Health Care Utilization of Insomnia Patients with Comorbid Depression and/or Anxiety

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Abstract

Chronic insomnia is associated with significant financial costs and is often comorbid with psychiatric disorders, particularly anxiety and depression. Cognitive-behavioral therapy of insomnia (CBTi) is an efficacious treatment, but its impact on healthcare utilization (HCU) is largely unknown. This study compared HCU pre- and post-CBTi of patients with chronic insomnia with and without comorbid depression and/or anxiety diagnosis. Greater pre-treatment HCU among patients with comorbid insomnia was expected. Following successful treatment, reductions in HCU for both groups were expected, with even greater reductions for those with chronic insomnia without anxiety and/or depression. A review of records was conducted for patients treated for insomnia (N =38; age M =52.1, SD = 18.86) at a behavioral sleep medicine clinic in an academic medical center from 2005-2010. Patients with chronic insomnia were characterized into four groups: 1) treatment responders without anxiety and/or depression, 2) treatment responders with anxiety and/or depression, 3) treatment non-responders without anxiety and/or depression, and 4) treatment non-responders with anxiety and/or depression. HCU was measured six months pre/post-treatment using a Chronic Disease Score (Clark et. al, 1995). There were no significant differences in HCU pre-CBTi. Differences in post-CBTi total (p = .08) and outpatient (p = .07) HCU and primary care visits (p = .07) HCU trended towards significance among treatment responders. No significant HCU differences were found in non-responders or between groups who responded positively to treatment. Results of this study imply that CBTi may help reduce healthcare service use.

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Economic Costs of Insomnia

Currently, over 60 million Americans suffer from insomnia (Chilcott & Shapiro, 1996) and depending on the definition of insomnia, 9% to 22% of the general population meets criteria for a chronic insomnia disorder (Ohayon, 1997, Roth et. al, 2011). According to Walsh and Engelhardt (1999), direct costs of insomnia were estimated to be approximately $13.9 billion in 1995; another study that measured both direct (e.g. cost of care) and indirect costs (e.g. workplace absenteeism, lost productivity) of insomnia estimated total costs of $92.5 billion to $107.5 billion (Stoller, 1994). Recent research indicates that direct costs of insomnia are estimated to be at $14 billion to $21 billion (Daley et. al, 2009). According to the literature, the direct and indirect costs of insomnia have increased significantly within the last 15 years (Daley et. al, 2009). On average, younger and older adults with untreated insomnia have an increased cost burden of $1,253 and $1,143, respectively, when compared to younger and older adults without insomnia (Ozminkowski, Wang & Walsh, 2007). Chronic insomnia has a substantial economic impact, and it is important to address the impact of insomnia on individual, provider, and systemic costs, as well as the potential to reduce costs through the treatment of insomnia.

Insomnia and Greater Health Care Utilization

Several studies have aimed to identify the relationship between people with poor sleep quality and greater health care utilization (HCU). Research indicates that people with insomnia have more emergency room visits, more calls to their physician, use more over-the-counter medications, and have an overall lower health-related quality of life compared to people without insomnia (Hatoum et. al, 1998). People who suffer from insomnia also engage in higher rates of

workplace absenteeism, have more difficulty concentrating at work, and report more medical problems than those who sleep well (Leger et. al, 2002).

Insomnia and Psychiatric Comorbidity

Chronic insomnia is often comorbid with other psychiatric disorders, and approximately 40-50% of people with insomnia have a psychiatric disorder (Ohayon et. al, 1997). The most common co-occurring psychiatric disorders with insomnia are anxiety and affective disorders (Roth & Roehrs, 2003). Recent research has shown that people suffering from clinical insomnia are 9.82 times and 17.35 times more likely to be clinically depressed and anxious than people without insomnia, respectively (Taylor, et. al, 2005). Additionally, people with insomnia tend to have more severe depressive symptoms and more severe anxiety than people not suffering from insomnia (Taylor et. al, 2005). The presence of insomnia with a comorbid major depressive disorder (MDD) diagnosis appears to result in higher direct and indirect costs compared to a MDD diagnosis without insomnia. One study that compared people with MDD and untreated insomnia to those with just MDD found that people with MDD had more total outpatient visits, MDD-related visits, were prescribed more antidepressant medications, and had higher direct healthcare costs than people with MDD alone (Asche et al., 2010). Although health care utilization costs appear to be higher in patients with comorbid insomnia and psychiatric disorders, the impact of insomnia treatment on these costs remains largely unknown. The present study aims to identify the potential economic benefits of treating insomnia in patients with comorbid depression and/or anxiety and insomnia.

