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Original Article

Predictors of improvement in subjective sleep quality reported by older adults following group-based cognitive behavior therapy for sleep maintenance and early morning awakening insomnia

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Abstract

Objective: Cognitive behavior therapy is an effective nonpharmacologic treatment for insomnia. However, individualized administration is costly and often results in substantial variability in treatment response across individual patients, particularly so for older adults. Group-based administration has demonstrated impressive potential for a brief and

inexpensive answer to the effective treatment of insomnia in the older population. It is important to identify potential predictors of response to such a treatment format to guide clinicians when selecting the most suitable treatment for their patients. The aim of our study was to identify factors that predict subjective sleep quality of older adults following group-based administration of cognitive behavior therapy for insomnia (CBT-I).

Methods: Eighty-six adults (41 men; mean age, 64.10 y; standard deviation [SD], 6.80) with sleep maintenance or early morning awakening insomnia were selected from a community-based sample to participate in a 4-week group-based treatment program of CBT-I.

Participants were required to complete 7-day sleep diaries and a comprehensive battery of questionnaires related to sleep quality and daytime functioning. Hierarchical multiple regression analyses were used to identify factors predicting subjective sleep quality immediately following treatment and at 3-month follow-up. Sleep diaries reported average nightly sleep efficiency (SE), which was used as the outcome measure of sleep quality.

Results and Conclusions: Participants with the greatest SE following treatment while controlling for pretreatment SE were relatively younger and had more confidence in their ability to sleep at pretreatment. These characteristics may be useful to guide clinicians when considering the use of a group-based CBT-I for sleep maintenance or early morning awakening insomnia in older adults.

1. Introduction

Chronic insomnia is a highly prevalent and persistent health concern, of which research has consistently demonstrated to increase with age [1-4]. In recent years, surveys have indicated that approximately 20% to 40% of adults older than 55 years of age reported waking a lot during the night, waking too early and not being able to get back to sleep, and

waking feeling unrefreshed [5,6]. Chronic insomnia not only significantly impacts the psychologic and physiologic well-being of the individual [1,7,8] but also places large economic costs and burden on society [9,10]. Therefore, it is not surprising that considerable attention has been given to optimizing treatment options in efficacy for the individual and also cost-effectiveness for the healthcare system [11,12].

The current treatment of choice for insomnia is cognitive behavior therapy for insomnia (CBT-I), which consistently produces significant improvements in most sleep variables including wake after sleep onset (WASO) and sleep efficiency (SE) [13-15] for 70% to 80% of patients [16,17]. Although significant, the changes in sleep variables are modest particularly for older adults [11-13]. Furthermore, individual administration of CBT-I is costly, not readily available, and can markedly vary in efficacy between individuals [12]. Alternatively, group-based administration has demonstrated impressive potential for a brief and inexpensive answer to the effective treatment of insomnia in the older population [18,19].

Several research groups have focused on identifying potential factors, which may predict treatment outcome in a bid to guide clinicians when selecting the most suitable treatment for their patient [20,21]. Characteristics such as the age of the patient [22-24] and the severity [11,25,26] and duration [25] of their insomnia have been recognized as predictors of treatment outcome. However, the majority of these studies have focused on predictors of treatment outcome in younger patients following individualized administration of CBT-I.

Few studies have focused on identifying potential predictors of sleep quality following group-based administration of CBT-I in the older population. Gagné and Morin [12] examined potential predictors of treatment outcome in 18 older adults (mean age, 64.6 y) following 8 weekly, 90-minute, group-administered sessions of CBT-I. Treatment outcome was defined as the mean (standard error of the mean) reported by participants on their sleep diaries during the final 2 weeks of the treatment program. Results indicated that younger age,

greater presence of medical illness, and more frequent use of sleeping medication predicted the greatest improvement in subjective estimates of SE following treatment. Gagné and Morin [12] acknowledged that better treatment outcomes associated with greater presence of medical illness and more frequent use of sleeping medications are counter intuitive. They concluded that the small sample size of their study warrants further research to establish these variables as predictors of treatment efficacy. Additionally, treatment outcome as assessed during the final 2 weeks of the treatment program may have reflected responses during the treatment itself rather than provide an accurate indication of longer-term posttreatment responses to CBT-I.

