificial light during the evening. It has been linked to sleep disturbances, decreased daytime functioning and increased risk for

psychiatric illness (Chellappa et al., 2019). The importance of maintaining circadian health therefore is growing more widespread in both physical and mental health.

Evidence over the past ten years has demonstrated a substantial reciprocal relationship between mood disorders and sleep disturbances. People who have chronic sleep deprivation or insomnia are more likely to have depression, anxiety, or bipolar disorder. These mental health conditions frequently exacerbate insomnia, making it difficult to get a decent night's sleep. A person's sensitivity to psychological distress is increased by persistent sleep disruption, which has been demonstrated to impact emotional regulation through changes in neurotransmitter functioning, inflammatory responses, and the hypothalamic-pituitary-adrenal (HPA) axis (Baglioni et al., 2016; Scott et al., 2021). Moreover, poor sleep has been associated with decreased decision making, attention, school or work performance, and increased risk of suicidal ideation and behaviour. The results underscore the significance of sleep disturbance as a manifestation and a possible factor in mental illness.

The link between sleep and mental health has become increasingly apparent, and there has been an emergence of innovative sleep interventions aimed at resynchronising sleep patterns and enhancing psychological wellbeing. In people with depression and circadian rhythm disorders, chronotherapy (a medical strategy that involves carefully scheduling sleep time to reset the biological clock) has been promising. Bright light therapy is another evidence-based treatment for SAD and is becoming more widely used to reduce symptoms of non-seasonal depression and circadian dysrhythmia (Geoffroy et al., 2022). Moreover, cognitive behavioural therapy for insomnia (CBT-I) is advised as the first-line treatment for chronic insomnia due to its long-lasting improvements in sleep quality and mental health measures (Edinger et al., 2021). The importance of embedding sleep focused interventions in routine mental health care is evident from these approaches.

The technological developments have also shifted the field of sleep assessment with wearable devices that are able to continuously measure sleep duration, sleep stages, heart rate variability (HRV), and other physiological measures. Smartwatches, fitness trackers and sleep rings provide personalized data which can help identify sleep issues early and help identify interventions. Wearable technologies have great potential to improve personalised healthcare, but there are issues with the accuracy of measurements, data privacy, accessibility and long-term clinical benefits (Chinoy et al., 2021).

In order to investigate the relationship between sleep disturbance and circadian health and mental wellbeing, this journal reviews the reciprocal relationship between sleep disruption and mood disorders, chronotherapy and light-based therapies for mood management, and wearable technology for personalized sleep management.

2. Sleep Disturbance and Circadian Health

2.1 Understanding Sleep Physiology

sleep is essential for healthy cognitive, emotional, and physical functioning. Sleep is a dynamic and active biological process that involves synchronized brain activity, hormonal impacts, and metabolic recovery rather than just being a state of rest. The circadian timing system and homeostatic sleep pressure combine to control the sleep-wake cycle; in order to maintain health, sleep should only take place when it is suitable and for the right amount of time (Walker, 2017). Although sleep needs may vary based on age, lifestyle, and health condition, it is advised that healthy individuals get between seven and nine hours of sleep per night (Watson et al., 2015).

These sleep phases are underpinned by the circadian rhythm, an endogenous 24-hour cycle that synchronizes physiological functions with ambient light and darkness. The circadian rhythm, commonly known as the "biological clock," is primarily regulated by the hypothalamus, more precisely the suprachiasmatic nucleus (SCN). The main regulator of the circadian rhythm is the hypothalamic suprachiasmatic nucleus, often known as the biological clock. The SCN controls the daily cycles of sleep, hormone secretion, temperature, and metabolism after receiving light signals from the retina (Chellappa et al., 2019). While darkness might help you fall asleep, bright natural light can help you stay awake. Electronic devices such as the use of devices in the evening and irregular sleep patterns, as well as shift work, can cause a disorganisation of the circadian system and lead to poorer sleep quality and mental health.