Defining Insomnia

Although chronic insomnia is a common disorder in the United States, especially among people with depression and/or anxiety, there is often disagreement amongst researchers and

clinicians regarding an operational definition of insomnia. Determining insomnia is based on self-report measures and information gathered from clinical interviews. In previous research, the presence of insomnia has often been based upon measures of convenience, which do not include severity, duration, or frequency of sleep problems. The above-mentioned criteria are critical in matching definitions with the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed; text rev.; DSM-IV-TR; American Psychiatric Association, 2000), *International Classification of Sleep Disorders* (2nd ed.; ICSD; American Academy of Sleep Medicine, 2005) and quantitative and research diagnostic criteria (Edinger et al., 2004).

Furthermore, researchers frequently choose to omit or partially-omit the recency component in insomnia studies. This lack of a standard operational definition for chronic insomnia can have a substantial impact on healthcare utilization estimates; when the operational definition of insomnia is vague, it can considerably complicate the process of quantifying the economic impacts of insomnia. It is unlikely that a patient experiencing insomnia for the past two weeks will have a comparable HCU impact as compared to a patient with a lifetime history of insomnia. A person with chronic insomnia would be more likely to suffer from other medical and psychiatric conditions in conjunction with their insomnia as opposed to a person with transient insomnia that has only recently developed sleep difficulties. It would be expected that people suffering from chronic insomnia, and in turn comorbid medical conditions, would have considerably higher HCU costs than people with transient symptoms of insomnia. Marginalizing insomnia subtypes into an overarching general insomnia group—including transient insomnia with chronic insomnia—can also alter prevalence rates of comorbid disorders, such as psychiatric and affective disorders (Taylor et. al, 2005). Poor operational definitions for insomnia make it difficult to accurately identify chronic insomnia and therefore calculate the

direct and indirect costs, especially for individuals with a comorbid disorder. This study extends previous research by investigating a community sample with chronic insomnia, diagnosed by a licensed clinical psychologist using criteria consistent with the DSM-IV-TR (APA, 2000), ICSD (AASM, 2005) criteria, and established research diagnostic criteria (Edinger et al. 2004). It is innovative, because it measures HCU pre/post-CBTi and HCU change among patients with and without comorbid anxiety and/or depression.

CBT for Insomnia

Cognitive-behavioral therapy for insomnia (CBTi) is a non-pharmacological treatment that has been found to be effective in both patients with primary and comorbid insomnia (Stepanski & Rybarczyk, 2006). CBTi aims to implement behavioral practices to improve sleep behavior and challenge maladaptive thoughts about sleep and insomnia. Common treatment procedures that are often incorporated into CBTi include sleep hygiene, stimulus control therapy, sleep restriction therapy, relaxation training, and cognitive therapy that challenges faulty beliefs about insomnia and may include paradoxical intention used to reduce anxiety surrounding sleep loss (Morin et. al, 2006). Furthermore, past research such as McCrae et al.'s RESTORE study has demonstrated the effectiveness of a briefer CBTi protocol (4 sessions as opposed to the 8-10 sessions commonly used in efficacy trials) in a primary care setting (McCrae et. al, 2007). CBTi has been shown to be similarly effective in both patients with primary insomnia and patients with insomnia and a comorbid psychiatric disorder (Edinger et. al, 2009), with effect sizes ranging from .42-.94 for various sleep disorder variables (Morin et. al, 1999). In addition, CBTi has been shown to significantly reduce both depressive and insomnia-related symptoms in patients with an insomnia diagnosis comorbid with MDD (Manber et. al, 2008). In insomnia patients with

comorbid anxiety, CBTi is moderately effective for reducing anxiety levels (Belleville et. al, 2011).