In a separate study, Espie et al [11] investigated predictors of treatment outcome in a somewhat younger group of 109 adults (mean age, 52.1 y) for 12 months following a group-administered CBT-I treatment program. Participants attended 6 weekly sessions, each lasting for 50 minutes. Espie et al [11] defined a clinically significant treatment outcome as (1) a 50% reduction in subjective sleep-onset latency (SOL) or WASO relative to pretreatment levels or (2) a reduction in SOL or WASO to 30-minutes or less. Reductions in SOL and WASO to this criterion level were associated with less severe insomnia at baseline, greater symptoms of depression and anxiety, and more dysfunctional worries about sleep.

Together the aforementioned studies have begun to address the question of the types of factors, which may be predictive of the effectiveness of small group-based CBT-I for older adults. The aim of our study was to contribute to this effort. The treatment program utilized in our study was shorter than the majority of those assessed in previous studies, consisting of only 4 weekly sessions, each lasting approximately 60 minutes in duration, which is the minimum number of sessions possible to include the most efficacious elements of a CBT-I program. Edinger et al [19] have previously demonstrated that 4 biweekly treatment sessions produced a favorable long-term outcome. The current program was administered to

small groups of 4 to 6 individuals. Our study assessed potential predictors of subjective sleep quality both immediately following treatment and at 3-month follow-up to predict the maintenance of improvements in sleep quality.

Both age and a variety of other factors related to insomnia severity and duration were assessed as potential predictors of treatment efficacy. Past research has indicated that older participants had a poorer treatment response relative to younger participants [22,25], though insomnia severity and duration have not yet been consistently related to treatment outcome [21,23,25,26,41]. Dysfunctional beliefs and attitudes regarding sleep, sleep-related anxiety, and fatigue also were assessed as potential predictors of treatment response. Studies conducted by Espie et al [11] and Morin et al [16] suggested that treatment response was not influenced by fatigue or sleep-related anxiety; however, more dysfunctional beliefs and attitudes about sleep have been associated with greater improvements in sleep quality [11]. Chronotype and sleep self-efficacy were included as potential predictors, which have not been previously published to the authors' knowledge. Sleep self-efficacy has been suggested to be predictive of adherence to CBT-I [38,39], while low sleep self-efficacy is associated with the experience of multiple symptoms of insomnia rather than a single symptom [40].

2. Methods

2.1. Participants

Our sample included 86 participants (41 men; mean age, 64.10 y [standard deviation [SD, {6.80}]; range, 49–85 y) with chronic sleep maintenance problems or early morning awakening difficulties selected from a community-based sample. Participants were assessed for eligibility using a semistructured telephone interview, 7-day sleep diaries, several questionnaires, and a home-based polysomnography. Participants were included in our study

if they (1) experienced WASO of greater than 30 minutes for at least 3 nights per week for a reported duration of at least 6-months, or (2) if they experienced impaired daytime functioning such as daytime fatigue, irritability, memory difficulties, or difficulty maintaining attention. All participants reported no use of sedative or hypnotic medication for at least one month prior to their involvement in the study. Participants with clear clinical symptoms of other sleep disorders or severe medical or psychiatric disorders were excluded. Participants were excluded if they (1) indicated the presence of sleep apnea (apnea hypopnea index >15) [35], (2) indicated the presence of major depression, (3) consumed excessive amounts of caffeine (>300 mg/d) or alcohol (>2 standard drinks/d), or (4) they scored ≥ 10 on the Geriatric Depression Scale or had a full-scale Wechsler Abbreviated Score of Intelligence quotient below 70. The study was approved by the Social and Behavioural Ethics Committee of Flinders University.

2.2. Screening measures

Potential participants were screened for sleep maintenance and early morning awakening insomnia using the Pittsburgh Sleep Quality Index [1] in addition to a brief semistructured telephone interview about typical sleep timing, daytime functioning, medication use, and diagnoses of any sleep disorders. Participants were screened for sleep-disordered breathing and periodic limb movements using an overnight home-based polysomnography recording (Compumedics enhanced Somte portable recorders, Melbourne, Victoria). The Geriatric Depression Scale short-form [33] was used to screen for depression, while two subscales of the Wechsler Abbreviated Scale of Intelligence [34] were used to screen for mild cognitive impairment.

