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SCIENTIFIC INVESTIGATIONS

Prevalence of somatic and pain complaints and associations with sleep disturbance in adolescents with insomnia presenting to a behavioral sleep medicine clinic

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Study Objectives: Sleep problems are highly comorbid with pediatric pain, yet there is a dearth of research on how pain and somatic complaints impact adolescent insomnia presentation and response to cognitive-behavioral therapy for insomnia (CBT-I). This study aims to (1) determine the prevalence of parent-reported somatic/pain complaints in adolescents with insomnia presenting to a behavioral sleep clinic, (2) assess the impact of somatic/pain complaints on initial sleep presentation, and (3) assess the impact of baseline somatic/pain complaints on response to CBT-I.

Methods: Participants included adolescents (n = 375) presenting to a behavioral sleep medicine center with a primary diagnosis of insomnia. As a part of clinical care, pre-evaluation measures were completed including the Pediatric Insomnia Severity Index, Adolescent Sleep Hygiene Scale, Adolescent Sleep Wake Scale, and Child Behavior Checklist. The Somatic Syndrome Scale of the Child Behavior Checklist measured somatic complaints and teens were categorized as endorsing pain if reported to experience aches/pains, headaches, or stomachaches. Adolescents completed the Pediatric Insomnia Severity Index at end of treatment.

Results: Most adolescents had parent-reported somatic (61.1%) and/or pain complaints: headaches (66.6%), stomachaches (48.5%), and aches/pains (45.1%). Greater somatic and pain complaints predicted a worse sleep presentation at intake (all $P < .05$). After controlling for insomnia severity at intake, neither end-of-treatment insomnia severity nor treatment status were predicted by somatic and pain complaints at intake.

Conclusions: Results suggest that parent-reported somatic/pain complaints are prevalent in > 50% of adolescents seeking behavioral insomnia treatment. Although complaints are associated with more severe insomnia at intake, they do not appear to interfere with treatment response.

Keywords: insomnia, somatic complaints, pain, sleep treatment, adolescents, parent report

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BRIEF SUMMARY

Current Knowledge/Study Rationale: Sleep problems are common in youth with chronic pain, yet it is not known how common or problematic somatic symptoms (eg, headaches, stomachaches, body pain) are in youth with primary sleep complaints. This study describes the prevalence of somatic complaints, based on parental report, in adolescents with insomnia presenting to behavioral sleep treatment and examines how somatization relates to sleep symptoms at the beginning and end of treatment.

Study Impact: Findings indicate that most adolescents presenting to sleep treatment had clinical levels of parent-reported somatic complaints and these complaints were related to worse sleep at the beginning of treatment. However, somatic complaints were not predictive of end-of-treatment outcomes, suggesting that these symptoms should not be a deterrent to behavioral insomnia treatment for adolescents.

INTRODUCTION

Somatic sensations are unpleasant, body-based perceptual experiences that are driven in part by an overactivation of the sympathetic nervous system.[1] With physiologic arousal as the underlying mechanism, somatic sensations can be experienced in different ways and across multiple body systems. Common somatic complaints include pain (headaches, abdominal pain, whole-body aches), gastrointestinal distress (nausea, diarrhea), cardiac symptoms (dizziness, heart palpitations), and general fatigue. Although the experience of somatic complaints in youth is sometimes linked to major adverse life events or trauma,[2,3] somatic complaints are also common in otherwise healthy youth. In community samples of adolescents, approximately 25% report at least 1 persistent somatic complaint.[4] More specifically, approximately 60% of youth are prone to headaches,[5] whereas the prevalence of gastrointestinal symptoms is 23%[6] and 15% for widespread body pain.[7]

Living with somatic complaints can have far-reaching implications for youth and their families. Youth with somatic complaints have more difficulty with functioning in daily life[8] and report having a lower overall quality of life.[9] School absenteeism[10,11] and academic problems[6] are common, as well as withdrawal from socializing and hobbies. Greater symptom burden is associated with accessing more medical services.[12] Without proper treatment, somatic complaints have significant

downstream effects for many youth. Simply having somatic complaints as an adolescent increases risk for developing chronic widespread pain,[7] and youth with chronic pain are also more likely to experience somatic complaints across multiple body systems.[13] Recent longitudinal work found that 45% of youth with somatic complaints may experience persistent or worsening somatic complaints into adulthood.[14] Further, when somatic complaints track into adulthood, they can become a vulnerability for the development of a chronic pain condition or mental health diagnosis.[15,16]

Sleep concerns may also be a hallmark of the somatic presentation. While the literature is limited examining the interaction of sleep and somatic complaints broadly, pediatric patients with chronic pain (who often report high somatic symptoms) report higher levels of sleep difficulties. This includes greater report of insomnia symptoms,[17] poorer sleep hygiene,[18] higher presleep arousal,[19] and more bedtime resistance,[20] all of which can impact functioning.[17] While it is well established that these sleep complaints are common in pain populations, it is not yet known how common or problematic somatic symptoms are in youth with primary sleep complaints.