Specific Aims

Although there has been much research on the economic impacts of insomnia and CBTi as an effective treatment for insomnia, little is known about CBTi's impact on HCU in insomnia patients. Even less is known about the relationship between CBTi and HCU in insomnia patients with a comorbid psychiatric disorder. This study aimed to calculate HCU costs in chronic insomnia patients with and without a comorbid anxiety and/or depression diagnosis six months pre and post CBTi treatment.

Hypotheses.

1) HCU pre-CBTi will be greater in chronic insomnia patients with anxiety and/or depression than in those without anxiety and/or depression.

2) There will be post-CBTi reductions in HCU costs among treatment responders, but no such reductions for treatment non-responders.

3) Post-CBTi, there will be within group reductions in HCU for both treatment responder groups, with greater reductions in HCU for patients without comorbid anxiety and/or depression.

Methods

Participants

Participants were patients treated at the Insomnia and Behavioral Sleep Medicine (IBSM), outpatient clinic at the University of Florida & Shands Sleep Disorders Center in Gainesville, FL. All participants were seen between 2005 and 2010 and were either referred by a physician or self-referred. Eighty-four patient charts were reviewed for eligibility for the current study. Forty-six individuals were excluded due to not having received a sufficient dose of Cognitive -

behavioral therapy for insomnia (CBTi), defined as attending at least three sessions of treatment. Of the remaining 38 individuals, all patients completed an initial therapy assessment in the IBSM clinic. Eight individuals did not have sufficient pre and post treatment medication data to perform all HCU analyses. All participants used in analyses (*N*=38) had a diagnosis of chronic insomnia consistent with DSM-IV-TR (APA, 2000; see below), ICSD (AASM, 2005), and established research diagnostic criteria (Edinger et al., 2009), and the majority (*N* = 29) had a comorbid psychiatric and/or medical disorder. For the purpose of this study, the only comorbid psychiatric disorders included were depressive and anxiety disorders (*N*=13).

Procedure

Following University of Florida IRB approval, a medical record review of patients seen in the IBSM Clinic from 2005-2010 was conducted. Patients were included in the study if they met criteria for insomnia and completed at least three sessions of CBTi. Patients referred to the IBSM Clinic were initially seen for an intake session that included a clinical interview and a battery of questionnaires (see Materials). If the patient was recommended for CBTi and chose to pursue treatment, they completed sleep diaries for 14-days prior to their first session of CBTi. Patients also completed daily sleep diaries throughout treatment, beginning the first night of treatment until their final appointment. Therapy consisted of multicomponent CBTi (sleep hygiene, stimulus control, sleep restriction, relaxation, and cognitive therapy). CBTi followed a treatment manual created by the director of the IBSM clinic (Christina S. McCrae, PhD, CBSM), and was conducted by clinical psychology graduate students and pre-doctoral interns enrolled in the University of Florida's APA-approved predoctoral training program in clinical and health psychology and pre-doctoral internship program, respectively. These therapists were supervised by a licensed clinical psychologist certified in behavioral sleep medicine (CSM).

Materials

Daily sleep diaries.

Patients completed a daily sleep diary for 14 consecutive days prior to starting treatment and throughout the length of their treatment. Participants completed a sleep diary (SD)[Lichstein, Riedel, & Means, 1999] each morning for 14 days prior to starting treatment and throughout the length of their treatment, providing subjective estimates of the following five sleep-wake parameters: (1) sleep onset latency (SOL)-time from initial lights-out until sleep onset; (2) wake time after sleep onset (WASO)-time spent awake after initial sleep onset until the last awakening; (3) time in bed (TIB)-total time spent in bed was determined by taking the difference between bedtime and arise time (when patient got out of bed for the last time); (4) total sleep time (TST)-computed by subtracting total wake time (SOL + WASO + time between last awakening and arise time) from TIB; (5) sleep efficiency percentage (SE)-ratio of TST to TIB × 100. Daily sleep diaries are a cost-effective method for monitoring sleep patterns (Chesson et al., 2000), and they are the 'gold standard' for measuring treatment outcomes in behavioral sleep trials. Furthermore, findings that positively correlate sleep diaries to polysomnography also appear to extend to people with insomnia comorbid with depression, with correlations of r=0.33 for TST to r=0.45 for SOL (McCall & McCall, 2011).

