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Internet-based Cognitive-Behavioral Therapy for Insomnia in Adults with Asthma: A pilot study

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Abstract

Background/Objective: Insomnia is common among adults with asthma and is associated with worse asthma control. Cognitive-behavioral therapy for insomnia (CBT-I) is an effective treatment for insomnia with medical comorbidities, but it has not been tested in asthma. The purpose of this study was to assess the feasibility and acceptability of an Internet-based CBT-I intervention, called Sleep Healthy Using the Internet (SHUTi), among adults with asthma and comorbid insomnia, and to gather preliminary efficacy data on changes in insomnia severity, sleep quality, asthma control, and asthma-related quality of life.

Methods: A single group, pre-test post-test design was employed, where all participants completed the SHUTi program. Online questionnaires were completed pre- and postintervention. Individual telephone interviews were conducted after post-treatment data collection to obtain participants' experiences with SHUTi and suggestions for improvement.

Results: The sample (N=23) comprised men and women aged 18–75 years with moderate to severe, not well-controlled asthma and comorbid insomnia. Nineteen (83%) completed

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postintervention assessments. Improvements on the Insomnia Severity Index, Pittsburgh Sleep Quality Index, Asthma Control Test, and Asthma Quality of Life Questionnaire-Marks were observed at post-intervention. Data from the telephone interviews suggest that most participants had a positive experience with SHUTi. Participants suggested incorporating asthma-specific content into future versions of the intervention.

Conclusions: Internet-based CBT-I is a potential treatment option for adults with asthma and comorbid insomnia.

Keywords

comorbid insomnia; asthma; cognitive-behavioral therapy for insomnia

Sleep difficulties are frequent complaints of adults with asthma, with 22–47% reporting problems initiating and maintaining sleep, over 75% reporting poor sleep quality, and 9–11% reporting sleep medication use (Braido et al., 2009; Janson et al., 1996; Janson, Gislason, Boman, Hetta, & Roos, 1990; Kripke, Langer, & Kline, 2012; Luyster et al., 2012; Mastronarde et al., 2008; Sundbom et al., 2013). The prevalence of insomnia disorder in this population (37%) is approximately 3-times higher than rates reported in the general population (Luyster et al., 2016; Ohayon, 2002). Insomnia symptoms persist even among those without nighttime asthma symptoms (Braido et al., 2009; Luyster et al., 2012; Mastronarde et al., 2008; Sundbom et al., 2013), with as many as 25% having clinically significant insomnia (Luyster et al., 2016). These findings suggest that sleep difficulties are not simply a consequence of nighttime asthma symptoms, but, for some, insomnia may have become an independent disorder that increases the risk for poor outcomes. Adults with asthma and insomnia have worse asthma control, poorer disease-specific quality of life, and more frequent asthma-related health care utilization than those without insomnia (Luyster et al., 2016). Decreased lung function and increased inflammation associated with sleep loss and insomnia symptoms are possible physiological mechanisms linking insomnia and inadequate asthma control (Irwin, Olmstead, & Carroll, 2015; Krouse & Krouse, 2007). Insomnia treatment may improve asthma control by altering these physiological mechanisms (Chen et al., 2011; Irwin et al., 2014; Savard, Simard, Ivers, & Morin, 2005).

Cognitive-behavioral therapy for insomnia (CBT-I) is a nonpharmacological intervention that addresses maladaptive behaviors and dysfunctional thoughts that perpetuate sleep problems, using a combination of techniques including sleep restriction, stimulus control, and cognitive restructuring (Morin, 1993; Morin et al., 2006). Compared to hypnotics which have short-term efficacy and potential adverse respiratory side effects (Holbrook, Crowther, Lotter, Cheng, & King, 2000; Nakafero, Sanders, Nguyen Van Tam, & Myles, 2015; Nowell et al., 1997), CBT-I has demonstrated short-term and long-term efficacy and is often preferred by patients, thus making it an appealing insomnia treatment option for adults with asthma (Morin et al., 2006; Morin, Gaulier, Barry, & Kowatch, 1992; Morin et al., 2009; Vincent & Lionberg, 2001). Recent meta-analyses found CBT-I in comorbid medical and psychiatric disease populations resulted in moderate to large treatment effects for insomnia and sleep quality and small effects on comorbid outcomes (Geiger-Brown et al., 2015; Wu, Appleman, Salazar, & Ong, 2015). The efficacy of CBT-I has not been investigated specifically in adults with asthma.

