

Treatment for Insomnia in Depressed Adolescents

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Abstract

Objective: Sleep undergoes dramatic changes during the adolescent years due to biological, circadian, and psychosocial influences. It is now known that sleep loss, both acute and chronic, can affect emotion regulation and can increase the likelihood of developing depression and risky behaviors.

Method: The authors carried out a systematic review utilizing the PubMed database by using the search terms including: “adolescence, depression, sleep, and insomnia.” The present review covers manuscripts accepted up to the year 2013. The following review discusses findings on the bidirectional relationship between insomnia and depression and will cover current evaluation and treatment options.

Results: Depression can be present in up to 20 percent of adolescents and most of these children will have some form of sleep disturbance. The etiology of sleep disturbances may reflect insomnia, circadian rhythm sleep disorder, sleep apnea, or other factors. Pharmacological and cognitive behavioral therapy approaches are common, but may result in limited gains due to persistent insomnia. Antidepressant medications may be lessened and relapse may be higher in those with insomnia. Treatment monitoring may be helped by motivational interviewing techniques and examining the teen’s self-report over parental sleep reports.

Conclusion: Sleep disturbances that are identified, addressed, and appropriately monitored may result in improved sleep and mood. Active involvement of the teen in the therapy process may improve outcomes. Further research is needed to develop non-pharmacological strategies that are acceptable and sustainable for adolescents.

Keywords: Adolescents; Sleep and mood; Antidepressant medications; Circadian rhythm; Insomnia

Introduction

Sleep undergoes dramatic changes during the adolescent years due to biological, circadian, and psychosocial influences [1]. While there is a wide range of individual variability, there is a consistent trend in a decrease of total sleep time in healthy children between the ages of 11 and 15 [2]. In addition to a reduction in the number of hours teens sleep, there are also age-related changes in the quality and timing of sleep. For example, deep slow wave sleep duration, (a proxy for sleep quality and restorative sleep) which makes up nearly half of the sleep period in childhood, declines by 27% from early adolescence to late adolescence [3]. While it is not yet clear whether these declines are associated with functional outcomes during adolescence, it is a critical time for emerging psychiatric disorders.

Additionally, the body’s internal clock—which regulates sleep (also called circadian rhythm)—shifts to a later clock time. This delay in the timing of the sleep/wake cycle during adolescence is across-cultural phenomenon [4] and is theorized to potentially be caused by a change in the circadian timekeeping mechanism due to pubertal hormones [5].

Regulation of the circadian rhythm is highly dependent upon exposure to bright light. Depending on the timing and the level of light, this exposure can reset the timing of sleep. For example, light exposure at night can cause the synthesis of the “night hormone” melatonin to be suppressed and shift the circadian rhythm to a later time [6].

As the circadian rhythm drifts to a later time, teens may prefer to interact socially (either in person or online) at night and delay the start of sleep. In fact, weekend bedtimes have been found to be delayed by approximately three hours between the ages of 11 to 18 [4].

Essentially, the circadian timing and quality of sleep in healthy teens undergo changes during adolescence, which may increase vulnerability to depression or chronic sleep disturbances like insomnia. Depression

is diagnosed in up to 20 percent of adolescents, [7] and up to 90 percent of those adolescents also have sleep complaints. Adolescents with depression may experience exacerbation of sleep problems as well as the consequences of poor sleep. Insomnia can be a symptom of depression and can also be a distinct co-occurring illness with a chronic course in depressed youth. This becomes important as depression is a predictor of depression relapse. According to a meta-analysis of 21 longitudinal epidemiological studies investigating sleep complaints and depression, even healthy individuals with insomnia were found to be twice as likely (confidence interval [CI]: 1.98-3.42) to become depressed compared to people without sleep complaints [8]. This review will focus on understanding the complexity of sleep complaints in the context of depression during the teen years, along with diagnostic assessments, clinical decision making, and treatment interventions for insomnia in depressed adolescents.

Methods

The authors carried out a systematic review utilizing the PubMed database by using the search terms including: “adolescence, depression, sleep, and insomnia.” The present review covers manuscripts accepted up to the year 2013. The following review discusses findings on the bidirectional relationship between insomnia and depression and will cover current evaluation and treatment options.

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Results

The bidirectional relationship between depression and insomnia during adolescence

The directionality of the relationship between depression and insomnia across the lifespan is complicated; it is a topic that is under investigation by a number of research groups.

It is now known that sleep loss, both acutely and chronic, can affect emotion regulation and can increase the likelihood of developing depression [9] and risky behaviors [10,11]. Depression and risky behaviors, such as substance use may also lead to insomnia. The relationship between sleep hours and risky behaviors was examined in a 2007 survey entitled the “National Youth Risk Behavior Survey.” This population survey analyzed reports of the sleep and behaviors of approximately 12,000 US high school students. The study revealed that teenagers who obtained insufficient sleep (“insufficient sleep” defined as less than 8 hours a night; 69% of the sample) were almost twice as likely to drink alcohol (AOR, 1.64; 95% CI, 1.46-1.84); use marijuana (AOR, 1.52; 95% CI, 1.31-1.76); be sexually active (AOR, 1.41; 95% CI, 1.25-1.59); to seriously consider attempting suicide (AOR, 1.86; 95% CI, 1.60-2.16); as well as feel sad or hopeless (AOR, 1.62; 95% CI, 1.43-1.84) [12].

