Development and Initial Feasibility Testing of Brief Cognitive-Behavioral Therapy for Insomnia in Adolescents With Comorbid Conditions

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Insomnia is highly prevalent in the adolescent population and frequently occurs in the context of other medical or mental health concerns. Efficacy of cognitive–behavioral therapy for insomnia (CBT-I) has been determined in adults with comorbid conditions. However, there are limited data applying CBT-I to adolescents with comorbid conditions. Therefore, the purpose of this study was to (a) develop and refine a 4-session CBT-I intervention for adolescents with co-occurring medical and mental health conditions, and (b) evaluate feasibility and acceptability of applying the intervention to adolescents and their parents. Forty participants (ages 11 to 18 years) were recruited from 2 pediatric specialty clinics representing a range of physical and psychiatric comorbidities (e.g., depression, chronic pain, anxiety). Adolescents and parents attended 4 treatment sessions of CBT-I delivered individually or conjointly to adolescent and parent. Daily sleep diaries were completed during the treatment period. Preliminary findings demonstrated a high level of feasibility and acceptability of treatment. Compliance with treatment visits was high, with 34 of the 40 families (85%) completing all 4 sessions. Youth and parents were highly engaged in therapy sessions as rated by treating therapists. On the Treatment Evaluation Inventory, parents’ and teens’ mean scores indicated high treatment acceptability ($M = 38.8, SD = 5.2; M = 36.8, SD = 4.6$, respectively). The preliminary data suggest that CBT-I is feasible to implement to treat insomnia in adolescents with co-occurring health and mental health conditions. Future studies are needed to evaluate intervention efficacy on sleep and functional outcomes in youth.

Keywords: insomnia, adolescents, intervention, sleep, cognitive–behavioral therapy
Insomnia, characterized by difficulties falling asleep or staying asleep, is the most common sleep disorder, affecting 10% of healthy adolescents (Johnson, Roth, Schultz, & Breslau, 2006). Insomnia is associated with impairments across many domains including attention, learning, and emotion regulation (Fortier-Brochu, Beaulieu-Bonneau, Ivers, & Morin, 2012; Mitchell, Mogg, & Bradley, 2012; Roberts, Roberts, & Duong, 2008). Moreover, left untreated, insomnia persists over time (Buysse et al., 2008; Morin et al., 2009). There has been particular interest in the relationship between sleep and health, with research demonstrating that youth with insomnia have increased risk for somatic health problems, psychological problems, and substance use (e.g., Roberts et al., 2008; Smaldone, Honig, & Byrne, 2007). Rates of insomnia are high among youth with psychiatric comorbidity (Johnson et al., 2006; Ivanenko, Barnes, Crabtree, & Gozal, 2004) as well as among youth with medical conditions (Lewandowski, Ward, & Palermo, 2011). For example, insomnia has been reported in over 50% of youth with chronic pain (Long, Krishnamurthy, & Palermo, 2007; Palermo, Wilson, Lewandowski, Toliver-Sokol, & Murray, 2011).

Research suggests that insomnia contributes to the onset, maintenance, and recurrence of symptoms related to co-occurring physical and mental health conditions. Insomnia symptoms have been shown to precede the onset of major depressive episodes (Baglioni et al., 2011; Perlis, Giles, Buysse, Tu, & Kupfer, 1997), and insomnia during adolescence predicts the development of depression during young adulthood (Roane & Taylor, 2008). Moreover, persistent insomnia following the remission of a depressive episode leads to greater risk of depression recurrence (Cho et al., 2008; Ohayon & Roth, 2003; Reynolds et al., 1997). In youth with chronic pain, insomnia symptoms have been shown to contribute to diminished physical function, poor quality of life, and depressive symptoms (Palermo, Fonareva, & Janosy, 2008; Palermo, Law, Churchill, & Walker, 2012), as well as poor response to cognitive–behavioral treatment (Fales, Palermo, Law, & Wilson, 2015). Bidirectional relationships between sleep and physical symptoms have been proposed. For example, sleep disruption has been shown to lead to increased pain across childhood, adolescence, and adulthood (Finan, Goodin, & Smith, 2013). Sleep has been suggested as a potential modifiable target that may lessen symptoms related to the underlying physical or mental health disorder. Thus, behavioral treatments for adolescent insomnia may be particularly critical for youth with comorbid mental and physical health conditions.

The most common cognitive–behavioral therapies for chronic insomnia (CBT-I) include stimulus control, sleep restriction, sleep hygiene, relaxation training, and cognitive therapy; typically, CBT-I includes at least three of these components (Perlis, Junquist, Smith, & Posner, 2005). Meta-analyses conclude that CBT-I produces reliable and durable improvement in sleep in many different patient populations, including adults with co-occurring conditions such as chronic pain, arthritis, fibromyalgia, and bipolar disorder (e.g., Finan, Buenaver, Coryell, & Smith, 2014; Kaplan & Harvey, 2013). There is emerging evidence suggesting that changes in sleep as a result of cognitive–behavioral treatment leads to changes in physical and mental health symptoms. For example, in a recent trial of CBT-I in patients with knee osteoarthritis and insomnia, patients receiving CBT-I had greater improvements in sleep and the baseline-to-posttreatment change predicted subsequent decreases in pain (Smith et al., 2015).