Despite its efficacy and safety, use of CBT-I in clinical settings is limited by the number of specialty-trained providers and patient burden given the cost, time, and travel commitments required. The Internet is a viable option for the delivery of CBT-I and overcomes the limitations of face-to-face CBT-I. Internet-based CBT-I produces improvements in insomnia severity and sleep-related outcomes that are comparable to face-to-face CBT-I (Seyffert et al., 2016; Zachariae, Lyby, Ritterband, & O'Toole, 2016).

The purpose of this study was to assess the feasibility and acceptability of Sleep Healthy Using the Internet (SHUTi), an efficacious, individually-tailored, interactive Internet-based CBT-I intervention, among adults with asthma and comorbid insomnia, and to gather preliminary efficacy data on changes in sleep and asthma outcomes. We hypothesized that adults with asthma would demonstrate significant improvements in self-reported insomnia symptoms and sleep quality, as well as on asthma control and asthma-specific quality of life. We also collected qualitative data via telephone interviews to gather information about insomnia and asthma symptoms before and after the intervention and to explore perceptions of the Internet-based CBT-I intervention. These data provide a more personal perspective to the quantitative acceptability and efficacy data and will provide valuable suggestions for potential adaptations of the intervention content which will guide future intervention revision.

METHODS

Sample

Participants were recruited between February 2017 and May 2017 using the University of Pittsburgh Clinical and Translational Science Institute Research Participant Registry, called Pitt+Me (Figure 1). Registry participants who were eligible for the study received study alert emails and mailings. The study was also advertised on the Pitt+Me website and social media. Inclusion criteria were (a) adults 18–75 years of age, (b) have regular Internet access, (c) physician-diagnosed moderate to severe asthma, (d) insomnia disorder, defined by sleep difficulties (i.e., falling asleep, maintaining sleep, or early morning awakenings) for at least 3 nights per week for at least 6 months and daytime consequences of sleep difficulties (e.g., fatigue, mood disturbance, performance deficits) (American Academy of Sleep Medicine, 2014), (e) at least moderate insomnia severity as indicated by an Insomnia Severity Index (ISI) (Bastien, Vallières, & Morin, 2001) score ≥ 10 , and (f) not well-controlled asthma as indicated by an Asthma Control Test (ACT) (Nathan et al., 2004) score ≥ 19 . Exclusion criteria were self-report of (a) shift work schedule, (b) physician diagnosis of dementia, (c) history of bipolar or psychosis, and (d) alcohol (men: > 5 drinks per day on a weekly or almost daily or daily basis; women: > 4 drinks per day on a weekly or almost daily or daily basis) or drug abuse (prescription drug use for non-medical reasons or illegal drug use) within the past 3 months. The study was approved by the Human Research Protection Office at the University of Pittsburgh.

Procedures

Interested participants contacted the University of Pittsburgh Pitt+Me research participant registry screening office and their contact information was forwarded to the investigators.

Research staff conducted a telephone screening to determine eligibility. Verbal telephone informed consent was obtained and participants received an electronic copy of the consent information. Eligible participants completed a battery of online questionnaires. Upon completion of the questionnaires, participants were provided a unique username and password to access the Internet-based CBT-I intervention. Participants received access to the intervention for 9 weeks, and, after the intervention period, participants completed additional questionnaires online. After post-intervention data collection, participants completed a semi-structured telephone interview about their insomnia and asthma symptoms, experience with the Internet-based CBT-I intervention, and suggestions for content to add to the intervention.

Internet Intervention for Insomnia

SHUTi is an interactive and tailored web-based program based on well-validated face-to-face CBT-I. The intervention content is delivered via six cores, which incorporate the primary tenets of CBT-I, including sleep restriction, stimulus control, cognitive restructuring, sleep hygiene, and relapse prevention (Morin, 1993). Daily sleep diaries are used to track progress and to tailor treatment (e.g., assign a sleep restriction window). Access to cores are metered out over time, so that a new core becomes available one week after completion of the previous core. Each core takes between 45 and 60 minutes to complete and parallels traditional weekly face-to-face CBT-I sessions, following a similar structure: (1) presentation of core objectives, (2) review and feedback on previous week's homework and sleep diary data, (3) teaching of new intervention material, (4) assignment of homework, and (5) summary of the core's main points. Numerous interactive features including personalized goal-setting, graphics, vignettes, and animations are incorporated into each core to enhance intervention content. Automated emails are sent to inform users of the next steps and to encourage adherence. For a more detailed description of SHUTi, see Thorndike et al., 2008 (Thorndike et al., 2008).