Knowing the prevalence of somatic complaints and pain in adolescents with insomnia could have important implications for behavioral sleep medicine (BSM) providers. For example, given the pediatric evidence that comorbid insomnia negatively impacts pain-focused treatment response,[21] providers may wish to know whether pain and somatic complaints also moderate insomnia treatment success. Additionally, BSM providers are inherently interested in the "perpetuating factors" that maintain insomnia. Interestingly, many of these cognitions and behaviors may parallel or directly influence the experience of somatic complaints and pain. For example, inconsistent sleep scheduling may increase headache frequency, indirectly leading to daytime napping to "cope" with the headache. Further, napping could be used more generally as an escape from uncomfortable symptoms like nausea, resulting in decreased homeostatic sleep pressure and greater nighttime frustrations. Difficulties with sleep onset may result in greater time opportunity to ruminate not only on the inability to fall asleep but also bodily discomfort. Likewise, difficulties with maintaining sleep may be associated with increased awareness or disruption of these sensations during the night, which, in turn, disrupt sleep continuity and impact perceptions of sleep.

In order to address this gap in the literature, we aimed to determine the prevalence of somatic complaints and specific pain complaints in adolescents presenting to a BSM clinic for evaluation and treatment of insomnia within a large, private Midwestern children's hospital. We also aimed to assess the relationship between somatic complaints and sleep disruption, both cross-sectionally at initial intake and longitudinally across treatment. We hypothesized that (1) somatic and pain complaints would be highly prevalent, (2) somatic and pain complaints would be positively associated with sleep disturbance at intake, and (3) greater somatic complaints and specific pain complaints would predict poorer response to treatment. For the current analysis, parent-reported somatic and pain complaints were used.

METHODS

Participants

Participants included 375 adolescents presenting with a caregiver to an outpatient pediatric behavioral sleep medicine center (BSMC) between July 2009 and April 2017 for evaluation and treatment of a behavioral sleep concern. Adolescents were included in the sample if they were diagnosed with primary insomnia as defined by the second edition of the *International Classification of Sleep Disorders*[22] (ICSD) for those presenting before 2014 and the third edition[23] for those presenting after. The criteria for insomnia disorder are consistent between the 2 ICSD editions, with a slight change in criteria for duration (ie, 1 to 3 months) and the addition of frequency criteria (at least 3 times per week).[24] Circadian rhythm delays and delayed sleep phase syndrome (DSPS) are common in adolescents. Thus, these were differentiated from insomnia by a thorough assessment by a board-certified BSM provider including a comprehensive interview accompanied by a sleep diary (for most patients) and validated sleep measures. The ability to fall asleep quickly and easily at a later clock time and maintain sleep throughout the night, indicating a diagnosis of DSPS, was differentiated from difficulty with sleep onset, maintenance, or early morning awakening, independent of clock time, that would be indicative of insomnia. Participants were only included if they had a diagnosis of insomnia; thus, by nature of the diagnostic criteria, those with DSPS were excluded (n = 52). Participants were not excluded based on the presence of comorbid organic sleep diagnoses (eg, sleep apnea), additional sleep concerns with behavioral components (eg, parasomnias), or mental health diagnoses that have been previously described for this sample (approximately 75% of the sample had a parent-reported mental health diagnosis).[25]

Procedures

All participants were presenting with a primary sleep-related concern to a BSMC located within an accredited sleep disorders center in a large Midwestern tertiary-care pediatric hospital. Upon referral to the sleep disorders center, caregivers provided a brief history and completed a referral questionnaire. Patients were subsequently triaged to be seen by a board-certified sleep physician in the sleep disorders center and/or by a licensed psychologist certified in BSM in the BSMC. Prior to being seen in the BSMC, as a part of routine clinical care, patients and caregivers completed a battery of pre-evaluation screening measures. These measures were used during the BSMC evaluation alongside a sleep diary (when available) and comprehensive clinical interview to make ICSD[22,23] diagnoses and behavioral treatment recommendations. At the initial BSMC evaluation, patients were given individualized evidence-based behavioral sleep recommendations and, when indicated, were referred for formal follow-up treatment. The clinic practice patterns and treatment provided to patients are described in detail by Byars and Simon.[26] Briefly, well-established cognitive-behavioral therapy for insomnia (CBT-I) techniques were used with preadolescents and adolescents including interventions such as stimulus control

and sleep restriction. At the initial BSMC evaluation, the purpose of the study was explained, and all families were invited to participate. For those agreeing, caregivers provided written informed consent and adolescents provided written assent. All study procedures were approved by the hospital's institutional review board.

Measures

Demographics

Participant demographics (ie, age, sex, ethnicity, and family income) were reported by caregivers in the pre-evaluation measures.

Sleep diagnoses and symptoms

Sleep-related diagnoses: Licensed clinical psychologists certified in BSM completed comprehensive evaluations in the BSMC. Pre-evaluation screening measures, sleep diaries (when available), and a comprehensive clinical interview informed clinical diagnosis. Patients presenting with concerns for sleep-disordered breathing, central disorders of hypersomnolence, sleep-related movement disorder, or any other sleep concern warranting sleep medicine evaluation were evaluated by a board-certified sleep physician. In total, 110 of our participants had a completed polysomnography to assist in the diagnosis of organic sleep disorders. ICSD criteria[22,23] were used to make clinical sleep diagnoses.