In contrast, the treatment literature for child and adolescent insomnia is much more limited. There have been only a few randomized controlled trials of individual and group CBT-I in children or adolescents, and this has been highlighted as a gap in a recent systematic review of the evidence base for psychological treatments for pediatric sleep (Meltzer & Mindell, 2014).

Two small RCTS have been conducted in young children with insomnia without comorbid conditions (Paine & Gradisar, 2011; Schlarb, Velten-Schurian, Poets, & Hautzinger, 2011). Treatment efficacy was demonstrated with greater improvements in sleep patterns and bedtime resistance in children receiving CBT-I compared to wait-list control conditions. Clarke and colleagues (2015) examined the initial feasibility of a combined CBT-I and CBT for depression (CBT-D) intervention in 41 youth, ages 12–20 years, with unipolar depression. Youth were randomized to two treatment arms, consisting of (a) CBT-I plus CBT-D, or (b)
control sleep-hygiene plus CBT-D. In this pilot RCT, medium to large treatment effect sizes were detected for improvements in sleep patterns and reduction in insomnia symptoms. Most recently de Bruin, Bügels, Oort, and Meijer (2015) evaluated CBT-I delivered in two formats, group therapy and Internet therapy, versus a wait-list control condition in 116 adolescents without comorbid conditions. They found evidence for medium to large treatment effects on reducing insomnia symptoms in both treatment conditions compared to wait-list control.

In addition, there have been a few feasibility trials and uncontrolled pilot studies conducted to evaluate individual, group, and Internet CBT-I treatment protocols in adolescents with comorbid substance abuse (Bootzin & Stevens, 2005) and in adolescents without comorbidity (de Bruin, Oort, Bogels, & Meijer, 2014; Schlarb, Liddle, & Hautzinger, 2011). Preliminary findings demonstrated that youth showed improvements in sleep onset latency, wake after sleep onset, and sleep efficiency as well as reductions in insomnia symptoms from pre- to posttreatment.

Taken together, the knowledge base on CBT-I in adolescent populations is small but demonstrates that treatment can be delivered individually, remotely, and in groups and leads to improvements in many sleep parameters for youth. Although two studies have included youth with specific mental health concerns (depression, substance use), there has been limited application of CBT-I to youth experiencing a wider range of comorbid chronic medical and mental health conditions. Thus, there remains a critical need to refine and evaluate CBT-I in this special subpopulation. The objective of our research was to refine or tailor CBT-I to take into account causes and contributing factors for insomnia in youth with medical and mental health conditions (e.g., Lewandowski et al., 2011) including (a) treatment-related factors; (b) behavioral, emotional, and psychological factors, and (c) parenting behaviors.

Therefore, the aims of this pilot study were to (a) develop a brief, four-session CBT-I intervention adapted for the population of adolescents with a range of co-occurring medical and psychiatric conditions, and produce draft materials for implementing therapy and for training and (b) evaluate feasibility and acceptability of the intervention. We hypothesized that adolescents would engage in CBT-I treatment as demonstrated by our ability to enroll youth into the study and to achieve high rates of treatment completion. We also expected that youth and parents would find the treatment to be acceptable based on compliance with homework, therapist ratings of motivation, and youth and parent ratings of treatment satisfaction.

Methods

Participants

To select a sample with a range of comorbidities, participants were recruited from two pediatric specialty clinics at a children’s hospital: a pediatric chronic pain clinic and a pediatric sleep disorders clinic. Inclusion criteria were (a) age between 11 and 18 years, (b) met research diagnostic criteria for insomnia disorder (self-reported sleep difficulties 3 or more nights during the past month with at least one daytime sleep-related problem), and (c) had a comorbid psychological or physical health diagnosis. Exclusion criteria included (a) parent or adolescent did not read or speak English, (b) active psychosis or suicidal ideation, or (c) previous outpatient cognitive–behavioral treatment for insomnia in the 6 months prior to screening. The Institutional Review Board at our center approved this study and parents provided consent and adolescents provided assent prior to the initiation of any study procedures.

Procedures

Potential participants were identified by providers at the pediatric pain and sleep specialty clinics, where they were given a study flyer and asked for permission to be contacted by study staff. Interested families underwent telephone screening to determine the presence of insomnia symptoms using a developmentally tailored interview to assess the Research Diagnostic Criteria for Insomnia (Edinger et al., 2004).

Participants are part of an ongoing proof of concept single-arm treatment development study. The present report is focused on describing treatment development and implementation. After all follow up assessments are complete, data on pre–post effects of treatment on clinically significant change in insomnia symptoms.
and behavioral functioning will be reported in a separate article.