2.3. Treatment

Participants attended 4 weekly 60-minute sessions of CBT-I, which were conducted in small groups of 4 to 5 individuals. The treatment was a structured multicomponent intervention, including bedtime restriction (based on sleep restriction but with modifications suggested by Morin [1]), cognitive therapy, and an educational component. Bedtime restriction involved restricting the amount of time the participant spent in bed (TIB), which should have been as close as possible to their estimated total sleep time (TST) as calculated from their sleep diary. At each therapy session, participants' sleep diaries were reviewed, and in cases in which SE ($TST/TIB \times 100$) was greater than 90%, TIB was increased by 30 minutes for the following week. In cases in which SE was $<90\%$, participants were instructed to maintain their current TIB. The cognitive component involved the identification of dysfunctional cognitions related to sleep, challenging the validity of these cognitions and providing more adaptive and rational substitute cognitions [1]. The education component focused on providing participants with basic information about sleep, such as the nature and function of sleep, circadian rhythms, sleep needs, and the effects that some sleep disorders (i.e., insomnia) can have on the sleep pattern [1]. Sleep hygiene practices also were discussed with particular reference to the effect of common substances (i.e., caffeine, alcohol, nicotine), diet, exercise, and bedroom environment on sleep.

Five trainee psychologists (4 women, 1 man) with experience in CBT-I administered the therapy sessions. Participants received the same therapist for each therapy session. Each therapist was provided with a treatment manual to ensure that participants in each group received identical information regardless of the therapist. A one-way analysis of variance revealed that the credibility and participant satisfaction with treatment, assessed using the Treatment Credibility and Satisfaction Scale [36], did not differ across therapists ($P < .28$).

For all therapists, a clinical psychologist specialized and highly experienced in the treatment of insomnia (Dr. Wright) was consulted weekly to discuss clinical issues, to ensure proper provision of treatment, and to maintain fidelity of treatment. Two assessors independently reviewed video recordings of a subset of 8 randomly chosen therapy sessions to assess treatment fidelity. The assessors concluded that the 8 therapy sessions did not differ from the treatment manual provided to therapists and that the therapists did not provide any additional therapeutic recommendations to participants.

Participants' TIB was used as an indicator of treatment compliance. Compliance was assessed by examining nightly TIB, as reported on sleep diaries. At each weekly therapy session, participants' sleep diary reports of nightly TIB were compared to those prescribed per the bedtime restriction procedure. A 1-way analysis of variance revealed that TIB, as reported on sleep diaries, did not significantly differ from allocated TIB ($P > .05$).

2.4. Measures

2.4.1. Outcome measure

Participants were required to complete a sleep diary for 7 days prior to the treatment sessions. Participants were asked to provide subjective estimates of their SOL, number and duration of awakenings, TST across the night, and the amount of TIB. From these estimates, the primary outcome measure (SE) was calculated. The SE was calculated as TST divided by total time spent in bed, multiplied by 100 (e.g., 6 h of sleep/8 h TIB *100=75%). As recommended by Gagné and Morin [12], sleep diary-reported average nightly SE was used as an outcome measure of sleep quality, as it provided the best composite index of insomnia severity, it was a reliable measure of improvement in sleep, and it was a continuous variable it provides greater power to identify relationships between predictors and sleep quality.

2.4.2. Predictor measures

Several variables were examined as potential predictors of subjective SE in the week following the last treatment session and at 3-month follow-up. These variables were selected based on the findings of previous studies [11,12,20,23,25] and included age, duration of insomnia, insomnia severity (as measured by the Insomnia Severity Index¹), fatigue (as measured by the Flinders Fatigue Scale [27]), and overall subjective sleep quality (as measured by Pittsburgh Sleep Quality Index [28]). Other variables examined included dysfunctional beliefs and attitudes about sleep (DBAS) (as measured the DBAS-16 [29]), chronotype (as measured by the Morningness-Eveningness questionnaire [30]), anxiety related to sleep (as measured by the Sleep Anticipatory Anxiety Questionnaire [31]), and sleep self-efficacy (Sleep Self-Efficacy Scale [32]). All measures were completed by participants prior to treatment. The demographic and clinical features of the sample are shown in Table 1.