Sleep-related treatment outcomes: Treatment outcomes were tracked for each patient across sessions. This included the status of the final session attended (ie, formal termination vs premature termination). After each visit the clinician noted whether treatment was complete (ie, formal termination) or whether treatment was active. If the patient's final session was coded as "active," they were categorized as having premature termination.

Pediatric Insomnia Severity Index: The Pediatric Insomnia Severity Index (PISI)[26,27] was completed by adolescents at the initial BSMC evaluation and at the beginning of each treatment session thereafter. The PISI is a 6-item measure assessing insomnia severity with questions related to difficulty falling asleep, maintaining sleep, daytime sleepiness, and sleep duration during the past week. Scores range from 0 to 30, with higher scores indicative of greater insomnia severity. The PISI adolescent form has high internal consistency (α = .80) and has demonstrated acceptable validity through correlations with other validated sleep measures (r = .418).[26]

Adolescent Sleep Hygiene Scale: The revised Adolescent Sleep Hygiene Scale (ASHS) is a 33-item, adolescent-report measure of sleep-facilitating and sleep-inhibiting behaviors.[28] Adolescents are prompted to report on the frequency of behaviors occurring in the past month using a 6-point scale (1 = always to 6 = never). The ASHS has 6 subscales: physiological (eg, caffeine use), sleep environment (eg, watching TV), cognitive/emotional (eg, worrying), sleep stability (eg, staying up past bedtime), daytime sleep (eg, napping), and behavioral arousal (eg, wake-promoting activity). Means were used to compute subscales scores ranging from 1 to 6, with higher scores indicative of better sleep hygiene. The revised ASHS subscales have good internal consistency and the measure has good evidence of concurrent and convergent validity.[28]

Adolescent Sleep Wake Scale: The Adolescent Sleep Wake Scale (ASWS)[18] is commonly used in community and clinical samples and assesses sleep quality across 5 subscales: going to bed (eg, delaying bedtime), falling asleep (eg, trouble settling), maintaining sleep (eg, night awakenings), reinitiating sleep (eg, trouble returning to sleep), and returning to wakefulness (eg, feeling rested). The 28-item measure prompts adolescents to respond to the frequency of sleep behaviors in the past month using a 6-point scale (1 = always to 6 = never). Means were used to compute subscale scores ranging from 1 to 6, with higher scores indicative of better sleep quality. The ASWS has acceptable internal consistency and concurrent validity with the ASHS.[29]

Somatic and pain symptoms

Child Behavior Checklist Somatic Syndrome Scale: Parents completed the full version of the Child Behavior Checklist (CBCL)[30] as a part of the BSMC pre-evaluation measures. The CBCL is a broadband measure of child functioning and mental health symptoms that is widely used in research and clinical care. The somatic syndrome subscale of the CBCL was used as a measure of somatic syndromes in youth and has been used as an outcome of sleep-related problems in youth in prior research.[31] Parents responded to the frequency (0 = never, 1 = sometimes, 2 = often) that their child experienced 11 different somatic complaints, including headaches, stomachaches, aches/pains, dizziness, nausea/feeling sick, rashes/skin problems, constipation, problems with eyes, vomiting, being overtired without reason, and nightmares. In the current study, we used 3 outcomes based on the CBCL. First, somatic syndrome T scores were used to describe the sample, with a $T \geq 65$ considered a borderline elevation and $T \geq 70$ considered a clinical elevation. Second, somatic syndrome subscale raw scores with sleep items (ie, overtired without reason, nightmares) removed were used in all analyses examining relationships with sleep. Third, based on parent responses to specific CBCL items, participants were classified into endorsing pain complaints (ie, aches/pains, headaches, stomachaches) never vs sometimes/often. Among the CBCL Somatic Syndrome Scale items, aches/pains, headaches, and stomachaches are more traditionally considered pain-related complaints[32] and were the most frequently reported items on the Somatic Syndrome Scale in our sample outside of sleep-related complaints.

Analysis plan

First, descriptive analyses were conducted to determine the breakdown of demographics, sleep-related diagnoses (behavioral and organic) and symptom severity (ie, intake and final PISI scores and ASWS and ASHS subscale scores), the frequency of somatic complaints as measured by the CBCL Somatic Syndrome Scale, and endorsement of pain complaints (ie, aches/pains, headaches, stomachaches). Next, baseline associations between sleep and somatic symptoms were evaluated with correlations