At study enrollment, teens completed a comprehensive pretreatment assessment of sleep patterns and sleep behaviors via standardized questionnaire measures. Parents provided demographic information. Following completion of the pretreatment assessment, youth and parents scheduled treatment visits over a 4–6 week period. Sleep diaries were completed during the treatment period either via paper or on REDCap per adolescent preference. A research assistant conducted all assessment procedures.

**Development of the CBT-I program.** Our research team of clinical pediatric psychologists and pediatric sleep medicine specialists with expertise in sleep, insomnia, cognitive–behavioral therapy, parent and family interventions, and chronic health conditions developed the CBT-I protocol based on therapy materials from existing CBT-I interventions for adults and adolescents with insomnia (e.g., Clarke et al., 2015; Perlis et al., 2005; Ritterband et al., 2009) and behavioral treatment studies for youth with chronic conditions (e.g., Law, Fisher, Fales, Noel, & Eccleston, 2014; Palermo, Law, Essner, Jessen-Fiddick, & Eccleston, 2014; Palermo et al., 2015) Several considerations guided our approach to refining CBT-I for this population. First, efficiency of treatment delivery was prioritized given that many youth with comorbid conditions may be participating in additional therapies for their comorbid medical or mental health condition. Thus a 4-session treatment was selected. Second, a flexible treatment that considered common issues related to sleep in adolescents with comorbidities such as treatment-related, behavioral, and emotional factors was desired. Third, based on research in children with chronic health conditions demonstrating a high level of parental involvement with sleep (Meltzer & Moore, 2007) parental interventions were incorporated into the treatment.

As a result, the core treatment delivers three components of CBT-I: stimulus control, sleep restriction, and sleep hygiene. Consistent with other CBT-I protocols, the overarching goal of treatment is to develop a consistent sleep-wake schedule and strengthen the association between bed and sleep by limiting time awake in bed. Parents were included in treatment and received sleep education, instruction in how to support their teen’s healthy sleep, and guidance on positive reinforcement strategies to reward achieving healthy sleep goals. See an overview of treatment content, structure, and goals for each individual session in Table 1.

In recognizing the potential need to address other concerns relevant to this population, several optional treatment strategies were developed including (a) interventions to address bedtime resistance and cosleeping (planned parental ignoring), (b) relaxation strategies, (c) strategies to address problematic sleep cognitions (cognitive restructuring), (d) strategies to address fatigue, and (e) social support for sleeping away from home.

Each treatment module included handouts and worksheets designed to assist with skills acquisition and homework practice. In addition, a booklet for teens and parents that illustrated the steps of CBT-I was developed using a vignette of a teen with sleep problems. Our final treatment materials included a therapist manual, a teen manual, a parent manual, and skills worksheets. Training materials and a workshop style format for teaching CBT-I was also developed to train study therapists. Materials are available upon request from Tonya Palermo. Using these draft treatment materials, four sessions of CBT-I were delivered to youth over 4–6 weeks. Each session was conducted in person at our research center and lasted a maximum of 75 min. Parents were included in all or part of sessions and received detailed instructions on the sleep plan and homework for each week.

In the first session, therapists focused on building rapport with teens and treatment planning. A semistructured interview was used to assess the teen’s current sleep difficulties. Teens and parents were also provided with sleep education, emphasizing the rationale for training the body to associate the bed with sleep to reduce insomnia symptoms. Instructions and rationale for the sleep diary (described below) were also introduced and participants were asked to complete the diary for the duration of treatment. Two worksheets were used in session to discuss barriers to healthy sleep and suggestions to improve sleep hygiene. For their homework, teens selected two sleep habits from the worksheet (e.g., avoid naps, use your bed for sleep only, avoid caffeine, do something relaxing before bedtime). Therapists helped families to create an action plan for working on these sleep habits. Emphasis was placed on the teen
taking responsibility for the action plan with understanding that further sessions would target additional sleep habits.

In the second session, teens were provided with instruction in stimulus control and sleep restriction. Stimulus control training addressed the following: (a) use the bed only for sleep—that is, no TV or talking on cell phones; (b) go to bed only when sleepy; (c) go to a “nesting place” when unable to fall asleep or return to