< Insert Table 1 about here >

3. Results

3.1. Response to treatment

SE increased 17% on the average from pretreatment ($M = 66.06$, $SD = 12.91$) to posttreatment ($M = 82.81$, $SD = 10.51$; $P < .001$) and was maintained at 3-month follow up ($M = 78.76$, $SD = 11.99$; $P < .001$). Table 2 below shows the distribution of sleep efficiencies across participants prior to treatment, immediately following treatment, and at 3-month follow up. The proportion of individuals with sleep efficiencies of 85% or above, indicative

of good sleep, increased from 1% at pretreatment to over 50% following treatment. Three-months following treatment, 32% of participants maintained sleep efficiencies within the ‘good sleeper’ range.

< Insert Table 2 about here >

3.2. *Correlations among predictor variables*

Correlation analyses were conducted to determine associations among the predictor variables. The significant correlations between the predictor variables are shown in Table 3 below. Dysfunctional beliefs and attitudes about sleep, fatigue, insomnia severity, overall self-reported sleep quality, and sleep anticipatory anxiety were all positively intercorrelated ($r_s=0.27-0.55$; $P<.05$). Sleep self-efficacy was negatively correlated with fatigue, insomnia severity, overall self-reported sleep quality, sleep anticipatory anxiety, and dysfunctional beliefs and attitudes about sleep ($r_s=-0.38$ to -0.51 ; $P<.05$). Sleep self-efficacy was also positively correlated with being more of a morning chronotype ($r=.28$; $P<.05$). Age and duration of insomnia were not significantly correlated with any other predictor variable.

< Insert Table 3 about here >

3.3. *Predictors of improvement in SE*

Hierarchical multiple regression analyses were used to identify factors predicting subjective SE immediately following treatment and at 3-month follow-up. Because there are no consistent results from previous research to guide model building, individual regression equations were conducted for each potential predictor variable [12]. In each case, subjective SE at either posttreatment or 3-month follow-up was entered as the outcome measure. For the

first regression equation (coefficients indicated by *B*), pretreatment SE was entered as a covariate to control for initial SE. For the second regression equation (coefficients indicated by *B2*), all other predictor variables in addition to pretreatment SE were entered as covariates.

Table 4 presents the simple correlations and standardized regression coefficients from hierarchical regression analyses. A significant correlation (*r*) indicates a significant relationship between the predictor variable and SE at either posttreatment or 3-month follow-up. Improvement of SE following treatment was confirmed by a significant *B* value (*B*), indicating that the predictor variable of interest explains significant unique variance above and beyond that explained by pretreatment SE. Likewise, a significant *B2* value indicates that the predictor variable of interest explains significant unique variance above and beyond that explained by both pretreatment SE and all other predictor variables (*B2*).

< Insert Table 4 about here >

Age, insomnia severity, self-reported sleep disturbance, and sleep self-efficacy were significantly related to SE at posttreatment and 3-month follow-up. However, to assess their relation to the improvements from pretreatment, the relationship only shows age as a predictor of improvement when pretreatment is controlled in the *B* column at posttreatment times and sleep self-efficacy as a significant predictor of improvement at 3-month follow-up.

When all other potential predictors are controlled (column *B2*), age remains a significant predictor of posttreatment improvement at both time points. Sleep self-efficacy remains a significant unique predictor of improvement at 3-month follow-up. Therefore, younger age and higher sleep self-efficacy at pretreatment were significant independent predictors of improvement in SE following treatment.

4. Discussion

Our study assessed potential predictors of improved sleep quality of older adults with sleep maintenance or early morning awakening insomnia following a brief group-administered CBT-I treatment program. Our hope is that the results from our study will provide clinicians with a useful guide when considering the use of a brief and inexpensive group-based CBT-I treatment program for older patients. Sleep diary–reported average nightly SE was used as the outcome measure of sleep quality. Participants who experienced the greatest improvement in SE both immediately following CBT-I and at 3-month follow-up were younger. Our study also assessed sleep self-efficacy as a predictor of treatment response, which to our knowledge is unique to our study. Those participants who reported the greatest sleep self-efficacy before treatment also reported the greatest improvement in SE at 3-month follow-up. Given that sleep self-efficacy is a predictor of improvement in SE following treatment, adapting the content of CBT-I to include some motivational enhancement techniques [36,37] may be beneficial in maximizing a favorable response to treatment.