Two hormones, melatonin and cortisol, are key to circadian health. The pineal gland secretes melatonin in the dark, which stimulates sleep onset and aids in regulating circadian rhythms. cortisol, on the other hand, shows a diurnal pattern, with a high level in the morning to promote alertness and a gradual decrease during the day (Riemann et al., 2022). Chronic circadian disruption could lead to reduced nighttime melatonin levels and elevated levels of cortisol at night, which are associated with insomnia, emotional instability and heightened risk for mood disorders. Therefore, proper sleep architecture and circadian rhythms are essential to physical and psychological well-being.

2.2 Epidemiology of Sleep Disturbance.

One of the most prevalent health issues worldwide is insomnia. According to the World Health Organization, sleep deprivation is a major contributor to the worldwide burden of disease and a recognized risk factor for mental illnesses and non-communicable diseases. According to recent research, 10% of people would be eligible for a diagnosis of chronic insomnia disorder, while 30–35% of individuals have symptoms of insomnia at some point in their lives (Riemann et al., 2022). Other prevalent sleep disorders that negatively affect psychological health and quality of life include obstructive sleep apnea, restless legs syndrome, and circadian rhythm sleep-wake disorders.

Sleep issues are also common in the United Kingdom. The National Health Service (NHS) reports that about a third of adults struggle to get a good night's sleep, with higher rates of insomnia reported in females, older people and those with mental health conditions (NHS England, 2023). Growing population rates of sleep disturbance are due to increased work related stress, irregular work patterns, extended use of digital devices and lifestyle changes. People who are chronically sleep-restricted are more likely to be depressed, anxious, have cardiovascular disease, be obese, and be less productive at work.

Factors that increase sleep disturbance are ageing, obesity, chronic illness, shift work, socioeconomic deprivation and substance use and psychological stress. Such issues can create a vicious cycle that worsens sleep problems and makes them more likely to occur. A public health impact of sleep disturbance is a significant economic burden due to higher health care utilization, sick leaves and lower productivity in the workplace. Therefore, improving sleep health has become an important focus for systems of health care looking to minimize the burden of mental illness and chronic disease.

Table 2.0: prevalence of common sleep disorders

Sleep Disorder	Estimated Global Prevalence	Estimated UK Prevalence	Common Consequences
Chronic insomnia	10–15%	10–12%	Depression, anxiety, reduced quality of life
Insomnia symptoms	30–35%	30–35%	Daytime fatigue, poor concentration
Obstructive sleep apnoea	9–38%	8–15%	Cardiovascular disease, cognitive impairment
Restless legs syndrome	5–10%	5–8%	Sleep fragmentation, fatigue
Circadian rhythm sleep disorders	3–5%	Increasing among shift workers	Mood disturbance, impaired performance

2.3 Biological Mechanisms Linking Sleep and Mental Wellbeing

Several intertwined biological mechanisms that have been demonstrated explain the connection between sleep disturbance and mental wellbeing. Emotional activity and sleep are controlled by neurotransmitters such as serotonin, dopamine, gamma-aminobutyric acid (GABA) and noradrenaline. These neurotransmitters are also disrupted by sleep loss, causing mood disorders, difficulty with attention and cognitive function (Goldstein & Walker, 2019). One example of this is reduced activity of serotonin being consistently linked to insomnia and depressive symptoms.

Another crucial process is the HPA axis, which is the body's primary stress response system. The HPA axis is continuously activated by chronic sleep deprivation, which raises cortisol release and physiological stress in general. Anxiety, despair, and a lack of emotional resilience result from the activation of this pathway (Scott et al., 2021). People who suffer from chronic insomnia frequently have high evening cortisol levels because they are constantly awake, which interferes with restorative sleep.

New research indicates that poor sleep also impairs the brain's ability to reorganise itself with learning and experience, known as neuroplasticity. Good sleep supports the strengthening of synapses and consolidation of memory; poor sleep decreases cognitive flexibility and adaptation to emotions. Sleep disturbances therefore, have a negative impact on emotional regulation, on negative emotional reactivity and on psychological resilience to stressors, and enhance vulnerability to common mental disorders.