Another large scale study utilizing data from 700 teenage participants examined both cross-sectional and longitudinal components contributing to the bidirectional nature of sleep and substance use. The study adjusted for the presence of depression, socio demographic characteristics, pubertal status, and body mass index. In adolescents between 11 and 18 years of age, shorter sleep periods during the school week were related to greater likelihood of alcohol use. Longitudinal follow up after two years revealed that achieving more sleep during the week predicted lower cigarette and marijuana use [13].

Insomnia symptoms may begin early in life and may increase risk for depression. Two studies have highlighted this issue. In an epidemiological study, lifetime questionnaire data about insomnia was collected in approximately 1,000 adolescents between 13 and 16 years of age. Results showed that the median age of insomnia onset was during the 11th year of life. In girls, onset of menses was associated with an onset of insomnia; yet, in boys, maturational development was not a factor. Over half of the adolescents with insomnia in that sample also had a comorbid psychiatric disorder [14].

In a prospective study depression and insomnia scores were examined in approximately 3,000 youths between ages of 11 through 17. Researchers found that baseline insomnia (either with or without daytime impairment) increased risk for major depression 2- to 3-fold. Given that the presence of daytime impairment caused by insomnia is a diagnostic necessity, this suggests that even those without insomnia diagnosis, but with sleep symptoms only may still be at risk for depression. The reverse was also true; i.e., major depression increased the risk for symptoms of insomnia, with and without impairment [15].

Studies comparing the sleep of depressed children and adolescents to healthy control children and adolescence suggest that there are differences in sleep that can be measured objectively. These objective differences may influence clinical outcome. In one study, researchers investigated the relationship between sleep polysomnography (PSG) in depressed children and adolescents and the clinical course of the disorder. Depressed adolescents with decreased sleep efficiency (defined as a measure of total sleep time divided by time in bed) and a “delayed” sleep onset (defined as >10 minutes) had a probability of recurrence

of depression at 12 months of 0.39 compared to 0.15 in subjects with non-delayed sleep onset ($p=0.005$) [16]. More sophisticated analyses of the sleep electroencephalogram—such as temporal coherence (the degree of synchrony between all night EEG rhythms) was significantly lower in adolescents with MDD, compared to healthy controls [17]. These studies raise the question of whether temporal coherence is a state or trait feature of depression and the clinical correlates of low coherence [18]. Lastly, a study using actigraphy to measure sleep patterns in depressed adolescents showed that there were differences in the rest/activity cycles. For example, lower activity levels, lower light exposure, and less time spent in bright light (>1000 lux) were found in depressed adolescents compared to healthy controls. Depressed girls, in particular, were prone to having a dampened circadian amplitude, thought to reflect weak entrainment to a 24-hour day [19].

The natural preference to initiate sleep at a later time may provide more time for teens to socialize or use electronics. This may unintentionally precipitate/contribute to and perpetuate symptoms of depression. For example, frequent use of social media at night may contribute to increased anxiety or cognitive rumination. A recent study found an association between social networking and higher depression scores [20]. Unresolved anxiety and guilt about the day’s events may also interfere with sleep onset. Catastrophic worry has been found to partially mediate the relationship between adolescent sleep disturbances and depressive symptoms [21]. In high school students with early school start times the next day, this may limit the opportunity to meet one’s physiological sleep need [22]. While this is highly individual and difficult to determine [23], this can result in chronic sleep deprivation during a time when sufficient sleep is essential for physician and emotional maturation. Clinical interventions, such as establishing a “worry time” has been shown to be effective in decreasing pre-sleep cognitive arousal in a college student population [24].

In summary, to date, research suggests an association between sleep disturbances and depression. Short sleep time, subjective sleep complaints, and/or objective signs (PSG) of sleep disturbance may lead to increased risk of the onset or recurrence of depression. On the other hand, insomnia is common in depression. The cognitive, behavioral, and biological rhythm changes associated with depression may exacerbate the sleep disturbance.

The Consequences of sleep disturbance during adolescence

According to the National Sleep Foundation, 61% of teenagers are chronically sleep deprived [25]. Sleep deprivation at any age can impair one’s ability to regulate emotions and can also impair judgment. As a result, chronic sleep deprivation in healthy teens has been associated with unintentional injuries, poor school performance [26], substance use [27], obesity [28], and the risk for suicide [29-31]. Adolescents with a preexisting history of major depressive disorder may be at even greater risk for these outcomes.

In 1998, researchers found that high school students who were struggling academically reported that they slept 25 minutes less and went to bed 40 minutes later than those getting As and Bs [32]. Approximately fifteen years later, adolescents are likely either sleeping the same or fewer minutes [2]. This negative trajectory may be associated with other academic, emotional and physical changes in adolescent health [33].