between the CBCL somatic syndrome scale (with sleep items removed) and insomnia severity (ie, PISI total score), sleep hygiene (ie, ASHS subscales), and sleep-wake behaviors (ie, ASWS subscales). Baseline differences in insomnia severity, sleep hygiene, and sleep-wake behaviors between those not endorsing pain complaints (ie, ache/pain, headaches, and/or stomachaches) and those endorsing pain complaints sometimes or often were examined using between-group analyses of variance (ANOVAs). Follow-up logistic regression analyses were used to examine if differences between groups remained when controlling for demographics (ie, age, sex, race, and income). Finally, analyses were run to examine the influence of somatization and pain on insomnia treatment outcomes. First, 2 separate hierarchical linear regression analyses were conducted to determine how baseline somatic symptoms predict insomnia treatment outcomes (ie, PISI final treatment session total score) for participants with 1 or more treatment sessions following intake evaluation. For each regression, baseline insomnia severity score was entered on step 1. The raw scores of the CBCL Somatic Syndrome Subscale with sleep items removed was entered on step 2 of 1 regression, and the presence of any pain complaint (sometimes/often vs never) was entered on step 2 of the other regression. Second, change in insomnia severity across treatment (ie, final insomnia severity score – first insomnia severity score) was assessed with a correlation with the CBCL Somatic Syndrome Scale and to see if differences in change existed for those with borderline or clinically elevated somatic symptoms ($T \geq 65$) compared with those with normal levels of somatic symptoms or between those reporting experiencing any pain vs no pain. Finally, chi-square analyses were used to determine if participants with pain complaints at baseline were more likely to terminate insomnia treatment early compared with those without pain complaints.

RESULTS

Descriptive analyses

Table 1 presents descriptive information on demographics (ie, age, sex, ethnicity, and family income) and sleep-related diagnoses. All 375 adolescents included in analyses met ICSD criteria for insomnia. Of those with comorbid organic sleep disorders, sleep-related breathing disorders (19.2%) and parasomnias (18.1%) were the most common. Descriptive information for sleep outcome measures is reported in Table 2. The average insomnia severity score at intake for the full sample was 19.01, indicating clinical levels of insomnia. Of the 375 adolescents who obtained an initial evaluation, 227 (60.5%) attended at least 1 follow-up treatment session. This subsample (n = 227) had an average insomnia severity score of 19.45 at intake vs 14.00 at the final visit, demonstrating significant improvement in insomnia across treatment: $F(1, 226) = 194.13$, $P < .001$. Finally, for those attending at least 1 follow-up treatment session, 62.8% had premature termination of treatment. Of the 148 patients only attending the initial evaluation, 91.2% had premature termination (ie, almost all of these patients were recommended to receive follow-up treatment but did not return for treatment).

Table 1—Demographic descriptive information and frequency of sleep diagnoses.

	Mean ± SD or n (%)
Demographics	
n	375
Age, y	14.8 ± 2.1
Sex	
Female	206 (54.9)
Male	169 (45.1)
Ethnicity	
White non-Hispanic	307 (81.9)
African American	30 (8.0)
Multiracial	24 (6.4)
Asian American	6 (1.6)
Hispanic/Latino	5 (1.3)
Native American	2 (0.5)
Other	1 (0.3)
Family income	
Under $20,000	59 (16.0)
$20,000–$49,000	73 (19.0)
$50,000–$74,000	47 (12.5)
$75,000–$99,000	42 (11.2)
$100,000–$149,000	64 (17.0)
$150,000 or more	53 (14.0)
Declined to report	37 (10.0)
Comorbid sleep disorders	
Parasomnias	68 (18.1)
Sleep-related movement disorders	18 (4.8)
Sleep-related breathing disorders	72 (19.2)
Sleep-related medical and neurological disorders	4 (1.1)

Prevalence of somatic complaints

On average, caregivers reported that most adolescents (61.1%) had elevated somatic complaints on the CBCL Somatic Syndrome Scale (mean = 66.60, SD = 8.94), with 19% of youth having borderline scores (T range: 65–69) and 42.1% falling within the clinical range ($T \geq 70$). See Table 3 for the somatic item prevalence ratings rank ordered from highest to lowest frequency rating ("never," "sometimes," and "often"). Outside of sleep-related complaints (ie, overtired without reason, which occurred in 53% of the sample), headaches (66.6%), stomachaches (48.5%), and aches/pains (45.1%) were most commonly endorsed as occurring either "sometimes" or "often," while constipation, problems with eyes, and vomiting occurred in less than one-third of the sample.

Relationships between somatic and pain complaints with sleep symptoms at intake

First, to examine the relationship between somatization and sleep symptoms at initial evaluation, correlations between the CBCL

Table 2—Descriptive information for measures of sleep.

Sleep Measure	n	Mean	SD	Min	Max
At intake					
Insomnia severity (PISI)	375	19.01	5.88	1	30
Adolescent Sleep Wake Scale (ASWS)	362				
Going to bed		3.47	1.29	1	6
Falling asleep		2.85	0.91	1	6
Maintaining sleep		3.19	1.09	1	6
Reinitiating sleep		3.73	1.01	1	6
Returning to wakefulness		2.32	1.12	1	6
Adolescent Sleep Hygiene Scale (ASHS)	363				
Physiological arousal		4.73	0.8	2.2	6
Behavioral arousal		3.53	1.27	1	6
Cognitive-emotional		3.95	1.18	1	6
Sleep environment		4.87	0.89	1.8	6
Sleep stability		3.17	1.29	1	6
Daytime sleep		4.99	1.14	1	6
At final visit					
Insomnia severity (PISI)*	227	14.00	7.33	1	30
Treatment status, n (%)					
Formal termination	84 (37.2)				
Premature termination	142 (62.8)				

*Reflects PISI scores collected in patients that complete ≥ 1 treatment sessions following initial evaluation. max = maximum, min = minimum, PISI = Pediatric Insomnia Severity Index, SD = standard deviation.