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Treatment Description: Brief CBT-I in Youth With Comorbid Physical or Mental Health Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session (75 min each)</td>
<td>Goals, structure, and content</td>
</tr>
</tbody>
</table>
| 1 (treatment orientation, sleep education, sleep hygiene) | This session is conducted with the teen and parent together. The primary goals of the first session are to:  
• build rapport  
• conduct a clinical sleep focused interview to identify barriers to good quality sleep and review sleep history  
• establish treatment expectations  
• provide sleep education  
• introduce healthy sleep habits  
• introduce positive reinforcement and help parents plan to support their teen’s sleep behavioral changes  
• introduce sleep diary  
• assign homework to select two sleep hygiene goals to work on |
| 2 (stimulus control and sleep restriction) | This session is conducted with the teen. The parent is invited to join for the last 15–20 minutes to review primary intervention strategies, homework, and parent support strategies. The primary goals of the second session are:  
• review of sleep diaries and orient the teen to interpretation and use of sleep diary data  
• assess homework completion (sleep hygiene) and problem solve barriers  
• provide instruction on sleep restriction and develop a new sleep schedule based on sleep diary data  
• provide education and review rules for stimulus control and use of nesting place  
• create a winding down plan for bedtime routine  
• perform session review with parent  
• discuss safety around driving if applicable during sleep restriction  
• assign homework to carry out the winding down routine, follow new sleep schedule and stimulus control plan (nesting place, nighttime activities)  
• assign homework to continue with new sleep schedule and stimulus control plan (nesting place, nighttime activities) |
| 3 (stimulus control and sleep restriction) | This session is conducted with the teen alone. The parent is invited to join the last 15–20 minutes to review primary intervention strategies, homework, and parent support strategies. The primary goals for this session are:  
• review sleep diary and set new target bedtime  
• assess barriers to completion of sleep plan  
• review morning schedule and create a positive wake up plan  
• perform session review with parent and review positive reinforcement plan  
• assign homework to continue with new sleep schedule and stimulus control plan and to use the positive wake up plan. |
| 4 (maintenance and relapse prevention) | This session is conducted with the teen alone. The parent is invited to join the last 20–25 minutes to review progress over the course of treatment and to plan for termination. The primary goals for this session are:  
• review sleep diary and set new target bedtime  
• assess barriers to completion of sleep plan  
• provide guidance on continuing sleep titration post-treatment  
• strategize for treatment maintenance (e.g., anticipate upcoming challenges to sleep plan)  
• review the skills learned over the course of the program with teen and parent and discuss maintenance or continued sleep titration |
| Optional interventions (may be implemented in Sessions 2–4) | Adolescent-focused:  
• relaxation strategies  
• cognitive restructuring  
• fatigue management  
Parent-focused  
• planned parental ignoring for bedtime resistance/co-sleeping |
sleep within 15–20 min and return to bed only when sleepy again, (d) rise at a consistent time each morning (no later than plus 2 hours on weekends), and (e) eliminate or reduce napping. Sleep restriction was implemented based on average sleep efficiency calculated from the previous week’s sleep diaries, with the aim of titrating the teen’s opportunity for sleep until the teen was successful with falling asleep more quickly. This was accomplished by matching bedtime with the teen’s typical sleep onset time while maintaining morning wake time and eliminating naps. Sleep was restricted to no less than 6.5 hours of sleep per night to avoid serious sleep deprivation. Teens who drove were instructed to make alternative transportation arrangements during sleep restriction. Teens also created a wind-down routine of quiet or relaxing evening activities to engage in during the time immediately prior to bedtime. For homework, teens were asked to follow their set bedtime and wake time, to continue work on their targeted sleep habits, to engage in stimulus control (including creating and using the nesting place), and to use the wind-down routine.

In the third session, the therapist and teen reviewed the sleep diary and made adjustments to bedtime and wake time and also modified sleep habits as needed. Once the teen was falling asleep quickly (within 20 min) and achieving high sleep efficiency (>85%), bedtime and wake time were gradually shifted to approximate the family’s preferred sleep–wake schedule and developmental sleep needs. In addition, teens created a positive wakeup routine to assist with difficulties getting out of bed in the morning (e.g., setting alarm clock, having favorite food for breakfast, listening to music while getting ready for the day). For homework, teens were asked to follow their set bedtime and wake time, to continue to work on their targeted sleep habits and stimulus control plan, and to use the wind-down and positive wakeup routines.

In the fourth session, therapists made adjustments to bedtime, wake time, and other sleep habit recommendations based on review of sleep diaries. When needed, a long-term sleep titration plan was created to help the teen reach their desired bedtime and wake time after treatment was terminated. Session 4 also included an emphasis on relapse prevention and maintenance, including review of skills learned during treatment and brainstorming to address future barriers.

At any point during the four treatment sessions, therapists could implement one or more of the optional treatment interventions based on their clinical interview and concerns endorsed by the family. For example, when parent cosleeping was identified, therapists used strategies to address the teen’s bedtime resistance and to encourage the teen’s independent sleep through use of planned parental ignoring. Often this was supplemented with a reward plan for achieving independent sleep. Similarly, when inaccurate beliefs or catastrophic thoughts about sleep were identified, therapists implemented cognitive strategies to reduce the teen’s worry about sleep. This included psychoeducation about the ways in which cognitions can interfere with sleep, identification of negative thoughts about sleep, and training in the use of positive self-statements and scheduled time for worrying.

**Therapist qualifications and training.** Study therapists were three postdoctoral pediatric psychology fellows and one licensed clinical pediatric psychologist. All study therapists had experience with cognitive–behavioral interventions for pediatric populations. Training in CBT-I was provided to study therapists via a 2-day in-person workshop. The training workshop included didactic instruction in pediatric sleep problems, training in the intervention components, and case examples. Ongoing weekly group supervision was provided by Tonya Palermo, a licensed clinical pediatric psychologist with experience delivering CBT-I to youth with comorbid conditions.