In addition to poor school performance, sleep deprivation in teens has been shown to be associated with depression in cross-sectional studies [34]; further, in a longitudinal study, it has been found to

exacerbate depression symptoms in middle school students [35]. In addition to short total sleep time, “chronotype” (which refers to the time at which a person prefers to be awake and asleep according to their body’s internal clock) may be playing an interactive role. Teens who categorize themselves as having an evening preference have more daytime complaints (such as attention problems, poor school achievement, and becoming emotionally upset) than other non-evening types [34]. Self-described “morning –type” adolescents have shown fewer waking problems and female morning types appear to show less externalizing and internalizing problems [36]. Furthermore, when examining the role of both sleep deprivation and chronotype on emotions (e.g. positive affect vs. negative affect), all participants reported lower positive affect when sleep deprived, but evening types reported less positive affect regardless of being sleep deprived or rested. The authors suggest that evening chronotype be a marker of emotional vulnerability [37].

Studies have now found that sleep disturbance (e.g. typically defined generally as “trouble sleeping” by a parent) plays a significant role in suicidal ideation, self-harm, and completed suicide. In 2010, researchers examined the subjective sleep reports from approximately 16,000 adolescents who participated in the National Longitudinal Study of Adolescent Health. The sample included teens in grades 7 through 12 in the United States between 1994 and 1996. The researchers found that adolescents with later bedtimes had greater likelihood of suicidal ideation and the perception that they were not getting enough sleep [38]. Two studies by Wong and Brower [39,40] examined whether sleep problems were prospectively associated with reports of suicidal ideation and self-harm. The investigators controlled for depression at baseline. Those who had trouble sleeping between ages 12-14 were four-times more likely to deliberately harm themselves or attempt suicide by 15-17 years of age (OR=10.4, 95% CI=3.9 to 27.8, p<.01) [40]. A third study examined retrospective reports found that adolescents who completed suicide were ten-times (OR = 10.4, 95% CI = 3.9 to 27.8, p< .01) more likely to have been experiencing sleep problems prior to suicide compared to controls [41,42].

Diagnostic Assessment

Depression

In the diagnostic assessment of depression in an adolescent, the clinician will typically use a combination of a semi-structured clinical interview (**Children’s Depression Rating Scale, Revised (CDRS-R)**), self-report symptom inventories (e.g. CDI, Reynolds Adolescent Depression Scale, BDI, Center for Epidemiological Studies-Depression Scale for Children) and rating scales completed either by the patient or by an observer, such as a parent or teacher. See Table 1. The diagnosis of depression is made based on a set of symptoms outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM).It is worthy of note that in the latest version of DSM, DSM –V, differs from DSM-IV as anxiety symptoms such as irrational worry or preoccupation with unpleasant worries may also indicate depression. In addition, new disorders have been included such as disruptive mood dysregulation disorder and premenstrual dysphoric disorder. Dysthymia in DSM-IV now falls under the category of persistent depressive disorder, which includes both chronic major depressive disorder and the previous dysthymic disorder [43].

While the criteria for the diagnosis of major depression in adolescents do not differ from the criteria used in adults, certain symptoms of depression may be more prominent at certain young ages

(e.g. irritability in children or adolescents) [44]. The adolescent must meet at least five of nine symptoms of depression to meet diagnosis. These symptoms must represent a change from prior functioning, be present for two weeks or longer, and be present for most of the time almost every day. See Table 2.

Insomnia

According to the diagnostic criteria outlined in the International Classification of Sleep Disorders, Second Edition, [45] insomnia is defined by difficulty falling asleep, staying asleep, waking too early, and having non-restorative sleep. This difficulty must be present despite adequate opportunity to sleep and must be associated with next-day impairment. The fact that the sleep difficulty must occur despite adequate opportunity to sleep distinguishes insomnia from behaviorally-induced insufficient sleep syndrome. Both disorders, however, can result in short sleep periods and an accumulation of sleep debt.

Assessment for insomnia begins with a full clinical evaluation. The clinician takes a thorough history of the insomnia from the patient, which may include information about the primary symptoms, frequency, and duration of the insomnia, as well as triggers or precipitants of the sleep disturbance. Information about the individual’s sleep prior to the onset of the insomnia helps to provide baseline sleep information. Obtaining a medication list, their doses, and their previous effectiveness is helpful. For example, stimulants and steroids can contribute to insomnia symptoms.

It can be difficult to ascertain whether the insomnia is associated only with the underlying depression (as insomnia is one of the symptoms of depression), or whether it reflects an independent sleep disorder. An understanding of the relationship between the insomnia and depression over time is warranted. For example, did the insomnia begin coincidentally with the onset of depression? What has been the course of the two disorders? Does the insomnia wax and wane in unison with the depression over time? Use of a timeline may be helpful but may still be difficult to discern from the patient. Therefore, use of collateral information from parent/caregiver would be helpful.