Somatic Syndrome Subscale raw score with sleep items removed and sleep symptoms were examined. Increased somatic symptoms were associated with worse insomnia severity (r = .13); difficulties falling asleep (r = −.14), maintaining sleep (r = −.18), reinitiating sleep (r = −.12), and returning to wake (r = −.20); and worse physiological (r = −.19), cognitive emotional (r = −.13), and sleep environment (r = −.18) sleep hygiene factors (all P < .05).

Next, differences in sleep symptoms were compared using between-group ANOVAs for those reported to experience at least

Table 3—Item-level frequency of parent-reported responses on the CBCL Somatic Syndrome Subscale.

Item	Often	Sometimes	Never
Headaches	121 (32.4)	128 (34.2)	125 (33.4)
Overtired without reason	99 (26.5)	99 (26.5)	176 (47.1)
Stomachaches	47 (12.6)	134 (35.9)	192 (51.5)
Aches/pains	60 (16.0)	109 (29.1)	205 (54.7)
Dizzy	35 (9.4)	132 (35.4)	206 (55.2)
Nightmares	42 (11.2)	114 (30.5)	218 (58.3)
Nausea/feels sick	43 (11.5)	113 (30.2)	218 (58.3)
Rashes/skin problems	41 (11.0)	86 (23.0)	247 (66.0)
Constipated	32 (8.6)	75 (20.1)	267 (71.4)
Problems with eyes	23 (6.2)	31 (8.3)	318 (85.5)
Vomiting	12 (3.2)	41 (11.0)	321 (85.8)

Data are presented as n (%). CBCL = Child Behavior Checklist.

Table 4—Differences in sleep symptoms at baseline for those with and without pain/somatic complaints (ie, aches/pain, headache, stomachache).

Intake Sleep Parameters	Presence of Somatic Complaints (Mean ± SD)			Adjusted Odds Ratio* (*P* Value)
	Yes (1)	No (0)	*P*	
Insomnia severity (PISI)—intake	19.1 ± 6.0	18.5 ± 5.7	.43	0.99 (.96)
Adolescent Sleep Wake Scale (ASWS)				
Going to bed	3.4 ± 1.3	3.6 ± 1.3	.20	0.86 (.19)
Falling asleep	2.8 ± 0.9	3.0 ± 1.0	.08	0.74 (.04)
Maintaining sleep	3.1 ± 1.1	3.4 ± 1.1	.13	0.87 (.25)
Reinitiating sleep	3.7 ± 1.0	3.9 ± 1.0	.15	0.82 (.14)
Returning to wakefulness	2.2 ± 1.1	2.7 ± 1.2	<.001	0.71 (.003)
Adolescent Sleep Hygiene Scale (ASHS)				
Physiological arousal	4.7 ± 0.8	4.9 ± 0.8	.06	0.71 (.06)
Behavioral arousal	3.5 ± 1.3	3.6 ± 1.3	.36	0.91 (.36)
Cognitive-emotional	3.9 ± 1.2	4.3 ± 1.2	.003	0.71 (.008)
Sleep environment	4.8 ± 0.9	5.1 ± 0.8	.005	0.62 (.005)
Sleep stability	3.1 ± 1.3	3.4 ± 1.4	.08	0.82 (.07)
Daytime sleep	5.0 ± 1.1	5.1 ± 1.2	.61	1.01 (.94)

Note that higher scores on the ASWS and ASHS indicate fewer complaints and better sleep. *Odds ratio is adjusted for age, sex, race (White vs non-White), and income (≤ $49,000 vs ≥ $50,000). PISI = Pediatric Insomnia Severity Index.

some pain (defined as headaches, stomachaches, or aches/pain) on the CBCL and those reported to never have these symptoms (see **Table 4**). Youth experiencing pain tended to have greater difficulty waking in the morning, worse cognitive-emotional arousal around sleep, and worse sleep environments. These differences remained even when controlling for patient age, sex, race/ethnicity, and income in logistic regression analyses.