**Measures**

**Screening.**

**Insomnia screening.** A structured interview was used to screen for the presence/absence of insomnia symptoms that was a developmentally adapted version of the Research Diagnostic Criteria for Insomnia (Edinger et al., 2004) to screen our adolescent population. Specifically, typical weekday bedtimes were assessed to screen for delayed sleep phase and the wording and content of items assessing interference due to insomnia were slightly modified. For example, rather than assessing interference in work or jobs, this item was modified to assess school attendance and participation in social or after school activities. A trained research staff member administered the interview via telephone to the youth and parent.
**Demographics.** Parents completed a brief demographic form assessing ethnicity, marital status, education, age, and family income.

**Medications.** Parents provided a list of their child’s current medications in the following categories: antidepressants, anticonvulsants, prescription pain medications, over-the-counter pain medications (e.g., ibuprofen), prescription sleep medications (e.g., trazodone), over-the-counter sleep medications (e.g., melatonin, antihistamines), other prescription medications, and other over the counter medications.

**Treatment engagement.** Therapists completed a standardized progress note at the end of each session. They rated families’ receptivity and motivation to learn new skills, understanding of the treatment process, completion of homework, and therapist–family rapport on a 10-point scale ranging from 0 (low) to 10 (high). Therapists also recorded scheduling information (e.g., number of sessions attended, rescheduled visits, no shows).

**Daily sleep diary.** A daily sleep diary was constructed for the study to use during the treatment period that could be completed on paper (in the treatment binders provided to families) or online through REDCap surveys. During Session 1, therapists instructed youth in completing the daily sleep diary throughout the treatment period. Each morning adolescents recorded sleep patterns for the previous night including time they went to bed; time they fell asleep; number and duration of night wakings; time they woke up to start the day; whether or not the nesting place was used; and number and duration of daytime naps. We designed a corresponding excel spreadsheet to aggregate nightly sleep data returned at treatment sessions and compute five sleep variables: average time awake after onset (WASO), average sleep onset latency (SOL), average total sleep time, average time in bed, and sleep efficiency (average total sleep time/average time in bed, expressed as a percentage). Therapists computed these values in session and used the information to titrate bedtimes for the upcoming week.

**Treatment satisfaction and acceptability.** Parents and teens completed the Treatment Evaluation Inventory, Short Form, TEI-SF; (Kelley, Heffer, Gresham, & Elliott, 1989) at posttreatment to assess participant perceptions of treatment. The measure has 9-items scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) which are summed to create a total score ranging from 9 to 45. Higher scores indicate greater satisfaction and acceptability of treatment. Scores of 27 and higher indicate “moderate” treatment satisfaction and acceptability (Kelley et al., 1989). The TEI-SF has been previously shown to have adequate internal reliability (α = .85) and construct validity, as demonstrated by the ability to discriminate among three treatments (p < .001; Kelley et al., 1989). Internal consistency was high in the current sample (parent α = .93, child α = .92).

**Data analytic plan.** All data analyses were conducted using IBM SPSS v21. Descriptive statistics were used to summarize the demographic characteristics of the sample. For categorical variables frequency statistics are reported, and for continuous variables we report means and standard deviations. Rates of participant referral, recruitment, and attrition were calculated using frequency statistics. Compliance was summarized through examining number of completed intervention visits, drop-out rate, and completion of homework assignments. Descriptive statistics were used to summarize mean ratings of treatment satisfaction. Independent samples t tests were used to compare means of the comorbidity groups on treatment engagement and satisfaction.

**Results**

**Sample Description and Referral Information**

Participants included 40 adolescents (75% female), ages 11–18 years ($M_{age} = 14.9, SD = 1.9$) and a parent (29 biological fathers, four adoptive mothers, one adoptive father; $M_{age} = 48.1$ years, $SD = 6.2$). Most adolescent participants were Caucasian (85%) and came from households with married parents (82.5%) and annual incomes over $100,000 (60%). At baseline, 12.5% of youth were bed-sharing and 10% were room-sharing. See Table 2 for sample characteristics.

Youth had a range of comorbid physical health and/or mental health conditions. The most common comorbid diagnoses were chronic pain conditions, anxiety, and depression.
(see Table 3). Obstructive sleep apnea ($n = 4$, 10%) and restless legs syndrome ($n = 3$, 7.5%) were the most common comorbid sleep disorders. The majority of youth were taking medications (87.5%). Over-the-counter pain medications (47.5%), other prescription medications (47.5%), and antidepressants (42.5%) were the most common parent-reported medication types. Prescription sleep medications (e.g., trazodone) were reported in 12.5% of the sample and over-the-counter sleep medications (e.g., melatonin and antihistamines) were reported in 27.5% of the sample.