Measures

Feasibility and acceptability.—Feasibility was reported as descriptive summaries of recruitment and retention data. Program usage was evaluated by number of SHUTi cores completed. Acceptability was assessed by questionnaire. Participants completed the Internet Intervention Utility Questionnaire (UQ) and the Internet Intervention Impact Questionnaire (IQ) (Thorndike et al., 2008). The UQ is a 15-item measure designed to assess usability, likeability, usefulness, understandability, and convenience of the Internet intervention. The IQ is a 14-item measure designed to assess participants' perceptions of the impact of the online intervention on targeted symptoms. A 5-point Likert scale (0–4, with 4 indicating most positive response) was used for both questionnaires. In a different Internet intervention study, these measures were found to have acceptable internal consistency reliability ($\alpha = 0.69$ for UQ and $\alpha = 0.64$ to 0.94 for subscales of IQ) (Ritterband et al., 2008).

Sleep outcomes.—At pre- and post-intervention, participants completed validated questionnaires to assess sleep as part of an online battery. Insomnia severity was measured using the Insomnia Severity Index (ISI), a 7-item questionnaire used to assess subjective severity of insomnia symptoms, degree of satisfaction with sleep, nature and noticeability of daytime impairments, and concerns caused by the sleep difficulties (Bastien et al., 2001). ISI

scores range from 0 to 28, with higher scores indicating greater insomnia severity. Categories of insomnia severity have been defined as 0–7 for no clinically significant insomnia, 8–14 subthreshold insomnia, 15–21 moderate clinically significant insomnia, and 22–28 severe clinically significant insomnia. The ISI is a well-established and reliable scale ($\alpha = 0.90$) that is sensitive to changes with treatment (Bastien et al., 2001). Overall sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI), an 18-item questionnaire that assesses seven components of sleep quality (i.e., subjective sleep quality, sleep latency, duration, efficiency, disturbances, use of sleep medication, and daytime dysfunction) (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). PSQI scores range from 0 to 21, with higher scores indicating worse sleep quality. The PSQI has acceptable internal consistency ($\alpha = 0.83$), and test-retest reliability ($r = 0.85$) (Buysse et al., 1989).

Asthma outcomes.—The asthma measures were also delivered online. Asthma control was measured using the Asthma Control Test (ACT), a 5-item questionnaire that assesses interference with activity, shortness of breath, nocturnal symptoms, rescue medication use, and self-rating of asthma control (Nathan et al., 2004; Schatz et al., 2006). Total scores range from 5 to 25, with higher scores indicating better asthma control. Recommended cut-offs on the ACT are 20 – 25 (well controlled asthma), 16 – 19 (not well-controlled asthma), and 0–15 (uncontrolled asthma). Asthma-related quality of life was measured by the Marks Asthma Quality of Life Questionnaire (AQLQ-Marks) (Marks, Dunn, & Woolcock, 1992). The AQLQ-Marks is a 20-item questionnaire assessing impact of asthma within four subscales: Physical Impact (includes breathlessness and physical restrictions), Emotional Impact, Social Impact, and Health Concerns. Each item is rated on a 5-point Likert scale ranging from 0 (not at all) to 4 (very severely). The subscale scores are calculated as the mean of the subscale items. Some items were used in the calculation of more than one subscale. The total score is calculated as the mean of the 20 items multiplied by 2.5 (range = 0–10), with higher scores indicating more negative impact of asthma on quality of life. The AQLQ-Marks has high internal consistency for the total score ($\alpha = 0.92$) and subscale scores ($\alpha = 0.82$ to 0.94) (Marks et al., 1992).

Telephone interviews

A semi-structured interview was conducted by a trained interviewer (not one of the study investigators) following collection of the post-intervention online questionnaires. Interviews were recorded. They lasted 15 to 20 minutes and focused on the following: insomnia and asthma symptoms before and after the Internet-based CBT-I intervention; experience of using the SHUTi program including likes and dislikes; and suggestions for improving the SHUTi program. The post-intervention interviews were transcribed, and the transcripts were imported into qualitative data analysis software (ATLAS.ti).