Influence of somatic and pain complaints on sleep treatment outcomes

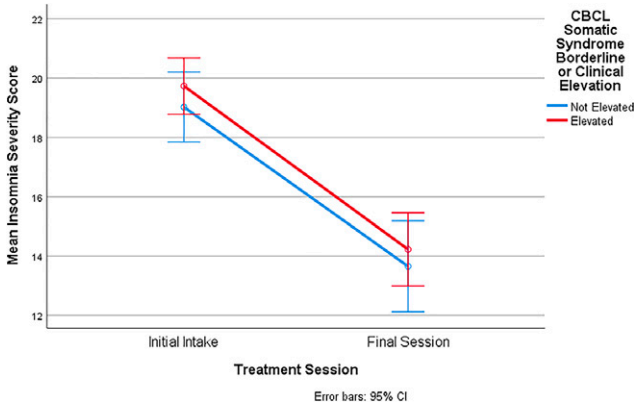
Two separate linear regression analyses were run to examine (1) the influence of somatic symptoms (measured by the CBCL Syndrome Scale raw score with sleep items removed) and (2) the experience of pain (headaches, stomachaches, aches/pain; "sometimes"/"often" vs "never") on insomnia severity treatment outcomes for those with at least 1 follow-up treatment session after the initial evaluation, controlling for insomnia severity at intake (see **Table 5**). Although insomnia severity at intake was predictive of insomnia severity at the final session, neither somatic symptoms nor experiencing pain were predictive of insomnia severity at the final visit. Similarly, somatic symptoms at intake (as measured by the CBCL Somatic Syndrome raw score with sleep items removed) did not correlate with change in insomnia severity (final insomnia severity score – intake insomnia severity score) across treatment ($r = -.035$, $P = .603$).

Table 5—Multiple linear regression models predicting final treatment insomnia severity scores by somatic symptoms and the presence of pain for those with at least 1 treatment session following intake.

Predictors	B	SE B	β	*P*
Full model 1: $F(2, 219) = 68.40$, $P < .001$				
Intake insomnia severity	0.791	0.069	0.613	<.001
CBCL Somatic Syndrome Scale	0.102	0.115	0.047	.377
Full model 2: $F(2, 221) = 68.39$, $P < .001$				
Intake insomnia severity	0.801	0.069	0.62	<.001
Presence of pain (yes/no)	−0.497	0.932	−0.028	.594

B = unstandardized coefficients; β = standardized coefficients; CBCL = Child Behavior Checklist.

Figure 1—Change in insomnia severity from initial intake to the final treatment session for those with elevated somatic symptoms.

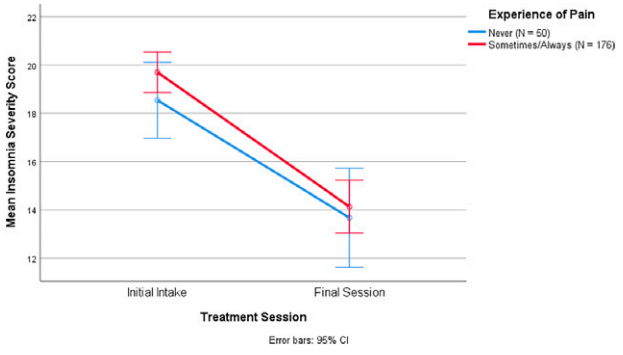


Elevated somatic symptoms, $T \geq 65$ on the Somatic Symptom Syndrome scale of the CBCL. Change did not differ by somatic complaint group.
CBCL = Child Behavior Checklist, CI = confidence interval.

To further explore these associations, we compared differences in change in insomnia severity in those having borderline or clinically elevated symptoms on the Somatic Syndrome Scale (vs in the normal range) and those experiencing pain (vs no pain) at intake. Adolescents with borderline or clinical somatic symptoms [$F(1, 225) = .029$, $P = .865$; see **Figure 1**] and pain [$F(1, 224) = .557$, $P = .456$; see **Figure 2**] exhibited comparable changes in insomnia severity over the course of treatment.

Finally, we examined how baseline sleep symptoms and the presence of pain/somatic symptoms (ie, headaches, stomachaches, aches/pain; "sometimes"/"often" vs "never") predicted final insomnia treatment status (ie, successful completion vs early termination). A series of between-group ANOVAs were conducted to examine differences in baseline insomnia severity (as measured by the PISI), ASWS subscales, and ASHS subscales for those with successful completion vs early termination (see **Table 6**). Those who terminated treatment early had greater baseline insomnia symptoms and worse sleep hygiene related to physiological arousal, cognitive emotional factors, and daytime sleep compared with those who successfully completed treatment (all $P < .05$). With the exception of cognitive-emotional factors, all of these differences remained significant even when controlling for age, sex, race/ethnicity, and family income in logistic regression analyses. A series of chi-square analyses were conducted to determine if participants with any pain complaint together (ie, aches/pain, headaches, stomachaches) or individually had a higher likelihood of early termination. Consistent with prior regression analyses, neither those with the presence of any complaint nor any individual complaint were more likely to terminate treatment early (all $P > .05$; see **Table 6**).

Figure 2—Change in insomnia severity from initial intake to the final treatment session for those experiencing pain sometimes/always compared with never.



Experiencing pain defined as headaches, stomachaches, and/or aches/pain sometimes or always. Change did not differ by pain group. CI = confidence interval.