Many youth (42.5%) were receiving outside treatment during their study participation including psychological treatment for anxiety, depression, or chronic pain, and psychiatric visits for medication management. At study enrollment, the sample had a high level of school impairment as indicated by needing to alter school schedules (22.5%) and to attend online/home-based schooling (7.5%). Most youth (80%) participated in treatment sessions while school was in session, while the remainder participated during summer when school was not in session.

Ninety-nine referrals were received from the two clinics ($n = 33$ pain clinic, $n = 66$ sleep clinic). A total of 59 youth were excluded—10 did not meet eligibility criteria, 23 declined participation due to lack of time, distance from treatment center, or lack of interest, and 25 were unable to be reached. One family completed the pretreatment assessment then dropped out before the first treatment session due to transportation issues.

**Treatment delivery.** The first treatment session was conducted conjointly with parents and adolescents. Subsequent sessions were delivered individually to the adolescent or in continued conjoint sessions based on the therapist’s judgment and/or family’s stated preferences. In all cases, parents were involved in the assignment review at the end of each session. Of the families who completed treatment, 27.8% ($n = 10$) continued with conjoint sessions for the duration of treatment, while 72.2% ($n = 26$) continued with individual sessions with parents attending part of the session as needed. Conjoint treatment was more likely to be delivered to younger than older teens ($M_{age}$ conjoint sessions = 13.6 years old, $SD = 2.1$; $M_{age}$ indi-

### Table 2

**Baseline Descriptives of CBT-I Participants (N = 40)**

<table>
<thead>
<tr>
<th>Demographics</th>
<th>$M$ (SD) or Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child age (years)</td>
<td>14.9 (1.9)</td>
</tr>
<tr>
<td>Child gender (% female)</td>
<td>75.0</td>
</tr>
<tr>
<td>Child race</td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>34 (85.0)</td>
</tr>
<tr>
<td>African American</td>
<td>2 (5.0)</td>
</tr>
<tr>
<td>Asian</td>
<td>2 (5.0)</td>
</tr>
<tr>
<td>Mixed</td>
<td>2 (5.0)</td>
</tr>
<tr>
<td>Parent age (years)</td>
<td>48.1 (6.2)</td>
</tr>
<tr>
<td>Parent marital status</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>33 (82.5)</td>
</tr>
<tr>
<td>Divorced</td>
<td>4 (10.0)</td>
</tr>
<tr>
<td>Separated</td>
<td>2 (5.0)</td>
</tr>
<tr>
<td>Never married</td>
<td>1 (2.5)</td>
</tr>
<tr>
<td>Parent education</td>
<td></td>
</tr>
<tr>
<td>High school or less</td>
<td>2 (5.0)</td>
</tr>
<tr>
<td>Vocational/some college</td>
<td>8 (20.0)</td>
</tr>
<tr>
<td>College</td>
<td>15 (37.5)</td>
</tr>
<tr>
<td>Graduate/professional</td>
<td>15 (37.5)</td>
</tr>
<tr>
<td>Household annual income ($)</td>
<td></td>
</tr>
<tr>
<td>10,000–29,999</td>
<td>2 (5.0)</td>
</tr>
<tr>
<td>30,000–49,999</td>
<td>2 (5.0)</td>
</tr>
<tr>
<td>50,000–69,999</td>
<td>2 (5.0)</td>
</tr>
<tr>
<td>70,000–99,999</td>
<td>7 (17.5)</td>
</tr>
<tr>
<td>More than 100,000</td>
<td>24 (60.0)</td>
</tr>
<tr>
<td>Parent-reported medications</td>
<td></td>
</tr>
<tr>
<td>Antidepressants</td>
<td>17 (42.5)</td>
</tr>
<tr>
<td>Anticonvulsants</td>
<td>3 (7.5)</td>
</tr>
<tr>
<td>Prescription pain medications</td>
<td>9 (22.5)</td>
</tr>
<tr>
<td>Over the counter pain medications</td>
<td>19 (47.5)</td>
</tr>
<tr>
<td>Prescription sleep medications</td>
<td>5 (12.5)</td>
</tr>
<tr>
<td>Over the counter sleep medications</td>
<td>11 (27.5)</td>
</tr>
<tr>
<td>Other prescription medications</td>
<td>19 (47.5)</td>
</tr>
<tr>
<td>Other over the counter medications</td>
<td>9 (22.5)</td>
</tr>
</tbody>
</table>

### Table 3

**Comorbid Conditions of Participating Adolescents**

<table>
<thead>
<tr>
<th>Comorbid condition</th>
<th>Frequency, N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADHD</td>
<td>5 (12.5)</td>
</tr>
<tr>
<td>Anxiety/OCD</td>
<td>25 (62.5)</td>
</tr>
<tr>
<td>ASD</td>
<td>1 (2.5)</td>
</tr>
<tr>
<td>Asthma/eczema</td>
<td>6 (15.0)</td>
</tr>
<tr>
<td>Chronic pain</td>
<td>21 (52.5)</td>
</tr>
<tr>
<td>Depression</td>
<td>16 (40.0)</td>
</tr>
<tr>
<td>Other sleep disorders</td>
<td></td>
</tr>
<tr>
<td>Paroxysmalias</td>
<td>1 (2.5)</td>
</tr>
<tr>
<td>Sleep apnea</td>
<td>4 (10.0)</td>
</tr>
<tr>
<td>Restless legs syndrome</td>
<td>3 (7.5)</td>
</tr>
</tbody>
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*Note. Categories are not mutually exclusive and thus sum to greater than 100%. ADHD = attention deficit/hyperactivity disorder; OCD = obsessive compulsive disorder; ASD = autism spectrum disorder.*
individual sessions = 15.3 years old, $SD = 1.7$; $t(34) = -2.6, p = .01$. There were no significant differences in level of parent involvement in sessions between comorbidity groups.