Statistical analyses

For quantitative data, descriptive statistics were computed for demographic characteristics and feasibility and acceptability outcomes (e.g., program usage, UQ, IQ). Wilcoxon signed-rank tests were used to compare pre- and post-intervention scores on the sleep and asthma questionnaires. Change scores (post-treatment-pre-treatment) were calculated for each person. Effect sizes were calculated (mean change score/mean change score standard

deviation (*SD*)) (Becker, 1988). All analyzes were performed using SPSS 24 for Windows (IBM Corp., Armonk, NY). For qualitative data, inductive content analysis was employed, in which categories were derived by coding text and then categories are grouped into higher-order categories (Elo & Kyngäs, 2008).

RESULTS

Feasibility and participant characteristics

Fifty-four participants were screened for eligibility, 23 were enrolled, and 19 completed post-intervention assessments (Figure 1). The four participants who dropped out or could not be contacted after baseline but before starting SHUTi were not included in analyses.

Completers (*n* = 19) and non-completers (*n* = 4) did not differ on demographic characteristics. Participants' mean age was 42.4 ± 11.6 years (range 21–63 years). The majority were female (63%). Most participants had some college education (47%) or had a college (13%) or graduate degree (22%). Participants were White (*n* = 11, 48%), African American (*n* = 8, 35%), American Indian (*n* = 1, 4%), Asian (*n* = 1, 4%), or other (*n* = 2, 9%). Mean duration of asthma was 17.4 ± 11.5 years. Almost all participants (*n* = 22, 96%) reported having insomnia symptoms for more than 12 months. One participant reported having insomnia symptoms for 6–12 months. Based on baseline data from the PSQI, 48% (*n* = 11) reported taking no sleep medications in the past month, 13% (*n* = 3) reported taking sleep medications less than once a week in the past month, and 39% (*n* = 9) reported taking sleep medications 3 or more times in the past month. Four (17%) participants reported having a physician diagnosis of sleep apnea, of which 2 reported being treated with positive airway pressure.

All but one participant (18/19) logged into the SHUTi program during the 9-week intervention period. Twelve of the 19 (63%) participants completed all of the 6 SHUTi cores. Of the intervention non-completers, 2 completed one core, 3 completed 2 cores, and 1 completed 4 cores.

Acceptability

The results from the UQ and IQ are presented in Figures 2 and 3. For both scales, > 50% of participants rated each item as “somewhat” to “very” useful/effective. The only exception was that > 50% of participants reported at least some privacy concerns, and < 50% reported reduced need for sleep medication.

Sleep outcomes

Intervention with SHUTi resulted in improvements in the ISI (pre-assessment = 19.1 ± 4.4 , post-assessment = 13.2 ± 5.3) and PSQI (pre- assessment = 13.6 ± 3.5 , post- assessment = 11.5 ± 3.6), with a large treatment effect for insomnia severity (−1.17) and a medium effect for sleep quality (−0.55) (Table 1). At baseline, 15/19 participants (79%) had clinically significant insomnia as defined by an ISI score of greater than 14 (Bastien et al., 2001). At post- assessment, 8/19 participants (42%) still had clinically significant insomnia (ISI > 14), 9/19 (47%) had subthreshold insomnia (ISI score 8 to 14), and 2/19 (11%) had no insomnia

(ISI < 8). Insomnia worsened from pre- to post-intervention in 1 SHUTi completer (n = 12) and 3 SHUTi noncompleters (n = 7).

Asthma outcomes

Intervention with SHUTi resulted in improvements in the ACT (pre- assessment = 13.8 ± 2.9 , post- assessment = 17.6 ± 3.7) and the AQLQ-Marks total score (pre- assessment = 4.3 ± 1.7 , post- assessment = 3.4 ± 2.3) at post-assessment (Table 1). Effect sizes were large for asthma control (0.81) and medium for asthma-related quality of life (−0.55). The subscales of the AQLQ-Marks showed small to moderate improvements. All 19 participants had not wellcontrolled (ACT score 16 to 19; n = 7, 37%) or uncontrolled asthma (ACT 15; n = 12, 63%) at baseline due to eligibility requirement. At post-assessment, 6 out of 19 (32%) had well controlled asthma (ACT score 20 to 25), 10 out of 19 (53%) had not well-controlled asthma, and only 3 out of 19 (16%) had uncontrolled asthma. Asthma control worsened from pre- to post-intervention only in 2 SHUTi completers.