2.4 Vulnerable populations and risk factors

Sleep disturbance can be a problem in people of all ages but some groups of people are at higher risk. The conflicting factors of pubertal biological shifts and their school responsibilities, as well as overuse of digital media, are common causes of delayed sleep timing among adolescents, which can lead to anxiety and depression. Disordered sleep is common in older people, due to age-related physiological changes, chronic illness and medication use.

Another susceptible population is the shift workers, since their working hours are irregular, which affects their sleep and quality of sleep. Shift workers who have endocrine disorders have been linked to depression, metabolic disorders and cardiovascular disease (Chellappa et al., 2019). Chronic sleep deprivation can also lead to healthcare workers becoming burnt out, stressed and experiencing poor psychological well-being, especially those working long shifts or in shifts late at night.

People with chronic conditions like diabetes, cardiovascular disease, chronic pain, and neurological disorders often have other sleep problems as well that make it more difficult to manage their disease and can decrease quality of life. The observations underscored the need for timely detection and intervention for vulnerable groups, and the significance of sleep health in the context of overall mental health services.

3. Bidirectional Relationship Between Sleep Disturbance and Mood Disorders

3.1 Sleep Disturbance and Depression

One of the most reciprocal interactions between mental health conditions and depression is sleep disruption. People with MDD frequently complain of chronic sleep disturbances, and there is evidence linking sleep issues to the emergence of depressive symptoms in healthy individuals (Baglioni et al., 2016). Sleep problems are increasingly recognized as an independent risk factor for the onset, aggravation, and recurrence of depression, rather than only a symptom of depression. Compared to good sleep, chronic insomnia is estimated to be about twice as likely to cause depression (Scott et al., 2021).

The association between sleep disruption and depression is explained by a number of concurrent biological and psychological factors. Your body's usual balance of many chemicals or neurotransmitters, including serotonin, dopamine, and GABA, that are important in sustaining a normal mood is upset when you don't get enough sleep. Furthermore, inadequate sleep causes the HPA axis to become activated, resulting in prolonged elevated cortisol levels. Long-term stress response activation raises depression symptoms and impacts emotional resilience (Riemann et al., 2022). Loss of sleep and systemic inflammation have also been related to depression because of elevated inflammatory cytokines.

Sleep disturbance also impacts emotional regulation, decreases focus & social isolation, which can exacerbate depressive symptoms and leads to a vicious cycle of depression and insomnia (Scott et al., 2021). Data now mounts that sleep-oriented treatments should be a part of depression treatment. Recently, treatment of insomnia using (CBT-I), chronotherapy and bright light therapy showed promising results for enhancing sleep and depressive symptoms when used in addition to standard psychiatric treatment (Edinger et al., 2021; Geoffroy et al., 2022). These results show that the failure to sleep is a crucial aspect of depression treatment and not a secondary symptom of depression in its own right.

3.2 Sleep Disturbance and Anxiety Disorders

Similarly, individuals with ADs such GAD, panic disorder, social anxiety disorder, and PTSD frequently experience sleep difficulties. Chronic sleep loss appears to be linked to increased emotional reactivity and susceptibility to anxiety disorders, while anxiety frequently contributes to the person's inability to fall asleep, propensity to wake up during the night, and poor quality of sleep (Alvaro et al., 2021). As a result, a vicious cycle may emerge, with worry impeding sound sleep and insufficient sleep resulting in heightened anxiety and physiological arousal.

Sleep deprivation disturbs the balance between the amygdala and the prefrontal cortex, lowers emotional control and increases cortisol secretion, leading to greater anxiety and less emotional control (Goldstein & Walker, 2019). CBT-I and MBIs can lead to an improvement in sleep, with subsequent reduction of anxiety symptoms; these benefits were reported for psychological wellbeing (Edinger et al., 2021). Therefore, a routine evaluation of sleep should be a part of the treatment of anxiety disorders.