Beck Depression Inventory II (BDI-II).

The BDI-II is a 21-item questionnaire with responses scored on a scale from 0 to 3, with higher responses indicating more severe depressive symptoms. The form is scored by collectively summing the 21 questions; therefore, making the possible score range 0-63. Scores <10 indicate minimal depression while scores >18 indicate clinically significant depression (Beck, Steer, & Garbin, 1988). The Beck Depression Inventory II is shown to have a high

internal consistency and a high test-retest reliability of approximately $\alpha = 0.93$ after one week (Beck et. al, 1996).

State-Trait Anxiety Inventory, Trait scale (STAI).

The State-Trait Anxiety Inventory, Trait scale is comprised of 20 questions that measure tension, apprehension, and physiological signs of stress (Spielberger, Gorsuch, Lushene, & Jacobs, 1983). Questions are scored 1-4 (higher scores indicating more severe symptoms) and are summed for a total range of 20-80. The STAI has good internal consistency (α =0.72-0.96) and good test-retest reliability (α =0.82-0.94; Barnes, Harp, & Jung, 2002). For this study, scores $\geq$ 59 were considered clinically significant levels of anxiety.

Operational Definitions

Insomnia.

Criteria used for diagnosing chronic insomnia are consistent with the DSM-IV-TR (APA, 2000), ICSD (AASM, 2005), and established research diagnostic criteria (Edinger et al., 2009). The predominant symptom associated with chronic insomnia is difficulty initiating or maintaining sleep, or experiencing non-restorative sleep that causes clinically significant impairment or dysfunction. Patients had to report sleep onset or awake time >30 minutes and insomnia at least 3 nights per week for more than 6 months. All patients diagnosed with chronic insomnia were offered CBTi, regardless of the presence of a comorbid anxiety or depressive disorder.

Depression.

Patients were diagnosed with depression if 1) they had a previous diagnosis by a physician, 2) met DSM-IV-TR criteria (APA, 2000) for depression at intake, and/or 3) had clinically elevated scores on the BDI-II at intake (> 18). Per DSM-IV-TR criteria for Major

Depressive Disorder (MDD) (APA, 2000), patients must exhibit a depressed mood and/or loss of interest/pleasure for at least two weeks in addition to other symptoms such as significant changes in weight, sleep disturbances, psychomotor retardation or agitation, fatigue, feelings of worthlessness, difficulty concentrating, and suicidal thoughts. Patients are ruled out for a MDD diagnosis if they report symptoms consistent with bipolar disorder, or report symptoms that are associated with substance use or bereavement (APA, 2000).

Anxiety.

As with depression, patients were diagnosed with anxiety if 1) they had a previous diagnosis by a physician, 2) met DSM-IV-TR criteria for anxiety (APA, 2000) at the intake, and/or 3) had a clinically significant score on the STAI (≥ 59). The predominant criteria associated with anxiety disorders is the presence of excessive anxiety or worry for at least six months that is both difficult to control and is associated with other symptoms such as restlessness, fatigue, irritability, muscle tension, and sleep disturbances. Symptoms of anxiety must not be related to another psychiatric disorder or substance use, and must cause significant impairment or distress (APA, 2000).

Treatment responders vs. non-responders.

Treatment responders were those that experienced 1) a 50% reduction in symptoms (i.e., SOL and WASO) (Lichstein et. al, 2003), 2) had sleep efficiency > 85% during the last two weeks of treatment (Dolan et. al, 2010; McCrae et al., 2007), or 3) had SOL/WASO less than 31 minutes, ≥ 5 nights per week (McCrae et. al, 2007). Non-responders did not meet the above criteria.