The next step of the assessment includes the patient’s description of their current sleep pattern. This may include obtaining information such as typical bedtime, how long it takes to fall asleep, how many awakenings occur, how long the individual spends awake during the night, and wake time. A distinction between the time the individual awakens in the morning and what time they physically get out of bed (also called “rise time”) provides information about early morning awakenings. Typically this information is collected each day in a sleep diary [46] and patients meet either weekly or biweekly with their therapist. Sleep diaries in addition to actigraphy, a watch-like device to monitor daily activity patterns, can provide valuable information.

Measure Children and Adolescents	Age appropriateness (approximate years)
Beck Depression Inventory (BDI)[92]	14 and older
Children’s Depression Inventory (CDI)[93]	7 to 17
Center for Epidemiological Studies-Depression Scale for Children (CES-DC) [94]	12 to 18
Center for Epidemiological Studies-Depression Scale (CES-D)[95]	14 and older
Reynolds Adolescent Depression Scale[96]	13 to 18

Table 1: Scales for Measuring Mood in Children and Adolescents.

1.	Depressed mood ^b
2.	Significant reduction in the level of interest or pleasure in most or all activities ^b
3.	Loss or gain of weight, characterized by a change of more than 5 percent of body weight in a month or failure to make expected weight gains
4.	Insomnia or hypersomnia is present nearly every day
5.	Behavior may be agitated or slowed down
6.	Adolescents may report diminished energy or fatigue
7.	Thoughts of worthlessness or guilt
8.	Reduced ability to think, concentrate, or make decisions
9.	Frequent thoughts of death or suicide, or a suicide attempt

^aThese symptoms cannot be attributed to another cause such as drugs or another medical condition. ^bRequired for diagnosis

Table 2: Depressive symptomatology a depression in adolescents^a

Understanding the impact of the sleep problem on next-day functioning is important. Examples of common daytime disturbances may include impaired concentration or memory, fatigue, daytime sleepiness, or excessive sleep concerns. Ohayon et al. (2102) found that global sleep dissatisfaction is the symptom most helpful in identifying daytime consequences [47].

Concerns about sleep are common; they characterize a specific type of insomnia known as psychophysiological insomnia. Adolescents with depression may present with features of this type of insomnia [21]. In adult patients with psychophysiological insomnia, there is “hyperarousal” about sleep—that is, they have excessive focus and heightened anxiety about sleep. Often, they will report mind racing in bed or an inability to relax their body in bed. Sleeping better away from home can sometimes be present, suggesting that the patient’s bed or bedroom have become a source of anxiety.

Clinical Decision Making: Differential Diagnoses

Behaviorally induced insufficient sleep syndrome (BISS)

BISS is a common phenomenon for adolescents. Insufficient sleep can result when one does not allow adequate opportunity for sleep. It is typically characterized by excessive daytime sleepiness, short habitual sleep time, and sleeping longer than usual during weekends or vacations. In a large study of approximately 1200 Norwegian adolescents, BISS was associated with poor grades, alcohol use, and symptoms of depression and anxiety [48].

Delayed Sleep Phase Syndrome

During adolescence, there is a natural tendency for the underlying biological rhythm to drift to a later clock time. This developmental shift in circadian rhythm phase can cause sleep difficulty and impair daytime functioning. Delayed sleep phase syndrome is a mismatch between the internal biological rhythm and preferred schedule. The complaints typically include difficulty falling asleep when attempting to go to sleep at an earlier clock time than usual. Once sleep is initiated, however, the amount and quality of sleep is normal for the individual’s age. Difficulty waking at planned rise time is also not unusual and can result in high conflict with caregiver.

When these complaints begin to interfere with daily functioning, this may be diagnosed as a sleep disorder called delayed sleep phase syndrome (DSPS). Rates of this disorder range between 0.2 percent and 10 percent [49,50] of the population but is more common in adolescents [14]. Delayed circadian sleep phase may increase the risk of developing depression [51] and people who prefer to be awake at night (or “night owls”) have greater incidence of depression [52].

Differentiating whether an adolescent has sleep onset insomnia versus a delayed circadian sleep phase can be tricky. It is also possible that there are components of both disorders at play. The use of a questionnaire, such as the Horne-Östberg Morningness-Eveningness Questionnaire (MEQ), [53] may be of benefit because it may highlight a mismatch between internal clock and preferred schedule.

Sleep Apnea

The complaint of insomnia may reflect an underlying primary sleep disorder. In the process of taking a thorough clinical history, clinicians should inquire about symptoms of sleep-disordered breathing and sleep apnea. These symptoms may include loud snoring, pauses in breathing while sleeping, gasping or choking in sleep. A dry mouth and a headache may be present upon morning awakening.

There is a line of research suggesting that Sleep-Related Breathing Disorders (SRBD) play a key role in the development of depression. Children with SRBD have shown higher scores on depression scales [54,55].