Telephone interview responses (Table 2)

Pre-intervention insomnia and asthma symptoms.—Prior to starting the SHUTi, participants reported irregular bedtime and wake up times, taking an hour or more to fall asleep, waking up multiple times during the night and lying awake for long periods of time, waking up too early in the morning, having racing thoughts while in bed, taking sleep medications, and using alcohol to help sleep. During the day, most reported having low energy, feeling exhausted and irritable, having a hard time concentrating, and difficulties in their social and work relationships.

When asked to describe their asthma before starting SHUTi, participants reported wheezing, coughing, shortness of breath, and chest pain during the day that were associated with physical exertion or weather conditions and needing to take their rescue inhaler. Participants reported having to limit or avoid activities because of their asthma and waking up during the night with asthma symptoms and having to take their rescue inhaler. Some participants identified a connection between their sleep problems and their asthma symptoms.

Post-intervention insomnia and asthma symptoms.—Participants reported that after SHUTi they did not need to continue taking sleep medications, were not waking up as much during the night, were falling asleep faster and sleeping longer in the morning, getting better quality sleep, and were waking up feeling rested. Participants also noted being less irritable and more energetic after the intervention. Improvements in asthma symptoms during the day and night and less frequent need for their rescue inhaler following the intervention were also reported by participants. Some participants reported that their insomnia and asthma symptoms did not change.

SHUTi program experience.—Aspects of the SHUTi program that participants liked included easy to navigate, layout and online format, videos of fictional characters with insomnia, sleep restriction window, sleep diaries, information about behaviors that impact sleep, and helpfulness of the program. Dislikes about the SHUTi program included too long, difficult to navigate, videos were not relatable or uninteresting, and difficult to remember to

complete sleep diaries. Reasons provided for not completing the SHUTi program included being overwhelmed with life circumstances, forgetting to complete the sleep diaries, technical issues, and frustration about sleep restriction window being “unreasonable”.

Suggestions for improving the SHUTi program.—Participants had several suggestions for ways to improve the SHUTi program, including voice narration to go with the written text, more follow-through on the stories of the characters from the videos, and an app version of SHUTi that participants could use in the future should symptoms reoccur. Also, participants recommended written text in bulleted format as opposed to videos, whereas others preferred more videos and less text. Participants suggested adding information about asthma and ways to manage asthma, and the link between insomnia and asthma.

DISCUSSION

Online CBT-I is feasible and potentially efficacious for adults with asthma and comorbid insomnia. The Internet-based CBT-I intervention was well-received by participants. Significant improvements were found among the participants, both in sleep measures and in asthma outcomes. The telephone interviews provided a greater understanding of the participants’ experience with the SHUTi program including likes and dislikes and allowed us to obtain useful information about how to tailor the SHUTi program to the specific needs of individuals with asthma and comorbid insomnia. This study is the first to suggest that Internet-based CBT-I can improve sleep and asthma control in asthma populations, and supports further research aimed at optimizing the SHUTi program for individuals with asthma.

Our study showed similar SHUTi completion rates to other studies using SHUTi (Ritterband et al., 2012; Ritterband et al., 2017). In addition to feasibility, the findings from this pilot study provide preliminary support for the efficacy of Internet-based CBT-I in adults with asthma. Moderate to large effect sizes were observed for insomnia severity (ISI) and sleep quality (PSQI). These findings are consistent with previous randomized controlled trials in comorbid psychiatric and medical populations that have reported large treatment effects for CBT-I on insomnia symptoms and sleep disturbances (Geiger-Brown et al., 2015; Wu et al., 2015). Internet-based CBT-I, in particular SHUTi, has also been found to improve insomnia severity and sleep diary-based parameters in a small sample of cancer survivors (Ritterband et al., 2012). SHUTi also resulted in better asthma control, yielding a large treatment effect, and improvements in asthma-related quality of life (AQLQ-Marks) and its 4 domains. Our qualitative findings captured a more dynamic picture of the participants’ insomnia and asthma before and after the Internet-based CBT-I intervention. In a recent meta-analysis, CBT-I had small but positive effects on psychiatric and medical disorder outcomes, including condition-specific clinical indices (i.e., depression, pain) and general measures of mood, fatigue, and quality of life (Wu et al., 2015). Our results suggest that addressing insomnia in adults with asthma may likewise have beneficial effects on this comorbid disorder.