Analyses

Calculating health care utilization.

Healthcare utilization (HCU) was calculated using direct health care costs and Chronic Disease Score (CDS), an estimate of HCU based on patient medications. Direct costs were measured by a patient's office visits to healthcare providers that were obtained through electronic medical records. Estimated HCU was measured during the 6 months prior to the intake appointment and 6 months post-treatment. CDS was derived using Clark et al.'s (1995) formula that takes into account a patient's age, gender, and medication history to predict three HCU variables —estimated total costs, estimated outpatient costs, and number of primary care visits. Bramoweth and Taylor (2012) previously used Clark's formula for analyzing CDS (Clark et. al, 1995) in an insomnia sample, and we also used it in the present study to total HCU, primary care HCU, and outpatient HCU. Each medication class, representing various chronic diseases, is weighted. The weights correspond to a cost (total and outpatient) and number of primary care visits. Medications are classified by American Hospital Formulary System (AHFS) category numbers. In addition to medications, gender and age (grouped by 10-year gaps) are weighted and are associated with the three CDS outcomes. The CDS equation is: CDS = intercept + gender + age group + medication 1 + medication 2 + medication 3 + . . . + medication n. CDS represents costs in US dollars over a six month period.

Statistical analyses.

Preliminary exploration of the data revealed that only one patient was identified as being a treatment non-responder with a comorbid psychiatric diagnosis. As is recommended for research with small patient samples (Blair & Higgins, 1985), non-parametric methods were used to analyze treatment outcomes. In this study, we utilized the related samples Wilcoxon signed-

rank test to analyze the total difference in HCU pre and post-CBTi. To analyze between-group differences, we used the non-parametric independent samples Mann-Whitney U Test (Auble, 1953). While there was a significant amount of missing data, 38 patients had sufficient data to measure pre- and post-treatment HCU and were included in the final analyses.

Results

Demographics

Among the 38 patients included in the study, 23 (60.5%) were female and 15 (39.5%) were male. Patient ages ranged from 18 to 79 (M =52.1, SD = 18.86). Regarding race, 35 (92.1%) identified as White, one (2.6%) as Black/African American, one (2.6%) as Native American/Native Alaskan, and one (2.6%) as Biracial. Additionally, five patients (13.2%) indicated they were of Hispanic background. The average number of patient medical conditions was 2.05 (SD =2.05).

Within the final patient sample, thirteen patients had a comorbid psychiatric disorder, of those 10 (26%) had a depressive disorder, four (10.5%) had an anxiety disorder, and one met criteria for both.

Treatment Response

Baseline sleep diaries indicated that there was a significant difference in SE ($p < .05$) and WASO ($p < .05$) among treatment responders and non-responders pre-CBTi. Pre-treatment, treatment responders reported lower SOL (M = 43.16, SD = 55.35), lower WASO (M = 34.17, SD = 48.71) and higher SE (M = 80.5, SD = 15.55) than non-responders who on average reported higher SOL (M = 50.52, SD = 35.89), higher WASO (M = 70.75, SD = 39.11), and lower SE (M = 64.07, SD = 14.12) values.

At the end of treatment, 30 (79%) patients were identified as treatment responders while 8 (21%) patients did not meet criteria for treatment response. Table 1 indicates treatment response for the 38 patients used in the final HCU cost analyses and their accompanying mental health status. Based on the previously described treatment response criteria, there were significantly more individuals who were classified as treatment responders than as non-responders as indicated by a chi-squared test ($X^2 = 12.74$, $p < .001$).

Estimated HCU Costs Pre-Treatment

Prior to treatment, there were no significant differences in HCU or the number of medical conditions among patients with and without anxiety and/or depression. However, there was a significant difference in age between the two groups. Patients without anxiety and/or depression were significantly older (*M* = 56.4 years old, *SD* =18.19) than patients with anxiety and/or depression (*M* = 43.7 years old, *SD* =16.5). The effects of age were controlled for in all analyses using the saved unstandardized residuals from regressions with age predicting HCU; however, they did not alter the pattern of results.