3.3 Sleep Disturbance, Bipolar Disorder and Suicide Risk

Sleep disturbance is a highly characteristic clinical aspect of BD that contributes to disease progression, relapse and impairment in functioning. People with bipolar disorder often experience insomnia during the depressive phase of the disorder, during manic periods their need for sleep may decrease and during remission they may have irregular sleep-wake cycles. Working in the center of developing mood instability is believed to be the disturbance of circadian rhythm, which impacts neurotransmitter activity, regulation of hormones and emotional processing (Geoffroy et al., 2022). Thus, it is important to keep stable sleep schedules as this is believed to reduce the likelihood of relapse and recovery. It is important to note that sleep issues usually help

to predict manic and depressive episodes beforehand and are a pertinent clinical marker for relapse. Chronotherapy and social rhythm therapy (SRT) have been found to improve sleep stability, thus decreasing mood instability (Geoffroy et al., 2022).

Suicidal ideation and behaviours, one of the most alarming outcomes of insomnia and sleep deprivation, being associated with sleep disturbances. Many studies have shown that insomnia is a risk factor for suicidal ideation in addition to depression and anxiety. Those who continue to have high levels of sleep disturbances regularly report a sense of hopelessness, a lack of emotional control and heightened psychological distress, which all increases the likelihood of suicide (Bernert et al., 2019). Another side to sleep loss is an impact on the cognitive functions of executive functioning and decision-making, which decreases people's ability to manage emotional crises effectively. The results highlight the need to view sleep problems as a clinically significant risk factor and not as a mere manifestation of severe mental illnesses. Evaluating how well patients sleep regularly in psychiatric services can help identify patients who are more likely to use drugs or to harm themselves or show signs of needing to return to hospital, thereby helping to prevent them from relapsing or being harmed and improve their outcomes.

3.4 Critical Evaluation of the Evidence

A large and growing volume of contemporary studies, based on systematic reviews, meta-analyses, RCTs and longitudinal cohort studies suggests there is a robust association between sleep disturbance and mood disorders. Meta-analysis studies have repeatedly shown that insomnia is a significant risk factor for depression and anxiety as well as for being less likely to remit from psychiatric illness after receiving treatment (Baglioni et al., 2016; Scott et al., 2021). Large sample sizes and synthesis of evidence on a wide range of populations are the strength of these reviews.

Randomised controlled trials have also built the evidence central in showing interventions that are effective for improving sleep quality and mood symptoms, including cognitive behavioural therapy for insomnia, chronotherapy and bright light therapy (Edinger et al., 2021; Geoffroy et al., 2022). These trials offer excellent evidence of a causal association that justifies the implementation of sleep treatments into mainstream, conventional mental health therapy.

Long-term studies demonstrate that sleep problems are not just signs of depression, anxiety, and bipolar disorder; rather, there is evidence that they frequently occur before these mental conditions manifest. However, many studies employ self-reported sleep measurements, which have short follow-up periods and little representation of low- to middle-class groups. In order to better understand the intricate link between sleep disruption and mental wellness, more varied populations and objective sleep measurement tools, such as polysomnography and approved wearable technologies, will be required in the future. .

4. Light-based interventions for mood regulation and therapies.

4.1 Chronotherapy

The evidence-based chronotherapy takes care of restoring normal circadian rhythms by adapting the timing of sleep, wakefulness and environmental lighting. Due to the strong relation with circadian rhythm disruption and depression, bipolar disorder and other mood disorders, chronotherapy has become an ever-growing non-pharmacological treatment within mental health care. The main goal of chronotherapy is to align the internal (circadian) clock with the light/dark cycle, to improve sleep quality, emotional responses and psychological wellbeing (Geoffroy et al., 2022).

Sleep phase advance, in which the bedtime and wake-up time is systematically advanced, is one of the main chronotherapeutic procedures. This intervention is useful for people who have delayed sleep-wake phase disorder and depression due to circadian misalignment. Patients will show the benefit of improved sleep quality, reactions and mood as well as daytime alertness by advancing the time that they sleep. Another commonly studied method is waking therapy (CTD), or controlled sleep deprivation. Staying awake during a set course of time might sound counterintuitive, but supervised Wake therapy is known to quickly yield antidepressant benefits in those who have major depression. Improvements, however, may only be temporary unless there is other intervention like bright light therapy or pharmacological therapy (Scott et al., 2021).