The quantitative evaluation of the SHUTi program (UQ and IQ) revealed that participants generally found the program easy to use, understandable, and effective. Qualitative data from the telephone interviews expanded upon these findings and highlighted features of the program that participants found particularly helpful and content that could be considered for inclusion in future versions of the Internet-based CBT-I intervention. In addition to voice narration and expansion of character stories, participants also suggested incorporating information about asthma and the potential interaction between asthma and sleep/insomnia into the intervention. Integrated management of medical conditions and comorbid insomnia has not been extensively investigated, and available studies are predominately pilot randomized controlled trials with small sample sizes (Arnedt, Conroy, Armitage, & Brower, 2011; Lami et al., 2017; Pigeon et al., 2012; Redeker et al., 2015; Tang, Goodchild, & Salkovskis, 2012; Vitiello et al., 2013). Studies that integrated CBT-I with approaches for managing pain, heart failure, and alcohol dependence found significant improvements in sleep outcomes, but varying results for condition-specific measures of pain, fatigue, and alcohol relapse (Arnedt et al., 2011; Lami et al., 2017; Pigeon et al., 2012; Redeker et al., 2015; Tang et al., 2012; Vitiello et al., 2013). Given that poor disease self-management can negatively affect sleep and sleep problems can exacerbate symptoms of the disease (Luyster et al., 2016; Luyster et al., 2012; Mastronarde et al., 2008; Sundbom et al., 2013), incorporating disease self-management into CBT-I could offer a more comprehensive approach to treating insomnia comorbid with medical conditions. Internet-based asthma self-management education programs that include components of asthma selfmanagement (e.g., education on the disease, medications, proper inhaler and device usage, and environmental triggers, self-monitoring, and use of a written asthma action plan) are available (Morrison et al., 2014), making incorporation of these pre-existing programs into an Internetbased CBT-I intervention potentially feasible.

Limitations

Although effects of the intervention on sleep and asthma outcomes were promising, the study did not include a control group or random assignment so pre- to post-intervention changes cannot be specifically attributed to the Internet-based CBT-I intervention. The sample size was small; replication in a larger sample is needed before efficacy of the Internet-based CBT-I intervention can be determined. Changes in asthma medications were not collected in our study, so we cannot exclude the possibility that such changes accounted for some of the observed treatment effects. Objective sleep assessments were not conducted in our study, thus future studies may want to evaluate the effect of Internet-based CBT-I on objective measures of sleep, such as actigraphy and polysomnography. We did not exclude participants with untreated sleep apnea. Future studies should consider untreated sleep apnea as an exclusionary criteria as it can worsen asthma control (Davies, Bishopp, Wharton, Turner, & Mansur, 2018). The study lacked follow-up data to determine if the treatment gains are maintained over time. A larger, randomized controlled trial with longer follow-ups is needed to confirm generalizability and efficacy.

Conclusions

Despite these noted limitations, the study findings offer novel information supporting the feasibility of CBT-I delivered over the Internet in adults with asthma. Preliminary efficacy data suggest Internet-based CBT-I provided some relief from insomnia, and was associated with better asthma control. Qualitative interviews revealed ideas for considering in future versions of SHUTi for this patient population, including education on asthma topics, such as its association with insomnia, self-monitoring, and medications. Future studies should consider an integrated treatment approach for adults with asthma and comorbid insomnia.

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Abbreviations

ACT	Asthma Control Test
AQLQ-Marks	Asthma Quality of Life Questionnaire-Marks
CBT-I	cognitive-behavioral therapy for insomnia
IQ	Internet Intervention Impact Questionnaire
ISI	Insomnia Severity Index
PSQI	Pittsburgh Sleep Quality Index
SD	standard deviation
SHUTi	Sleep Healthy Using the Internet
UQ	Internet Intervention Utility Questionnaire

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Figure 1.
Study Enrollment Flow

Figure 2.
Findings from the Internet Intervention Utility Questionnaire

Figure 3.
Findings from the Internet Intervention Impact Questionnaire

Table 1.