The predictors of treatment outcome identified in our study are similar to some but not all of those reported in previous research following group-administered CBT-I in older adults [11,12]. Gagné and Morin [12] reported that the younger participants of their older sample experienced the greatest improvement of SE following treatment, as in our study.

However, Espie et al [11] found that participants who experienced the greatest improvements in sleep quality were those who reported less severe insomnia at pretreatment. We did not find insomnia severity or Pittsburgh Sleep Quality Index to be related to improvement with treatment. This discrepancy may be explained by the difference in defining the severity of insomnia used by Espie et al [11] in contrast to that used in our study. Unlike our study, which defined insomnia severity as the Pittsburgh Sleep Quality Index

score, Espie et al [11] defined insomnia severity by summing nightly mean SOL and WASO at baseline.

Duration of insomnia, feelings of fatigue, sleep-related anxiety, dysfunctional beliefs and attitudes about sleep, and chronotype were not predictive of treatment outcome in our study. With the exception of chronotype, each of these variables has previously been investigated as a potential predictor of treatment outcome in older adults. Espie et al [11] and Gagné and Morin [12] also found no predictive value in duration of insomnia, feelings of fatigue, and sleep-related anxiety. In contrast to our results, previous research by Espie et al [11] demonstrated that more dysfunctional worries about sleep were associated with greater improvements in sleep quality following CBT-I.

It is important to recognize the high level of intercorrelation between pretreatment variables in these types of studies when interpreting such results [12]. For example, it is possible that the relationship between dysfunctional beliefs and attitudes about sleep and treatment outcome is mediated by other variables such as insomnia duration or severity.

Although these types of analyses can be useful to guide clinicians in selecting the most suitable treatment for their patient, findings of this type should be interpreted with caution. The predictive factors assessed in our study explained approximately 4% to 12% of the variance (indicated by the r value) associated with improved SE. Therefore, these results provide modest predictive models of treatment outcome. There are a multitude of potential factors beyond the pretreatment characteristics included in our analyses that are likely to influence response to treatment, such as support from family, motivation, and readiness for change.

The characteristics of the sample utilized in our study also have implications for the interpretation of these analyses. Our study and the study conducted by Gagné and Morin [12] solicited individuals from the community for a clinical research trial. Therefore, it is possible

that predictors of treatment outcome could be different in patients who individually seek treatment in medical settings compared to those who respond to public notifications or advertisements of a clinical research trial. Similarly, our sample comprised primary insomniacs with no medical or psychiatric comorbidities. Predictors of treatment outcome for these participants may not be generalized to older adults in the broader community with insomnia. Future research would benefit not only from assessing predictors of treatment outcome in clinical samples but also including measures beyond pretreatment characteristics, such as motivation for change and compliance to treatment.

Overall, the results of our study suggest that relatively younger insomniacs in the older age category and with higher sleep self-efficacy can benefit from brief, small, group-administered CBT-I treatment programs.

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References

[1] Morin, C. *Insomnia: psychological assessment and management*. New York: The

Guilford Press, 1993.

[2] Paine SJ, Gander PH, Harris H, Reid P. Who reports insomnia? relationships with age, sex, ethnicity, and socio-economic deprivation. *Sleep* 2004;27:6:1163-9.

[3] Ohayon M. Prevalence of DSM-IV diagnostic criteria of insomnia: distinguishing insomnia related to mental disorders from sleep disorders. *J Psychiatr Res* 1997;31:3:333-46.

[4] Sivertsen B, Krokstad S, Øverland S, Mykletun A. The epidemiology of insomnia: associations with physical and mental health. the HUNT-2 study. *J Psychosom Res* 2009;67:109-16.

[5] Ancoli-Israel S, Cooke J R. Prevalence and comorbidity of insomnia and effect on functioning in elderly populations. *J Am Geriatr Soc* 2005;53(7 suppl): S264-2.