Estimated HCU Costs Post-Treatment

Treatment responders exhibited trends towards decreased estimated HCU at post-treatment—total costs (-$89.33, *SD* = $246.86; *p* = .08), outpatient costs (-$51.33, *SD* = $132.36; *p* = .07), and number of primary care visits (-.23, *SD* = .61; *p* = .07). Additional tests revealed that there were no significant HCU reductions for treatment non-responders at post-treatment.

Within group Wilcoxon analyses were separately run among treatment responders with no comorbid psychiatric disorder and among those with a comorbid psychiatric disorder to estimate change in HCU from pre-treatment to post-treatment. When these groups were analyzed separately, there was no significant within group changes. Furthermore, there were no significant

between group differences on any of the HCU variables when comparing changes in treatment responders with and without a comorbid psychiatric disorder at post-treatment. Table 2 depicts the average estimated HCU for total costs, outpatient costs, and number of primary care visits for the six months pre- and post-CBTi by group.

Discussion

The aim of this study was to examine the impact of treatment response and presence of comorbid anxiety and/or depression on HCU in patients with chronic insomnia who received CBTi in an outpatient setting. Although this study did not demonstrate that insomnia patients without comorbid anxiety and/or depression had lower HCU costs following CBTi as hypothesized, the results are still of particular interest, because they suggest CBTi may contribute to reduced healthcare utilization and costs. Specifically, there was a trend for decreased estimated total healthcare costs, outpatient healthcare costs, and number of primary care visits for patients successfully treated with CBTi (regardless of the presence or absence of comorbid psychiatric diagnosis).

While our hypothesis that patients with chronic insomnia and comorbid depression and/or anxiety would have greater HCU prior to starting treatment was not supported, the significant difference in age among patients with chronic insomnia with and without a comorbid psychiatric disorder may help explain the results. It is likely that among middle aged and older adults, severity of comorbid medical disorders contributed to higher HCU than among younger adults. The patients in this study with chronic insomnia and comorbid depression and/or anxiety were significantly younger, on average, than patients without a comorbid psychiatric disorder. While the two groups reported similar number of medical disorders, the type and/or severity of the comorbid medical disorder may have significantly impacted HCU in the non-psychiatric group.

Psychiatric disorders may have significantly impacted the younger adults more than comorbid medical disorders. Among older individuals presenting for treatment of insomnia, medical conditions likely played a larger etiological role in their presentation for the treatment of insomnia, as has been previously documented in the literature concerning comorbid insomnia in older adults (Lichstein et. al, 2000). It may be that these individuals presented with an increased severity of medical disorders and subsequently more medications; thus, impacting their overall HCU. As a result, the impact of the number of medical disorders and the severity of disorders should be accounted for in future research.

Despite the lack of significant difference in HCU costs among chronic insomnia patients with and without comorbid anxiety and/or depression pre-CBTi, treatment responders and non-responders differed significantly in SE and WASO pre-treatment. On average, treatment responders had higher SE and lower WASO than non-responders, in addition to lower SOL (although not statistically significant). Although this difference was not controlled for in analyses, it is nevertheless an important finding that adds to the growing interest in predicting treatment response. If we are able to identify variables on which treatment responders and non-responders consistently differ, it may aid in predicting treatment response among patients in future studies. Additionally, identifying treatment responder predictor variables may help explain why patients often choose not to complete therapy, and ultimately may help increase retention rates. More importantly, however, significant pre-treatment differences among treatment responders and non-responders could have a substantial impact on HCU. For example, we would expect people with greater sleep disturbances and less efficient sleep to generally use more healthcare services. If these people choose not to engage in treatment or end treatment early, however, not only can we not accurately assess HCU associated with chronic insomnia, but we would also expect

greater HCU long-term over those who responded positively to CBTi treatment. In essence, not receiving adequate treatment for chronic insomnia could translate to a greater usage of healthcare services. More research is needed to determine the healthcare cost impact of more severe chronic insomnia symptoms and how to more effectively retain these individuals throughout treatment.