Wilcoxon Signed-rank Analysis with Effect Sizes of Sleep and Asthma Outcomes

	Pre-treatment (n=19) Mean (SD)	Post-treatment (n=19) Mean (SD)	Change from pre- to post-treatment (n = 19) Mean (95% CI)	ES
ISI (possible range 0–28)	19.1 (4.4)	13.2 (5.3)	-5.9 (-8.3 to -3.6)	-1.17 ^a
PSQI (possible range 0–21)	13.6 (3.5)	11.5 (3.6)	-2.1 (-3.9 to -0.3)	-0.55 ^a
ACT (possible range 5–25)	13.8 (2.9)	17.6 (3.7)	3.8 (1.6 to 6.0)	0.81 ^a
AQLQ-Marks				
Total score (possible range 0–10)	4.4 (1.7)	3.4 (2.3)	-1.0 (-1.9 to 0.0)	-0.55 ^b
Physical impact (possible range 0–4)	1.4 (0.8)	1.3 (1.0)	-0.1 (-0.6 to 0.4)	-0.47
Emotional impact (possible range 0–4)	2.5 (0.8)	1.8 (0.9)	-0.7 (-1.1 to -0.3)	-0.77 ^a
Social impact (possible range 0–4)	1.4 (1.0)	1.1 (1.1)	-0.3 (-0.8 to 0.2)	-0.24
Health concerns (possible range 0–4)	1.8 (0.9)	1.3 (1.0)	-0.5 (-0.8 to -0.1)	-0.56 ^a

Note: ACT = Asthma Control Test, AQLQ-Marks = Asthma Quality of Life Questionnaire (Marks version), CI = confidence interval, ES = mean change score/mean change score standard deviation (SD), ISI = Insomnia Severity Index, PSQI = Pittsburgh Sleep Quality Index. For the ISI, PSQI, and AQLQ-Marks, lower values are better (i.e., less symptoms, better sleep quality, better quality of life). For the ACT, higher values are better (i.e., better asthma control).

^a p < .05

^b p < .10

Table 2.

Selected quotes from study participants

<p>Pre-intervention insomnia and asthma symptoms</p> <p>"I would wake up in the middle of the night...first of all, I couldn't even go to sleep, and it would take me about two hours to get to sleep, sometimes three, and I'd fall asleep and I'd get up in the middle of the night. In the morning, I was cranky, very short with people. I just didn't want to do anything. I was too tired and miserable."</p> <p>"On a frequent basis, I was having sleep disturbances from my asthma. I would wake up in the middle of the night and would have coughing fits. So I would maybe wake up once or twice a night with asthma symptoms and have to take a rescue inhaler."</p> <p>"The less I sleep, the more my asthma seems to bother me."</p>
<p>Post-intervention insomnia and asthma symptoms</p> <p>"When I wake up, I feel like a brand new woman. I haven't sleep seven hours straight in who know when. I feel so refreshed."</p> <p>"I still wake up anywhere from two to four times a night."</p> <p>"I noticed that I had none of the asthma symptoms at night, and during the day, in general, the asthma was kept under control."</p> <p>"[My asthma] hasn't gotten any worse, but it definitely hasn't gotten any better since doing the program."</p>
<p>SHUTi program experience</p> <p>"The sleep diary is what I found most helpful, because I never actually paid attention to how I was sleeping, when I was waking up, and that forced me to be accountable and to pay attention to my sleep pattern, when I never did before."</p> <p>"It helped me understand that I had options and there were things that I could do differently to improve my insomnia, like if I couldn't sleep, getting up and out of my bedroom and then coming back when I was sleepy. As I began to see progress, it encouraged me to be more committed."</p> <p>"It was a bit too lengthy where it kinda took my interest away. So, I wasn't completing a lot of my daily diaries."</p>
<p>Suggestions for improving the SHUTi program.</p> <p>"If this whole thing was supposed to be something to help me with my asthma, I feel like there should have been a piece to that, too. Like, how are the two [asthma and insomnia] connected and then here are ways in conjunction with your sleep that you can help your asthma."</p>
<p>"It would have been helpful to have been able to enter information about my asthma symptoms in the sleep diary. This could have helped show a connection between my sleep and my asthma symptoms."</p>