One more chronotherapeutic technique is social rhythm therapy (SRT) which aims to create diurnal stability in areas such as sleep, eating, physical activity and social interaction. predictable daily schedules allow for a regular sleep/wake cycle and can decrease mood volatility, especially for people suffering from bipolar disorder. There is evidence that using chronotherapy in conjunction with traditional psychiatric therapy helps to enhance long-term symptom control and help to lower the rate of relapse. As a result, chronotherapy has emerged as an important part of integrated mental care, as it is a treatment option to the one of the underlying mechanisms that has been linked to mood disorders.

4.2 Bright Light Therapy

Bright, white light therapy is a form of light tube therapy that has been proven to help treat circadian rhythm disorders and mood disturbances, by bringing people exposure to high-intensity artificial light in the morning hours. Bright light has both positive and negative effects on melatonin and can enhance daytime alertness and emotional modulation, and induce normal

sleep-wake rhythm and sleep/wake cycle (Golden et al., 2022). It is especially effective in those showing an out-of-sync circadian rhythm from seasonal adjustments, shift working or extended exposure to artificial nighttime light.

There have been many clinical trials showing that bright light therapy is effective in the treatment of seasonal affective disorder and is beneficial to those with nons-seasonal depressed mood. Other benefits include better sleep quality, better functioning during the day and overall psychological wellbeing with bright light therapy in addition to cognitive behavioural therapy and/or antidepressant medication (Geoffroy et al., 2022). Carefully supervised morning light therapy can be used to help treat depressive symptoms while reducing the likelihood of triggering a manic episode with proper dosing and timing for patients who experience bipolar depression.

While bright light therapy is considered safe, a number of precautions should be taken into consideration. Some temporary side effects are headaches, eye strain, nausea and mild irritability, especially in the early phases of treatment. Patients with retinal disorders or medical conditions who are sensitive to light, should undergo specialist evaluation prior to therapy. However, when applied in a clinical format, bright light therapy is shown to be a safe, non-invasive and cost-effective method of circadian health therapy and mood regulation.

4.3 Behavioural and Pharmacological Sleep Interventions

To address the behavioral and biological underpinnings of a persistent sleep disruption, pharmaceutical and behavioral therapies are combined with chronotherapy and bright-light therapy. Because it addresses the maladaptive sleep behaviors, dysfunctional beliefs, and poor sleep patterns that contribute to insomnia, CBT-I is widely acknowledged as the first-line treatment for chronic insomnia. Sleep restriction, stimulus control, relaxation training, and cognitive restructuring are all part of CBT-I, which produces long-lasting improvements in psychological well-being and sleep quality (Edinger et al., 2021). Unlike hypnotic medication, CBT-I does not cause dependency or withdrawal symptoms.

Another important intervention is melatonin for those who have circadian rhythm sleep-wake disorders or delayed sleep phase syndrome. Melatonin is the body's natural sleep hormone that promotes the initiation of sleep and aids in restoring circadian synchronisation, at the proper time and consistent with normal functioning. It is well tolerated; however, its effectiveness is dependent on dosage, time and on individual circadian characteristics. Therefore, melatonin needs to be administered based on a clinical evaluation rather than as a broad-based treatment.

A growing body of evidence suggests that a combination therapy of CBT-I, chronotherapy and medication is more effective than single therapy. These multi-disciplinary approaches work on both behavioural and physiological mechanisms to sleep disturbance, as well as enhancing emotional regulation and reducing relapse of mood disorders. The National Institute for Health and Care Excellence (NICE, 2023) have made recommendations in the United Kingdom to conduct a full investigation into sleep problems and focus on evidence-based psychological treatments before considering long-term pharmacological interventions. This comprehensive approach is fuelled by growing awareness that better sleep is essential for better mental wellbeing and better psychiatric care.