Results of this study indicate that a majority of patients who came to the clinic responded positively to treatment. These findings confirm previous studies indicating the effectiveness of a briefer CBTi protocol used in primary care settings (McCrae et. al, 2007). Consistent with the second hypothesis that there would be post-CBTi HCU cost reductions for treatment responders but not for non-responders, both chronic insomnia groups exhibit reductions (trends) in HCU if they responded positively to treatment. Additionally, a trend towards reduced estimated total costs, outpatient costs, and number of primary care visits among treatment responders illustrates that CBTi may have a positive impact on HCU. These findings underline the clinical importance and potential economic benefits of treating insomnia not only in chronic insomnia patients, but also in patients with comorbid psychiatric and/or medical conditions. It also highlights that insomnia patients with comorbid anxiety and/or depression respond well to CBTi. For many years, comorbid insomnia was viewed as a condition primarily driven by the co-occurring condition; as a result, treatments were generally focused on the comorbid condition while neglecting the insomnia (McCrae & Lichstein, 2001). A large and growing body of research now indicates that comorbid insomnia can be successfully treated when targeted directly and without targeting the other condition. The current study extends that research by demonstrating that in addition to sleep improvements, cost savings are possible through the successful treatment of insomnia, even when the insomnia is comorbid with other conditions. Furthermore, it has also been noted that improvements in psychological symptoms are possible following the successful

treatment of comorbid insomnia (Manber et al, 2008; Taylor et al., 2007; Morawetz, 2003). Future research should evaluate the relationship between changes in psychological symptoms and healthcare utilization, as these two domains may be interrelated among individuals with comorbid insomnia. To better estimate healthcare savings associated with treating insomnia, future research should involve larger sample sizes that are representative of a primary care population.

Although significant within group reductions in HCU for both treatment responder groups, with greater reductions in HCU for patients without comorbid anxiety and/or depression were expected post-CBTi, no significant differences were found. This lack of statistical significance may be attributed to small group sizes, and in effect a reduction of power, that occurred when treatment response was analyzed by psychiatric diagnosis. Furthermore, fairly large standard deviations indicate that HCU costs varied greatly among the patient sample.

There were several limitations associated with this research study. It is important to note that this study did not use data from a randomized control trial examining the efficacy of CBTi. Instead, this study used a clinical patient sample and data were extracted from a record review. Because data came from patient medical records, inconsistencies and missing data were an issue. For example, only 38 out of the original 84 patients treated at the IBSM clinic had sufficient pre and post-CBTi medication data to successfully analyze changes in healthcare use. Furthermore, this sample was comprised of primarily middle-aged and older adults, many with several comorbid medical conditions such as hypertension, cardiovascular disease, diabetes, etc. The presence and frequency of comorbid medical conditions may have been an important confounding variable in accurately estimating HCU costs; however, in the real world these factors are unavoidable. Thus, this may represent a methodological limitation on one hand, but it

may increase ecological validity on the other, as the patient sample is representative of the types of insomnia patients seen in primary care settings (patients with multiple medical and/or psychiatric comorbidities). It is possible that younger populations with better health may see greater HCU reductions post-treatment. Conversely, younger persons in better health may already have lower HCU costs in the first place, thus justifying the importance of using CBTi and examining healthcare costs in samples such as the one used in this study, despite the methodological challenges they pose. Another limitation was that HCU was estimated using patient medications extracted from the medical records during the six-month pre- and post-treatment periods. Although measuring HCU based on medications is validated method for estimating HCU (Clark et. al, 1995), it is unlikely that all medical conditions and associated costs of a patient can be accurately accounted for by looking at their medications. The HCU reported in this study is likely an underestimate of true HCU. Finally, the time interval used to estimate reduction in HCU post-treatment may not have been a sufficient amount of time to see the full economic benefits of CBTi. It is possible that significant reductions in HCU post-CBTi are not seen until beyond the six-month time period utilized in this study. For example, those with medical and/or psychiatric comorbidities might be motivated by their success with CBTi to pursue treatment of their other medical conditions. Therefore, healthcare savings may not be observed until after the measured six months post-CBTi. Future research should aim to estimate HCU reductions after longer time intervals to see if there are greater reductions in HCU post-CBTi.