DISCUSSION

This study examined the prevalence and impact of unpleasant somatic complaints (like pain, dizziness, and gastrointestinal distress), based on parental report, on sleep among adolescents seeking behavioral treatment for insomnia. While sleep problems have previously been documented in youth with a primary somatic complaint (eg, pain[17]), no previous literature has specifically examined the prevalence of somatic complaints (including pain-related symptoms) in adolescents with clinically diagnosed insomnia. Consistent with the first 2 hypotheses, we found that (1) most adolescents seeking insomnia treatment had frequent somatic complaints, including pain-related complaints (eg, headache, abdominal pain, and aches/muscle pain), based on parental response and (2) greater overall somatic complaints predicted worse sleep at intake across multiple measures, including insomnia symptoms, sleep/wake patterns, and sleep hygiene. More specifically, youth experiencing general aches/pains, headaches, or stomachaches tended to have greater difficulty waking in the morning, worse cognitive-emotional arousal around sleep, and worse sleep environments at intake. Interestingly, our hypothesis regarding the impact of somatic and pain complaints on treatment outcomes was not supported. The current study findings suggest that, despite being a risk factor for "starting worse," somatic complaints and/or experiencing pain at intake did not predict insomnia treatment course. While contrary to our expectations, this finding is encouraging, as it suggests that baseline somatic and pain complaints did not appear to differentially impact insomnia treatment, and thus should not be a deterrent to insomnia-specific treatment for youth with clinically significant levels of somatic complaints.

Although the presence of pain/somatic complaints at baseline was not predictive of final treatment status, certain sleep symptoms were. Specifically, greater insomnia severity, increased physiological arousal, worse cognitive-emotional factors, and increased daytime sleep (eg, napping) predicted early termination of insomnia treatment. Clinicians should assess for these sleep symptoms at the beginning of treatment, consider how they may interact with somatization or pain complaints, and

Table 6—Differences in sleep and somatic symptoms at baseline for those with successful completion vs premature termination of insomnia treatment.

Baseline Symptoms	Completion of Therapy [Mean ± SD or n (%[a])]			Adjusted Odds Ratiob (*P* value)
	Yes	No	*P*	
Sleep symptoms				
Insomnia severity (PISI)—intake	16.8 ± 5.9	19.8 ± 5.7	<.001	1.07 (.004)
Adolescent Sleep Wake Scale				
Going to bed	3.6 ± 1.3	3.4 ± 1.3	.34	0.86 (.14)
Falling asleep	3.0 ± 1.0	2.8 ± 0.9	.14	0.80 (.41)
Maintaining sleep	3.3 ± 1.0	3.1 ± 1.1	.15	0.86 (.21)
Reinitiating sleep	3.9 ± 1.1	3.7 ± 1.0	.13	0.82 (.13)
Returning to wakefulness	2.4 ± 1.3	2.3 ± 1.0	.18	0.95 (.63)
Adolescent Sleep Hygiene Scale				
Physiological arousal	4.9 ± 0.7	4.7 ± 0.8	.04	0.67 (.02)
Behavioral arousal	3.6 ± 1.3	3.5 ± 1.3	.49	1.0 (.96)
Cognitive-emotional	4.2 ± 1.2	3.9 ± 1.2	.02	0.87 (.25)
Sleep environment	4.9 ± 0.9	4.9 ± 0.9	.89	1.03 (.84)
Sleep stability	3.3 ± 1.4	3.1 ± 1.2	.37	0.91 (.34)
Daytime sleep	5.3 ± 1.0	4.9 ± 1.2	.006	0.77 (.046)
Somatic symptoms				
Any complaint (0 = no, 1 = yes)	80 (83.3)	213 (77.2)	.20	0.60 (.12)
Aches/pain	41 (42.7)	128 (46.2)	.55	1.01 (.97)
Headache	68 (70.8)	180 (65.0)	.30	0.64 (.11)
Stomachache	51 (53.1)	130 (47.1)	.31	0.31 (.19)

[a]Percentage of individuals who have a somatic complaint present in each group. [b]Odds ratio is adjusted for age, sex, race (White vs non-White), and income (≤ $49,000 vs ≥ $50,000). PISI = Pediatric Insomnia Severity Index.

clearly communicate with at-risk patients regarding the course of treatment and expected outcomes. Further, future research is needed to determine what other factors (eg, mental health symptoms) might predict insomnia treatment completion.

Although this was the first study of somatic and pain complaints in a pediatric behavioral sleep setting, results align with the broader adolescent literature linking sleep with somatic complaints. With pain as the most studied somatic complaint, numerous studies found that adolescents with pain conditions perceive themselves to have shorter sleep duration and poorer sleep quality,[19,20] as well as have less efficient sleep than healthy peers.[33–35] In one of the few studies of sleep and broadband somatic complaints (as measured by the CBCL), persistent parent-reported sleep problems from preschool to school age predicted a 9-fold increased risk of having clinically elevated somatic complaints during school age.[31] Similar to the effects of sleep deprivation, somatic complaints can create significant problems and functional disability for teens.[8] Studies have also connected these 2 phenomena, showing that adolescents with *Diagnostic and Statistical Manual of Mental Disorders*, *Fourth Edition*–diagnosed insomnia were at increased risk for experiencing somatic distress (poorer perceived physical health), having frequent school absences, and experiencing negative impacts on their personal and family lives.[36]

Because somatic complaints (like pain) can negatively impact engagement in sleep-promoting behaviors (such as school attendance, physical activity, daytime socialization[37]) we believe they are important to consider in the BSM context. BSM clinicians would likely benefit from assessing somatic complaints in all adolescents with insomnia, given the high prevalence rates in our clinic. Important things to consider may include how complaints influence daytime stimulus control practices (eg, spending the day in bed in a dark room with a headache), school attendance and downstream effects on sleep/wake patterns (eg, staying home from school and sleeping in late on days with greater nausea, dizziness, or pain), daytime napping (eg, using naps as an escape from physical discomfort), and whether physical discomfort might influence sleep onset or maintenance difficulties.