5. Case Study: Sleep Disturbance and its Effects on Health

Severe night-time insomnia, which is so prevalent as to be a recognized effect and cause of distress due to either physical and/or mental illness or disability, is now recognized as a symptom or a cause. Chronic insufficient sleep and circadian disruption affect emotional regulation, cognitive performance, physiological functions and leads to an increased risk of mood disorders and chronic disease. It is only by examining the particular consequences of chronic sleep loss on an individual's health that the need to identify the effects early and intervene with evidence-based strategies is clarified.

The patient was a 35-year-old female secondary school teacher who saw her GP due to chronic insomnia of around 9 months duration from the United Kingdom. She said she took over an hour to fall asleep, woke up multiple times during the night and woke up too early, but was unable to fall back asleep. Her symptoms began while she was experiencing greater stress at work and more hours on digital screens when she went to sleep at night and less deep sleep. She said she felt more tired, more irritated, less focused and less effective at work and that she was withdrawing from social events due to a constant sense of being run down. Her past medical history did not include any remarkable notes except well controlled hypertension.

Clinical triage consisted of a full clinical history of sleep and mental health assessment and physical examination. The patient also filled out the Insomnia Severity Index (ISI) which shared severe insomnia scores and the Patient Health Questionnaire-9 (PHQ-9) which shared moderate scores for depression. Average sleep duration was 4-5 hours per night with sleep latency of less than 10 minutes and multiple awakenings during the night on a two-week sleep diary. Results from a wearable sleep monitoring device corroborated with poor sleep efficiency and disruptions in sleep timings. Routine lab tests did not reveal any underlying medical conditions of the child that would account for the symptoms.

Chronic insomnia disorder and moderate major depressive disorder were determined. Circadian rhythm disruption was found to be a significant factor in the diagnosis. The assessment revealed both a cause-effect relationship between insomnia and depression and a reciprocal relationship, in which depression exacerbated insomnia and insomnia aggravated depression. This cycle was likely to remain and could lead to poorer psychological health and functioning of the individual if no help was available.

A multidisciplinary treatment programme was undertaken consisting of CBT-I (sleep restriction, stimulus control, relaxation training and cognitive restructuring). Light therapy with bright lights in the morning was used to try to reset the circadian rhythm, and sleep hygiene was taught to promote bedtimes and cut back on-screen time, levels of caffeine and physical activity in the evening, as well as regular bedtimes. All treatment and detailed monitoring of sleep duration and treatment adherence was conducted with the wearable sleep-monitoring device. The medication a person has been prescribed and their usage was not started as psychologic symptoms were assumed to resolve after the sleep had reestablished itself in a healthy pattern.

The patient was significantly improved after 12 weeks. The duration of sleep was on average seven hours, wake-up rates reduced and sleep efficiency enhanced. Clinically significant decreases were observed in insomnia and depression reporting at follow-up when assessed with the ISI and the PHQ-9 questionnaire, respectively. The patient said there was a resulting improvement in attention span, emotional stability, and job productivity, along with the return of an active social life.

This case illustrates a chronically disturbed sleep that can be identified as a separate clinical entity with a potential role in depression, cognitive dysfunction, and reduction of life quality. Similarly, it demonstrates the efficacy of the integration of CBT-I, SLT and sleep hygiene education and wearable technology in the framework of personalised treatment programmes. It is important to include sleep assessment in routine clinical and mental health care as a means to improve mental wellbeing, to reduce disease progression and to improve long-term health outcomes through early detection and comprehensive management of sleep disorders.

6. Findings

This research demonstrates that sleep disruption has a significant role in mental health and should be viewed as a risk factor for mood disorders as well as a symptom. Overall, the data indicates that there appears to be a reciprocal association between sleep disturbance and mental disease, particularly bipolar disorder, anxiety disorders, and depression. Chronic insomnia is linked to a higher risk of hypomanic and depressed symptoms, and common mental health conditions frequently impair sleep quality by interfering with the circadian rhythm. Poor sleep can exacerbate mental discomfort and detrimental changes in mental health can affect sleep, which in turn can lead to a general decline in functioning and quality of life (Scott et al., 2021). The review further shows that such disruption of the circadian rhythm has a central role in the development and progression of mood disorders. Changing levels of melatonin, cortisol, neurotransmitters and inflammation pathways result in emotional decontrol and cognitive dysfunction. This biological process is why people with chronic sleep problems are more vulnerable to stress, have less attention span and are more prone to relapse after treatment. Therefore, it is necessary to consider sleep health within the framework of mental health services and treatment, and not just as a secondary clinical concern.