In summary, while there were no significant pre-treatment differences in HCU between chronic insomnia patients with and without comorbid anxiety and/or depression, there was a significant difference in age between the two groups in addition to significant pre-treatment

differences in SE and WASO among treatment responders and non-responders. A majority of patients responded positively to treatment, and results demonstrated that HCU cost reductions were trending towards significance among treatment responders post-CBTi. However, no significant differences were seen post-CBTi among treatment non-responders, nor between chronic insomnia patients with and without comorbid anxiety and/or depression who responded to treatment. Findings of this study indicate that CBTi may be effective in reducing healthcare costs in patients with chronic insomnia and comorbid anxiety and/or depression. Future research should aim to explore the potential economic benefits of using CBTi to treat chronic insomnia patients with other comorbid medical and psychiatric disorders, using larger and more varied patient samples. Finally, future research should also aim to identify variables that could potentially predict treatment response and ultimately increase retention rates among chronic insomnia patients engaging in CBTi.

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Table 1

CBTi Treatment Response Among Chronic Insomnia Outpatients with and without Comorbid Anxiety and/or Depression

	Treatment Responders	Treatment Non-Responders
Depression and/or Anxiety Diagnosis	12	1
No Depression and/or Anxiety Diagnosis	18	7

Note: Treatment responders experienced 1) a 50% reduction in symptoms (i.e., SOL and WASO) (Lichstein et. al, 2003), 2) had sleep efficiency > 85% during the last two weeks of treatment (Dolan et. al, 2010), or 3) had SOL/WASO less than 31 minutes, ≥ 5 nights per week (McCrae et. al, 2007). Non-responders did not meet any of the above criteria. Insomnia, anxiety, and depression diagnoses were based on the *Diagnostic and Statistical Manual of Mental Disorders* (4^{th} ed.; text rev.; DSM-IV-TR) criteria (APA, 2000). Cognitive-behavioral therapy for insomnia (CBTi) included sleep hygiene, stimulus control, sleep restriction, relaxation, and cognitive therapy.

Table 2

Average Estimated Outpatient HCU Costs Pre and Post-CBTi Treatment

		Non-Responders Without Depression/Anxiety	Non-Responders With Depression/Anxiety	Responders Without Depression/Anxiety	Responders With Depression/Anxiety
Total HCU	Pre	$ 618.28 ($512.83)	$0	$ 769.27 ($430.88)	$ 290.74 ($201.67)
	Post	$ 662.34 ($560.60)	$0	$ 614.62 ($539.84)	$290.24 ($201.56)
Outpatient HCU	Pre	$ 314.88 ($164.37)	$0	$ 382.25 ($123.57)	$ 218.51 ($146.17)
	Post	$ 311.82 ($183.59)	$0	$299.80 ($206.25)	$ 218.26 ($146.18)
Primary Care HCU	Pre	1.60 (1.27)	0	1.84 (0.98)	1.31 (1.09)
	Post	1.68 (1.40)	0	1.48 (1.34)	1.06 (.72)

Note: Total HCU and Outpatient HCU are measured in US dollars while Primary Care HCU is measured in the number of patient visits. *Note:* Treatment responders experienced 1) a 50% reduction in symptoms (i.e., SOL and WASO) (Lichstein et. al, 2003), 2) had sleep efficiency > 85% during the last two weeks of treatment (Dolan et. al, 2010), or 3) had SOL/WASO less than 31 minutes, ≥ 5 nights per week (McCrae et. al, 2007). Non-responders did not meet any of the above criteria. Insomnia, anxiety, and depression diagnoses were based on the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; text rev.; DSM-IV-TR) criteria (APA,

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