BSM clinicians can also play an important role in providing families with psychoeducation about how their sleep and body sensations may be linked. Validating adolescents' experience by informing them that teens with more pain and uncomfortable body sensations do tend to have more severe sleep difficulties can help teens feel heard. Perhaps most importantly, clinicians can use this information to instill hope and motivation to engage in treatment by providing this message; despite having more severe sleep problems when they come in, adolescents with pain or somatic complaints still respond to treatment. Beyond assessment

and psychoeducation, clinicians can use information about patients' somatic experience to help guide conceptualization and treatment. As alluded to earlier, many components of behavioral treatments for insomnia are complementary to cognitive-behavioral treatments for improving function in youth with pain. Although future research is needed to determine whether specific components of CBT-I are more effective for youth with comorbid somatic concerns, clinicians can use information gleaned from a thorough assessment to emphasize certain treatment components. For example, if an adolescent uses sleep as an escape from their headache after school, treatment will likely need to also focus on providing alternative coping strategies to napping.

This study has many strengths. Namely, data were collected "in the trenches" from a large, purely clinical sample of adolescents seeking insomnia treatment. However, results should also be interpreted in consideration of the study's limitations. Perhaps most notably, somatic and pain complaints were parent-reported as part of a larger measure of the adolescent's social-emotional functioning. Because somatic complaints are by their very nature subjective, prevalence rates reported here may not accurately reflect adolescents' true somatic experience. Several studies have shown that parents underreport their child's somatic and pain experiences/complaints.[38–41] However, a study by Walker et al[42] reported a moderate concordance with the CBCL and adolescent reports of somatic distress (r = .42), and a more recent study by Janssens et al[43] reported similar trajectories for parent- and adolescent-reported somatic/pain symptoms. Further, parents were given the options of "never," "sometimes," and "often" when reporting on the frequency of each somatic/pain complaint on the CBCL, which adds an additional layer of subjectivity to the report. Because we only obtained measures of insomnia severity (and not sleep/wake patterns, sleep hygiene behaviors, or the CBCL measuring somatic complaints) at the final visit, we were unable to take a more refined look at how more specific sleep behaviors or somatic complaints changed across treatment. Finally, it should be noted that our findings about the prevalence of somatic/pain complaints could be an artifact of referral patterns specific to our particular institution.

Such study limitations open up opportunities for interesting future directions. Future studies should aim to replicate these findings using adolescent reports of somatic distress (eg, using the Children's Somatic Symptom Inventory-24[12]) and/or the presence of pain complaints related to headaches, abdominal pain, and musculoskeletal pain. While the CBCL characterizes the frequency of these pain complaints, the CBCL does not assess other dimensions of pain, including intensity, duration, and impact. Tracking severity or intensity of these symptoms over the treatment course would also open up doors for investigating whether improvements in sleep impact changes in somatic complaints. A recently published study found that experimentally restricting sleep duration causes somatic complaints among healthy adolescents, suggesting that improving sleep duration may be an effective way to improve the somatic experience.[44] Future examination of specific insomnia interventions would help clarify which interventions may be most effective for this population. Interventions such as increasing activity and light exposure during the day, decreasing daytime napping, and decreasing time spent in bed while not sleeping may have positive effects on not only sleep but also functional disability associated with greater somatic complaints.

CONCLUSIONS

The current study findings are consistent with prior research demonstrating that somatic and pain complaints are associated with disrupted sleep, and provide novel insights regarding the somatic/pain profiles of youth with clinically diagnosed insomnia followed in a BSM clinical setting. Clinical awareness that most adolescent patients seeking insomnia treatment will present with specific pain and global somatic complaints is important and should be used to guide delivery of insomnia treatment. While these findings must be interpreted considering the specific clinical context of the study, the knowledge that insomnia treatment is effective irrespective of the presence/severity of somatization/pain has significant clinical implications and can fuel a powerful message that patients experiencing pain and somatization can have hope for improved sleep after participating in evidence-based treatment for insomnia. Future research is needed to replicate these findings using more refined measures of sleep, objective sleep assessments, and across other BSM settings.

ABBREVIATIONS

ASHS, Adolescent Sleep Hygiene Scale
ASWS, Adolescent Sleep Wake Scale
BSM, behavioral sleep medicine
BSMC, behavioral sleep medicine clinic
CBCL, Child Behavior Checklist
CBT-I, cognitive-behavioral therapy for insomnia
ICSD, *International Classification of Sleep Disorders*
PISI, Pediatric Insomnia Severity Index

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