**Feasibility and treatment engagement.** Compliance with treatment visits was high, with 34 of the 40 families (85%) completing all four sessions ($M$ sessions $= 3.7, SD = 0.76$). Of the six families who did not complete all sessions, the reasons for early termination were transportation/scheduling difficulties ($n = 3$); no longer interested in treatment ($n = 2$); and one family dropped out of treatment after two sessions because of a preference to prioritize treatment of the teen’s more pressing anxiety symptoms. Of the total 160 sessions (four sessions each for 40 participants) planned for this feasibility trial, 148 were successfully completed (92.5%). Families were generally compliant with scheduled visits, with no missed appointments and about 20% rescheduled visits (range $= 0–3$ per participant). Youth were also rated by therapists to be highly compliant with homework completion ($M = 7.5, SD = 1.7$). Youth with a physical comorbid condition were more likely to reschedule visits as compared to youth with a comorbid mental health condition ($M = 1.5, SD = .85$ vs. $M = .64, SD = .67$, respectively; $t(37) = 2.1, p = .04$). The two groups did not differ on other measures of treatment engagement, including the number of sessions completed and the number of homework assignments completed.

**Treatment satisfaction and acceptability.** Therapist ratings indicated that families were motivated to participate ($M = 7.4, SD = 1.7$), receptive to learning CBT-I skills ($M = 7.5, SD = 1.5$), and understood the CBT-I process ($M = 7.7, SD = 1.3$). Therapists reported having strong rapport with families ($M = 7.7, SD = 1.3$). Therapist ratings of treatment satisfaction and acceptability did not differ between comorbidity groups.

On the TEI-SF completed by 38 families, parents’ and teens’ mean scores indicated high treatment satisfaction and acceptability ($M$ parents $= 38.8, SD = 5.2$; $M$ teens $= 36.8, SD = 4.6$), exceeding the threshold mean of 27 representing “moderate” treatment satisfaction (Kelley et al., 1989). Across comorbidity groups, youth and parents were equally satisfied with treatment.

With respect to individual items on the TEI-SF, parents and teens rated the program as an acceptable way of helping children’s insomnia ($M$ parents $= 4.4, SD = .65$; $M$ teens $= 4.3, SD = .72$), and generally had a positive reaction to the treatment ($M$ parents $= 4.4, SD = .78$; $M$ teens $= 4.1, SD = .71$). Parents and teens rated the parent and child manuals and handouts as being useful ($M$ parents $= 4.0, SD = .86$; $M$ teens $= 3.7, SD = 1.2$). They also used the CBT-I skills at home ($M$ parents $= 4.7, SD = .48$; $M$ teens $= 4.4, SD = .55$), liked the skills taught in CBT-I ($M$ parents $= 4.5, SD = .70$; $M$ teens $= 4.2, SD = .83$), saw the skills as helpful for improving the teen’s sleep ($M$ parents $= 4.0, SD = .88$; $M$ teens $= 4.2, SD = .96$), and liked learning the skills with their CBT-I therapist ($M$ parents $= 4.4, SD = .84$; $M$ teens $= 4.1, SD = .99$). Participants perceived this treatment as somewhat likely to result in permanent improvement in teen’s sleep ($M$ parents $= 3.8, SD = .96$; $M$ teens $= 3.6, SD = 1.1$) and reported that they would be highly likely to recommend this treatment to other families managing teen insomnia ($M$ parents $= 4.5, SD = .70$; $M$ teens $= 4.2, SD = .88$).

**Discussion**

Preliminary findings demonstrate feasibility in delivery of a brief four-session CBT-I intervention emphasizing stimulus control, sleep restriction, and sleep hygiene to the special subpopulation of adolescents with co-occurring medical and mental health conditions. Unique features of this newly developed intervention were inclusion of parents and inclusion of optional treatment strategies tailored to individual needs (e.g., parent interventions, cognitive therapy, and relaxation skills). Across comorbidity groups, youth and parents were highly compliant with treatment visits (85% completed all 4 sessions), engaged in therapy sessions, and rated treatment as highly acceptable. Thus, our preliminary data provide promising evidence that CBT-I can be feasibly applied to adolescents with a range of co-occurring physical and mental health conditions in order to treat their insomnia symptoms.