[6] National Sleep Foundation. (2003). 2003 Sleep in America Poll.
[http://www/sleepfoundation.org](http://www.sleepfoundation.org).

[7] Blackwell T, Yaffe K, Ancoli-Israel S, Schneider J L, Cauley JA, Hiller T A, et al. Poor sleep is associated with impaired cognitive function in older women: the study of osteoporotic fractures. *J Gerontol A Biol Sci Med Sci* 2006;4:405-10.

[8] Roth T, Ancoli-Israel S. Daytime consequences and correlates of insomnia in the united states: results of the 1991 national sleep foundation survey. II. *Sleep* 1999;2:354-8.

[9] Hillman D, Murphy A, Antic R, Pezzullo L. The economic cost of sleep disorders. *Sleep* 2006;29:299-305.

[10] Ozminkowski RJ, Wang SY, Walsh JK. The direct and indirect costs of untreated insomnia in adults in the United States. *Sleep* 2007;30:263-73.

[11] Espie CA, Inglis SJ, Harvey L. Predicting clinically significant response to cognitive behavior therapy for chronic insomnia in general medical practice: analysis of outcome data at 12 months posttreatment. *J Consult Clin Psychol* 2001;69:58-66.

- [12] Gagné A, Morin CM. Predicting treatment response in older adults with insomnia. *J Clin Geropsychol* 2001;7:131-43.
- [13] Germain A, Moul DE, Franzen PL, Miewald JM, Reynolds CF 3rd, Monk TH, et al. Effects of a brief behavioral treatment for late-life insomnia: preliminary findings. *J Clin Sleep Med* 2006;2:403-6.
- [14] Irwin M, Cole J, Nicassio P. Comparative meta-analysis of behavioural interventions for insomnia and their efficacy in middle-aged adults and in older adults 55+ years of age. *Health Psychol* 2006;25:3-14.
- [15] Rybarczyk B, Lopez M, Benson R, Alsten C, Stepanski E. Efficacy of two behavioural treatment programs for comorbid geriatric insomnia. *Health Psychol* 2002;17:288-98.
- [16] Morin C, Culbert JP, Schwartz SM. Nonpharmacological interventions for insomnia: a meta-analysis of treatment efficacy. *Am J Psychiatry* 1994;151:8:1172-80.
- [17] Murtagh D, Greenwood K. Identifying effective psychological treatments for insomnia: a meta-analysis. *J Consult Clin Psychol* 1995;63:79-89.
- [18] Backhaus J, Hohagen F, Voderholzer U, Riemann D. Long-term effectiveness of a short-term cognitive-behavioral group treatment for primary insomnia. *Eur Arch Psychiatry Clin Neurosci* 2001;251:1:35-41.
- [19] Edinger JD, Wohlgemuth WK, Radtke RA, Marsh GR. Dose response effects of behavioural insomnia therapy: final report. Paper presented at the Associated Professional Sleep Societies, Philadelphia, PA, 2004.
- [20] Bliwise DL, Friedman L, Nekich JC, Yesavage JA. Prediction of outcome in behaviorally based insomnia treatments. *J Behav Ther Exp Psychiatry* 1995;26:17-23.
- [21] Edinger JD, Stout AL, Hoelscher TJ. Cluster analysis of insomniacs' MMPI profiles: relation of subtypes to sleep history and treatment outcome. *Psychosom Med* 1988;50: 77-87.