A correlation was also found in this population between severity of the apnea-hypopnea index, oxygen desaturation values, and depression scores [56]. Treatments for sleep-disordered breathing may be of benefit. Treatments can include nasal Positive Airway Pressure (PAP) therapy, an oral appliance, or upper airway surgeries.

In a case report, an 18 year old with treatment-resistant depression who underwent a procedure to widen the upper airway (a procedure called rapid palatal expansion) to treat his upper airway resistance syndrome resulted in marked improvement in mood and sleep. Two years after his last ECT treatment, the patient was in remission and maintained improvement off all psychotropic medications [57]. A questionnaire—such as the “STOP [58] questionnaire” (which is a four item scale that asks about snoring, daytime tiredness, stopping breathing during sleep, and high blood pressure)—may be of benefit.

Other Considerations

There are a number of other sleep and psychiatric disorders that may be considered. Here, some additional differential diagnoses are discussed. When insomnia is temporally associated with use or abuse of the substance or its withdrawal, insomnia due to a drug or substance may be considered [45]. Information regarding the use of substances—such as alcohol, recreation drugs, or prescription drug abuse (for example, taking medications in a way that was not prescribed or taking medications that were not prescribed to that individual) or other risky behaviors [59]—will help guide the clinical interview.

When substances such as alcohol, nicotine, or caffeine are used just before bedtime, the patient may have inadequate sleep hygiene. Inadequate sleep hygiene can accompany a diagnosis of insomnia and typically includes practices such as a variable sleep schedule, spending excessive amount of time in bed, use of mentally stimulating activities (such as video games or social media) close to bedtime, or failure to maintain a comfortable sleeping environment [45].

Other primary sleep disorders might also be considered in the context of insomnia complaints in an adolescent. If they are available to the clinician, it is helpful to review any previous sleep studies that the patient might have undergone. The sleep study will provide information about sleep continuity (for example, latency to sleep and wakefulness during the night) and will describe any sleep pathology (for example, sleep apnea or periodic limb movements in sleep).

If the patient has not undergone a sleep study and suspicion of other occult sleep pathology is present (such as snoring or choking in sleep), a referral for a diagnostic polysomnogram (PSG) at an accredited sleep disorders center is warranted.

If the adolescent reports restlessness at night, further inquiry about symptoms of restless legs syndrome (RLS) or periodic limb movement disorder may be warranted. Obtaining a thorough family history of sleep disorders may help provide additional information as RLS may have a genetic component. RLS might also be associated with diet, so asking teens about diet (e.g. green leafy vegetables) is important.

Finally, if the teen reports significant daytime sleepiness for at least three months with or without episodes of cataplexy, one may consider referring for an evaluation for narcolepsy. In this case, however, the excessive daytime sleepiness must not be due to a medical, psychiatric, medication, or substance-use problem. If suspicion is high for any primary sleep disorder, a referral for a diagnostic PSG is recommended. If there is suspicion of narcolepsy, a PSG followed by a next-day Multiple Sleep Latency Test (MSLT) may be indicated.

Administering Treatment Interventions

If, after the clinical interview, the insomnia appears to be associated in time with the depression, a referral to initiate psychological intervention or to continue psychological follow up may be indicated. If the underlying mood disorder improves with psychological or psychopharmacological treatment, the insomnia may improve as well. Cognitive Behavioral Therapy (CBT) for depression and antidepressant therapy are common treatments.

While these treatments independently or in combination may be helpful for some teens, data from a large study on this topic suggests that CBT plus a selective Serotonin Reuptake Inhibitor (SSRI) was only minimally effective in helping teens fully remit from depression (a 37 percent remission rate) after three months [60]. This may be due, in part, to sleep disturbance, as insomnia is one of the most common residual symptoms in teens with low response rates [60,61] to CBT and SSRI therapy for depression. For this reason, addressing the sleep disturbance directly may be beneficial. Pharmacological and nonpharmacological options are available. A referral to a board certified behavioral sleep medicine specialist for nonpharmacological treatment delivery is best if there is a clinician with this distinction in the area.

A Nonpharmacological Option

Cognitive Behavioral Therapy for Insomnia (CBT-I) is the current recommended approach for nonpharmacological treatment of chronic insomnia [62]. This multicomponent therapy, which includes behavioral and cognitive strategies to improve sleep quality and daytime functioning, benefits 70 to 80 percent of insomnia patients and has more sustained benefits than medications in adults [63-66].

Components of CBT-I include a combination of behavioral techniques (including stimulus control, sleep restriction, and relaxation) combined with sleep hygiene education and cognitive therapy.

There are four main components of CBT-I:

1. Stimulus control: The primary goals of stimulus control therapy for insomnia are to help the insomnia patient establish a consistent sleep/wake rhythm, reestablish the bed and bedroom as cues for sleep and sleepiness, and reduce the bedroom's association with sleep-incompatible activities.