Another important discovery was that chronotherapy and bright light therapy are effective non-pharmacological methods for better sleep quality and better regulation of mood. Data from systematic reviews and RCTs showed that various interventions, including those of sleep phase advance, social rhythm therapy and bright light therapy in the morning, can normalize circadian alignment and lower depressive symptoms and improve psychological functioning. Another therapy, called CBT-I, has also shown sustained benefits and is the first-line recommended treatment for chronic insomnia as the training focuses on behavioural and cognitive aspects that underlie chronic sleep disturbance.

The review also emphasises the increasing role of wearable devices and Artificial Intelligence in individual-based sleep medicine. However, concerns persist about limited clinical validation and digital inequality, as well as measurement accuracy and data privacy. The challenges suggest that wearable technologies should be used in addition to a thorough clinical evaluation.

Overall, the conclusions highlight the potential of diet and lifestyle interventions addressing sleep health on both prevention and early intervention for mental health practice, as well as management of chronic diseases. The sleep assessment, circadian-based modalities and personalised digital technologies could be integrated into the routine clinical care, which would benefit patients' outcomes, decrease the burden of mood disorders and enhance effective, evidence-based mental health care. Future studies are still needed to enhance the evidence base in general, including long-term studies in diverse populations and on objective markers of sleep and circadian health.

7.Recommendations

7.1 United Kingdom Government Interventions and Policies

The UK government's national policies and initiatives should highlight a greater understanding of and dedication to sleep health as a vital component of promoting mental health and preventing illness. In order to further integrate mental health services, the NHS Long Term Plan should include community mental health services, psychological support programs, and routine sleep assessments as part of primary care. In addition to improving patient outcomes, early detection and treatment of sleep problems will lessen the burden of depression, anxiety, and other mood disorders on the NHS over the medium to long term (NHS England, 2019).

Aim to continue to develop evidence-based and clinically-relevant guidelines that incorporate new evidence on chronotherapy, wearable technology and digital sleep interventions through the National Institute for Health and Care Excellence (NICE). It is important to have clear guidance which helps health care professionals choose the most suitable non-pharmacological and/or pharmacological treatments based on patient needs and clinical presentations.

It is also important for the Government to develop and promote nationally-funded campaigns for good sleep hygiene, in which public awareness of healthy behaviour is raised. Consistency of sleep habits, reduction in screen usage in the evenings and awareness of sleep and mental wellbeing should be emphasized in public education campaigns. These campaigns may be carried out via NHS programmes and community organizations or events.

Occupational health policies should promote flexibility among employers in working practices, shift work and fatigue management programmes and provision of workplace support for mental wellbeing and minimise the potential for negative impact of shift and long working hours. Companies should also aim to educate employees about sleep hygiene and stress relief to prevent work burnout and a better health of the workers.

Lastly, sleep education must be integrated into primary and secondary school health programmes. Educating kids and young people on healthy sleep, responsible use of digital technology and how to manage their stress could not only equip them with lifelong healthy behaviours, but it could also help to prevent mental illness in the future.

7.2 Health and Medical Interventions

The overall evaluation of clinical practice should include routine screening for sleep issues and treatments; especially in primary care, psychiatry and chronic disease management programmes. Sleep problems should not be left untreated until they reach more serious physical or psychological stages, and in that, validated instruments like Insomnia Severity Index (ISI), Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleepiness Scale (ESS) should be used to detect any signs of sleep impairments. Early recognition would help to intervene as early as possible which would give better treatment.

CBT-I is the preferred initial treatment for chronic insomnia for its effectiveness and chronicity effect because of current effectiveness evidence and its durability. Healthcare systems need to upskill more clinicians in the delivery of CBT-I, and enhance its availability via digital platforms, especially where sleep specialist services are limited.