Findings add to the small, but growing, literature on CBT-I in adolescents. This feasibility trial demonstrates that we were able to recruit, screen, and implement brief intervention in adolescents with insomnia and co-occurring con-
ditions, even among those with serious impairment in their school and behavioral functioning. The next phase of treatment development will involve testing the treatment package to see if it produces clinically significant change in insomnia symptoms and behavioral functioning in this population. Thereafter, future studies are needed to determine the source of the treatment effect by testing the CBT-I treatment in larger, more definitive trials with appropriate control groups.

Given our particular interest in applying CBT-I to youth with co-occurring physical and mental health conditions, a priority was placed on developing an efficiently delivered brief intervention consisting of three primary components of sleep restriction, stimulus control, and sleep hygiene. Youth with comorbidities are likely to be engaged in other forms of medical or behavioral treatment (42% of our sample was engaged in other psychological or psychiatric treatment) and may not be able to participate in a lengthy sleep-focused treatment. This brief intervention was feasible to deliver in full to 85% of our sample. Brief insomnia treatment packages are also ideal from a training and dissemination standpoint, and may make it possible to train more general CBT practitioners to integrate CBT-I into multicomponent psychological treatments without extensive training in behavioral sleep medicine.

Future studies are needed to examine the impact of CBT-I on symptoms related to adolescents’ co-occurring conditions including emotional, behavioral, and physical symptoms. It will be particularly important to obtain objective (e.g., actigraphy monitoring) and subjective sleep assessments in future RCTs of CBT-I with long-term follow up in order to examine causally whether changes in sleep lead to subsequent changes in health or mental health symptoms. Effective treatment of sleep problems has potential to lead to minimization or resolution of medical and mental health symptoms for youth. This hypothesis has been tested in several adult populations. For example, in adults with chronic pain conditions, sleep improvement in the early treatment period predicts later reductions in clinical pain (Smith et al., 2015; Vitiello et al., 2014). Similar analyses in adolescent populations have not yet been conducted. Teasing apart the directionality of treatment effects in the context of combined interventions has important implications for treatment planning. In addition, it will be important to tease apart the essential components of CBT-I in future studies as protocols differ in their inclusion of stimulus control, sleep restriction, sleep hygiene, cognitive therapy, and relaxation training. Our brief intervention emphasizes stimulus control, sleep restriction, and sleep hygiene but future studies are needed to determine which patients may benefit from which particular protocols.

Given that lifelong sleep patterns and behaviors develop in adolescence and sleep problems have critical implications for healthy development, treatment of sleep disturbances in youth should be a public health priority. Adolescence has been referred to as the “perfect storm” for the occurrence of sleep problems by virtue of circadian changes that occur with advancing pubertal development and social and environmental changes (e.g., early school start times; Carskadon, 1990). Adolescence is also a common period for the emergence of medical and psychiatric comorbidities. Our newly developed CBT-I treatment may help to address the gap in the treatment literature that exists for sleep interventions in special adolescent subpopulations.

This report is limited to describing the development and feasibility of delivering the CBT-I intervention only. Future work will examine the preliminary efficacy of the intervention for producing clinically significant change in insomnia symptoms in this sample. A randomized, controlled trial of CBT-I in adolescents with co-occurring conditions is needed to extend these preliminary findings. This is critically important given that youth with comorbid physical and mental health disorders represent the majority of youth presenting for treatment of insomnia. Indeed, sleep disturbance is part of the diagnostic criteria of several DSM-5 mental health disorders.

Because our sample was primarily Caucasian, female, and middle to upper class, generalizability may be limited. Future studies are needed to understand whether CBT-I is equally feasible and acceptable to more diverse populations. Although not sociodemographically diverse, the sample was diverse along clinical parameters as compared to the samples included in prior trials of CBT-I. For example, youth were included who had a range of physical and
mental health comorbidities, who were on a range of medications, and who had a high level of school and behavioral impairment; thus our sample may be more representative of typical presentations of adolescent insomnia in tertiary care settings.

There are substantial clinical implications for this line of research. These initial findings demonstrate that it is feasible to use stimulus control, sleep restriction, and sleep hygiene training in adolescents with comorbid medical and mental health disorders. Because insomnia is a transdiagnostic process and sleep behaviors are highly modifiable, brief targeted insomnia treatments are a particularly promising area of intervention. The brevity and focus of this CBT-I protocol may allow a broad range of pediatric providers to incorporate these interventions into practice, even without more extensive behavioral sleep medicine training, and allow for more widespread treatment options. That said, it will be important to train providers in how to conduct a detailed sleep assessment to identify youth who may benefit from this treatment approach. For example, it is particularly important to distinguish delayed sleep phase disorder from insomnia disorder as the recommended behavioral interventions differ.

In summary, this study provides support for the feasibility of a brief CBT-I intervention for youth with comorbid medical and mental health disorders. Future research is needed to determine preliminary efficacy on sleep outcomes and to examine whether changes in sleep can produce changes in psychological and physical functioning.

References


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