2. Sleep restriction: Sleep restriction therapy is based on the clinical observation that insomnia patients spend excessive amounts of time in bed to compensate for sleep loss. The therapy is designed to have patients limit the amount of time they spend in bed to approximate the amount that they are actually sleeping, as ascertained by baseline sleep logs. The major goal of this strategy is to build the "drive for sleep" by restricting sleep to shorter periods of time spent in bed and by prohibiting sleep at times outside of this restricted sleep schedule.
3. Sleep hygiene education: Sleep hygiene education is a set of guidelines about health practices and environmental considerations that can either aid or disturb the quality and quantity of sleep. Sleep hygiene is recommended as part of a comprehensive treatment approach. It is considered a second-line intervention because there are insufficient data supporting its use as a stand-alone treatment for insomnia.
4. Cognitive therapy: Cognitive therapy for insomnia alters the dysfunctional beliefs about sleep which perpetuate insomnia; further, it helps patients develop realistic expectations about their sleep. The best candidates are those patients who worry about how much sleep they need (such as a patient saying "I need eight hours of sleep"), the consequences of their insomnia (as with a patient saying "Without adequate sleep, I can barely function the next day"), the predictability of their sleep ("I'm losing control of my sleep"), or strategies used to promote sleep ("I should stay in bed and try harder to fall asleep").

Other adjunctive therapies may include relaxation therapy for patients who "cannot relax" or who report feeling too "keyed up." There are several types of relaxation, including progressive muscle relaxation, diaphragmatic breathing, autogenic training, guided imagery, and biofeedback.

Adding CBT-I to depression therapy

In adults, adding an insomnia treatment component to antidepressant therapy can improve both depression and insomnia outcomes. For example, in a 2008 study, depressed participants with insomnia were randomly assigned either to take escitalopram plus a CBT-I or to an escitalopram plus a control condition. Rates of remission for both depression and insomnia were markedly higher for those treated with the escitalopram plus CBT-I compared to those treated with escitalopram and the control condition [67].

Another group compared antidepressant therapy plus placebo to antidepressant therapy plus the hypnotic medication zopiclone. They found that the treatment with the added hypnotic improved depression response and remission [68].

Unfortunately, few randomized, controlled studies of nonpharmacological treatment options for depressed adolescents with sleep disturbances have been conducted. One study utilized cognitive behavioral therapy for insomnia in adolescents in substance abuse treatment and found improved sleep [69]. Other adjunctive treatment options are described below.

Behavioral activation

Behavioural Activation (BA) can be a powerful complement to sleep restriction and stimulus control. This brief psychotherapeutic approach aims to increase engagement in adaptive activities, decrease

engagement in activities that maintain depression or increase risk for depression, as well as solve problems that limit access to reward. [70] Including behavioral activation and exercise into one's therapy approaches can be powerful adjuncts [71,72].

Bright light therapy

Light therapy can be used to treat both mood and sleep disorders at any age. Seasonal Affective Disorder (SAD) occurs in approximately 2% of adolescents and is higher in adolescent females [73]. Common symptoms of season affective disorder may include fatigue, irritability, and school problems that are confined to the winter months. Light therapy for SAD has been successfully utilized as a therapeutic approach in adults [74], but few studies have been conducted utilizing bright light therapy in SAD in adolescents. Additional randomized controlled trials on morning light therapy for depression in a teenage population are underway [75]. In one of the first randomized controlled trials of light therapy in children (ages 7-17) with SAD, participants who received 1 hour of bright-light therapy plus 2 hours of dawn simulation had significant improvements in their Hamilton Depression Rating Scale, Seasonal Affective Disorders version (SIGH-SAD) compared to those in a placebo condition [76]. Similar findings were revealed in a 14-17 year old sample who underwent light therapy in a randomized cross-over trial. Beck's depression inventory scores improved significantly [77].

Circadian rhythm sleep disorders, e.g. delayed sleep phase syndrome (DSPS) also responds well to bright light therapy. Delayed circadian sleep phase occurs in 7-16% of adolescents and young adults [78]. If it is suspected that the patient has a circadian rhythm sleep disorder, they may benefit from sleep scheduling combined with bright light therapy. The time of day that the light is delivered and the light level is important to consider in the treatment of circadian rhythm disorder.

In adolescents with DSPS, teens can begin the light therapy after their normal wake-up time and then shift it about 15 to 30 minutes earlier every day or every few days. The light shifts the internal clock to an earlier time and helps the teen initiate sleep at an earlier bedtime.

Bright light plus a CBT-I condition has been shown to be effective. When in 23 healthy adolescents with delayed sleep phase received bright light and CBT-I (the CBT-I consisted of six sessions and included education, sleep hygiene, and plans for morning bright light) results showed that compared to waitlist control groups, teens in the treatment condition showed improvements in sleep and an earlier sleep onset time [79]. Adherence over time to this treatment can be challenging in teenagers.

Pharmacological Options

Residual symptoms are common in adolescents who respond to antidepressant treatment interventions. Research findings from the Treatment for Adolescents with Depression Study reveal that residual sleep disturbances, mood problems, and fatigue are some of the most common residual symptoms [60]. These symptoms can increase the likelihood of a relapse to depression.