The use of bright light therapies in people with circadian rhythm disorders, seasonal affective disorder and in selected cases of non-seasonal depression, should be considered if treatment is performed following clinical guidelines that are supported by the scientific literature. Additionally, melatonin can be used in selected cases of compromised circadian rhythms, such as patients with those disorders who do not respond sufficiently to behavioural therapy. Treatment should be tailored to the individual, however, and delivered by qualified health care providers at all times.

We should see multidimensional management of complex sleep disorders, which should involve general practitioners, psychiatrists, psychologists, sleep specialists and behavioural therapists that is the norm. Digital Mental Health Services (including telemedicine, wearable technologies and mobile Health Services) should also be incorporated into routine care to facilitate ongoing monitoring, engagement with patients and individualised care and ensure appropriate mental health data security and governance.

7.3 Academic Research Directions and Research gaps

To better understand the causal association between sleep disruptions, circadian dysfunction, and mood disorders at different stages of life, future research should concentrate on long-term, longitudinal studies. To evaluate the long-term effectiveness of these treatments (behavior interventions, bright light therapy, and chronotherapy) in standard clinical practice, additional solid data is also required.

There is a need for additional research on AI and digital-biomarkers, and the development of precision psychiatry, to understand the value of wearable technologies in supporting personalized diagnosis, early detection, and treatment planning. These technologies need to be tested in a variety of clinical settings and among a range of populations in order to ensure reliability and applicability to clinical practice.

There is a need to increase the generalisability of the current evidence by increasing the number of participants within other socio-economic, ethnic and cultural groups. Finally, it is important to conduct broad cost effectiveness analyses to assess the clinical and economic impacts of the use of wearable technology, along with digital mental health and personalised sleep interventions within national health service systems in a sustainable way. Answers to these research gaps can support development of future evidence-based policies, and inform better sleep-related mental health prevention and management.

8. Conclusion

Emotional control, cognitive function, and physical well-being are all impacted by sleep deprivation or circadian disruption. Evidence of a reciprocal relationship between mood disorders and sleep disturbances has been found in this review; chronic insomnia and/or irregular sleep patterns raise the risk of depression, anxiety, and bipolar disorder, which exacerbates sleep abnormalities. The data demonstrates that sleep disturbances are not only a component of mental illness but rather a significant, early-detectable, and modifiable risk factor that should be addressed as such.

The review has also found that CBT-I, bright light therapy, and chronotherapy are useful in promoting good sleep and improving psychological well-being. When utilized as part of a continuous mental health treatment plan, the therapies, which focus on the biological and behavioral factors that contribute to sleep disruption, have demonstrated long-lasting effects. Additionally, advances in wearable technology and artificial intelligence have created new opportunities for customized sleep medicine, enabling ongoing monitoring, early identification of sleep problems, and individualized treatment regimens. But the accuracy of devices, safeguarding patients' data privacy, digital inequity, and long-term clinical validation are important concerns to be resolved before these technologies can be seamlessly incorporated into healthcare systems.

The findings also highlight the need for multi-sectorial action by all stakeholders – the policy-makers, the healthcare practitioners and the researchers. Improving national health initiatives to support sleep in the UK; provision of better access to evidence-based interventions and integration of routine sleep assessment into primary care and mental health services, could be a key factor in the improvement of mental health among populations. Focusing on sleep education systems, sleep systems in the workplace and school-based sleep promotion programmes are also significant for the prevention of sleep disorders throughout the lifespan.

Although a solid basis for comprehending the relationship between sleep and mental health has been established, there are still some unanswered research questions. Longitudinal designs, objective sleep assessment, and more diverse study populations could be used in future to assess cost-effectiveness and evaluate the role of new and emerging digital technologies in sleep medicine. Overall, we should place the care of the sleep system at the centre of future clinical practice, public health policies and research efforts to enhance psychological wellbeing and decrease burden of mood disorders, thereby leading to better, personalized mental care for future generations.

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