To determine the influence of insomnia on acute treatment intervention for depression, a large study was conducted on 309 depressed children and adolescents between 7 to 18 years of age with insomnia. Children were defined as 11 years of age and younger; adolescents as 12 years of age and older. Insomnia was defined as a score of greater than four on the sleep item on the Children's Depression Rating Scale. One hundred fifty-seven participants were randomized

to receive fluoxetine and one hundred fifty two participants were randomized to placebo for 8-9 weeks.

Adolescents with insomnia were less likely to respond to fluoxetine (39.2%; 20/51) than those without (65.9%; 27/41; $p=0.013$), whereas children on fluoxetine with insomnia were more likely to respond (69.4%; 25/36) than those without insomnia (41.4%; 12/29; $p=0.027$). [80] This study suggests that insomnia may interfere with the response to antidepressant medications and highlights the need for targeted insomnia treatment in adolescent depression.

To obtain a better understanding of the prescribing practices in child psychiatry, in 2010, a large survey was sent out to approximately 6,000 members of the American Academy of Child and Adolescent Psychiatry. Child psychiatrists said that they were more likely to use sleep medications in children with mood and anxiety disorders, particularly for the more severe disorders (such as bipolar disorder and PTSD). Clinicians typically prescribed pharmacological therapies to improve daytime functioning—but also added that they were concerned about side effects and lack of empirical support regarding efficacy.

Non-Benzodiazepine Receptor Agonists

The commonly-used hypnotics in adults—such as benzodiazepine receptor agonists like zolpidem, eszopiclone, and zaleplon have limited research studies on their use in teenagers. In adolescents who had attention-deficit hyperactivity disorder-associated insomnia, a double-blind, placebo-controlled, parallel-group study was conducted. Zolpidem (at a maximum of 10 mg) failed to reduce the latency to persistent sleep on polysomnographic recordings after 4 weeks of treatment in children and adolescents 6 through 17 years of age [81].

Some clinicians may be reticent about prescribing these medications in this population amid concerns of illicit use or misuse. The 2009 National Survey on Drug Use and Health, which included a sample of more than 17,000 adolescents (ages 12 to 17), had a 1.4 percent lifetime prevalence of misusing zolpidem. Older and white adolescents were at an increased risk for zolpidem misuse. Those who reported a major depressive episode ($OR=4.16$) had four-times the risk of misusing zolpidem [82].

Melatonin

Melatonin is a hormone naturally produced by the pineal gland in the brain. It plays an important role in the regulation of sleep through a feedback system controlled by the suprachiasmatic nuclei—also known as the body's master clock.

In the American Academy of Child and Adolescent Psychiatry Survey, approximately one-third of respondents said they recommended melatonin to adolescents with sleep problems. However, there is concern about the use of melatonin in children and adolescents because of the role it plays in the reproductive systems in animals [83].

For other clinicians, melatonin is considered to be a safe treatment with the appropriate dosage and timing of administration. A recent study on prepubertal children (ages 6 through 12) who had been taking melatonin for difficulty initiating sleep at an average dose of 2.69 mg for 3.1 years did not find any changes in pubertal development or mental health changes [84].

In most European countries, melatonin is a prescription-only medication. Among hypnotic prescriptions written for children in Norway (ages 0 to 17), melatonin was dispensed in the highest annual amount of all hypnotic drugs. Between 2004 and 2011, melatonin

use increased steadily from 6 to 12 years of age, and this was most pronounced in males [85].

While more than one-third of clinicians recommend melatonin for insomnia in pediatric populations, the research regarding melatonin in pediatric sleep disorders is somewhat limited [86]. Melatonin does have empirical supports for its use as a “chrono-biotic;” i.e., as an agent that helps shift one’s internal circadian clock. However, it is important to note that in the US, melatonin is a hormone that is not a Food and Drug Administration- approved medication.

In one study, researchers administered melatonin 1 mg in the evening to adolescents 14 to 19 years old with sleep onset insomnia. In this placebo-controlled crossover study, teenagers received the melatonin in the evening for five weeks between 4:30 pm and 6:00 pm. Results showed that after five weeks, teens reported earlier sleep-onset times and sleep length was longer compared with the baseline week [87].

Trazodone

Trazodone is a commonly-prescribed medication for the treatment of insomnia in both the adult and pediatric populations. According to a survey of the American Academy of Child and Adolescent Psychiatry members, trazodone was the most commonly-prescribed insomnia medication for children with mood disorders (78%) and anxiety disorders (72%) [88].

In 2008, a large, randomized, controlled trial called the Treatment of Resistant Depression in Adolescents (TORDIA) study was conducted by Brent and colleagues. Approximately 300 adolescents who did not respond to SSRI therapy were studied. Patients were randomized to one of four categories: (1) they were switched to another SSRI; (2) they were prescribed venlafaxine XR; (3) they were prescribed another SSRI plus CBT; or (4) they were prescribed venlafaxine plus CBT.

After 3 months, 55 percent of the adolescents in the CBT plus medication responded—compared to only 40 percent of those who received medication alone. Patients who had also been prescribed a medication for insomnia at the treating clinician’s discretion, had even lower response rates to treatment [89].

A separate study reporting a more detailed analysis of the Brent 2008 study revealed that adolescents who were prescribed trazodone were six-times less likely to respond to treatment (adjusted odds ratio [OR]=0.16, 95% confidence interval [CI]: 0.05-0.50, $p=0.001$) than those with no sleep medication. In addition, they were three-times more likely to engage in self-harming behaviors (OR=3.0, 95% CI: 1.1-7.9, $p=0.03$). Adolescents treated with other sleep medications (such as antihistamines and non-benzodiazepines) did not fare much better and still had greater likelihood of self-harming behavior [90].

In summary, prescribing practices for adolescents may differ by clinician preference. To date, few studies have explored the use of non-benzodiazepine receptor agonists (e.g. zolpidem, escopiclone) in adolescents. Recommendations to use melatonin are common, however data is lacking to support its use as a hypnotic in teens; there is some evidence to support its use as a chronobiotic. Trazodone is a commonly prescribed medication for insomnia in teens with mood disorders, but has been shown to be associated with decrease response rate to depression treatment and an increased likelihood of self-harming behaviors.

Treatment Monitoring

Treatment monitoring for sleep disorders typically includes completing a daily sleep diary. Actigraphy may also be used to collect information about sleep/wake patterns, although the use of actigraphy is more often utilized in research studies. In this analysis, the patient wears a wrist watch-like device on their nondominant hand called an actigraph—a device that is placed generally where a wristwatch is worn to collect daily patterns of motor activity. Actigraphy is most informative when used in conjunction with the sleep diary.

There are some barriers that may arise with treatment monitoring with adolescents with depression and sleep disturbance. First, motivational issues may limit the patient’s ability to engage in and benefit from therapy. Even when an adolescent has achieved therapeutic gains during the therapy process (such as sleeping better), the maintenance of those treatment gains may drop once the adolescent has left therapy [91-95].

Treatments may be improved with motivational interviewing or motivational enhancement techniques. Another barrier may arise if the clinician chooses to obtain a parental report of the adolescent’s sleep pattern instead of or in addition to direct reporting from the adolescent. Parents may either provide socially-desirable reports or report on the time the adolescent goes into their room intending to sleep, but might not actually be sleeping.

To explore this phenomenon, researchers obtained parental reports of adolescent sleep patterns and compared them to the adolescent’s personal reports of sleep habits and to actigraphy [91]. The study revealed that parents estimated that their adolescent went to bed significantly earlier and woke up significantly later in the morning than was captured by actigraphy and by adolescent self-report. This was true on both school nights and weekends. This study suggests that more accurate picture of the adolescent’s sleep patterns may be obtained from the adolescent themselves as opposed to parental report.

In conclusion, depression can be present in up to 20 percent of adolescents and most of these children will have some form of sleep disturbance. The etiology of the sleep disturbances can be multifactorial, including (but not limited to) insomnia, circadian rhythm sleep disorder, sleep apnea, or other factors. These sleep disturbances can play either a precipitating or perpetuating role in depression during these years. Pharmacological and cognitive behavioral therapy approaches are common but may result in limited gains. The limitation in gains may be associated, at least in part, to the presence of insomnia. If insomnia is present, the effectiveness of the antidepressant medications may be lessened and relapse may be higher. Unfortunately, few nonpharmacological treatment studies for insomnia have been conducted in depressed teens. Treatment monitoring may be helped by motivational interviewing techniques and examining the teen’s self-report over parental sleep reports.

Sleep disturbances that are identified, addressed, and appropriately monitored may result in improved sleep and mood. Active involvement of the teen in the therapy process may improve outcomes. Further research is needed to develop non-pharmacological strategies that are acceptable and sustainable for adolescents.

Conclusion

Depression is common during the adolescent years, occurring in up to 20% of adolescents. Most of these children have some form of sleep disturbance. Research studies have revealed that insomnia

in teens may precipitate or perpetuate depression. Untreated sleep disturbances in adolescents may lead to negative consequences, such as academic problems, substance abuse, and risk for suicide. The etiology of sleep disturbances may reflect insomnia, circadian rhythm sleep disorder, sleep apnea, or other factors. Treatment interventions may include pharmacological or non-pharmacological options (e.g. cognitive behavioral therapy, bright light therapy, behavioral activation). Pharmacological approaches have been found to be helpful in some studies, but other studies suggest that they may result in limited gains if insomnia persists. Treatment monitoring may be helped by motivational interviewing techniques and examining the teen's self-report over parental sleep reports.

In summary, sleep disturbances that are identified, addressed, and appropriately monitored may result in improved sleep and mood. Active involvement of the teen in the therapy process may improve outcomes. Further research is needed to develop non-pharmacological strategies that are acceptable and sustainable for adolescents.

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