- [22] Alperson J, Biglan A. Self-administered treatment of sleep onset insomnia had the importance of age. *Behav Ther* 1980;10:347-56.
- [23] Chambers M, Alexander S. Assessment and prediction of outcome for a brief behavioural insomnia treatment program. *J Behav Ther Exp Psychiatry* 1992;23:289-97.
- [24] Lick JR, Heffler D. Relaxation training and attention placebo in the treatment of severe insomnia. *J Consult Clin Psychol* 1977;45: 153-61.
- [25] Lacks P, Powlishta K. Improvements following behavioral treatment for insomnia: Clinical significant, long-term maintenance and predictors of outcome. *Behav Ther* 1989;20:117-134.
- [26] Shealy RC, Lowe JD, Ritzler BA. Sleep onset insomnia: personality characteristics and treatment outcome. *J Consult Clin Psychol* 1980;48: 659-61.
- [27] Gradisar M, Lack L, Richards H, Harris J, Gallasch J, Boundy M, et al. The Flinders Fatigue Scale: preliminary psychometric properties and clinical sensitivity of a new scale for measuring daytime fatigue associated with insomnia. *J Clin Sleep Med* 2007;3: 722-728.
- [28] Buysse D, Reynolds C, Monk T, Berman S, Kupfer D. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res* 1989;28: 193-213.
- [29] Morin C, Vallieres A, Ivers H. Dysfunctional beliefs and attitudes about sleep (DBAS): validation of a brief version (DBAS-16). *Sleep* 2007;30: 1547-54.
- [30] Horne JA, Östberg OA. Self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. *Int J Chronobiol* 1976;4:97-110.
- [31] Bootzin R, Shoham V, Kuo T. Sleep Anticipatory Anxiety Questionnaire: a measure of anxiety about sleep. *Sleep Res* 1994;23:88.
- [32] Lacks P. *Behavioral treatment for persistent insomnia*. New York: Pergamon Press; 1987.

- [33] Yesavage J, Brink T. Development and validation of a geriatric depression screening scale: a preliminary report. *J Psychiatr Res* 1983;17:37-49.
- [34] Psychological Corporation. Wechsler Abbreviated Scale of Intelligence (WASI) manual. San Antonio: TX: Author; 1999.
- [35] American Academy of Sleep Medicine. Sleep-related breathing disorders in adults: recommendations for syndrome definition and measurement techniques in clinical research. *Sleep* 1999;22:667-89.
- [36] Aloia MS, Arnedt JT, Stepnosky C, Hecht J, Borrelli B. Predicting treatment adherence in obstructive sleep apnea using principles of behavior change. *J Clin Sleep Med* 2005;1:346-53.
- [37] Richards D, Bartlett DJ, Wong K, Malouff J, Grunstein RR. Increased adherence to CPAP with a group cognitive behavioral treatment intervention: a randomized trial. *Sleep* 2007;30:635-40.
- [38] Bouchard S, Bastien C, Morin CM. Self-efficacy and adherence to cognitive-behavioral treatment of insomnia. *Behav Sleep Med* 2003;1:187-99.
- [39] Harris J, Lack L, Wright H, Gradisar M, Brooks A. Intensive sleep retraining treatment for chronic primary insomnia: a preliminary investigation. *J Sleep Res* 2007;16:276-84.
- [40] Suh A, Ong JC, Steidtmann D, Nowakowski S, Dowdle C, Willett E, et al. Cognitions and insomnia subgroups. *Cognitive Ther Res* 2012;36:120-8.
- [41] Lacks P, Bertelson AD, Gans L, Kunkel J. The effectiveness of three behavioral treatment for different degrees of sleep onset insomnia. *Behav Ther* 1983;14:593-605.

Table 1

Mean (and standard deviation) and number of subjects (and proportion) for demographic and clinical features of our sample.

Age	64.10 (6.80)
Gender (man)	41 (47.7%)
Duration of insomnia (>5 y)	66 (76.7%)
Insomnia Severity Index	16.34 (3.83)
Wake after sleep onset (min)	133 (70.2)
Flinders Fatigue Scale	14.40 (5.88)
Pittsburgh Sleep Quality Index	11.87 (2.70)
Dysfunctional Beliefs and Attitudes about Sleep	43.71 (14.25)
Morningness-Eveningness Questionnaire	64.82 (7.90)
Sleep Anticipatory Anxiety Questionnaire	11.64 (4.68)
Sleep Self-Efficacy Scale	23.40 (6.26)

Abbreviations: y, years; min, minutes.

Table 2

Proportion of individuals within each sleep efficiency category at pretreatment, posttreatment, and 3-month follow-up.

	Pretreatment (n)	Posttreatment (n)	3-month follow-up (n)
Sleep efficiency (%)			
85–100	1	53	32
75–84	26	24	34
65–74	28	11	22
55–64	23	5	5
0–54	22	3	6

Table 3

Correlation matrix of predictor variables.

Predictor variables	Flinders Fatigue Scale	Insomnia Severity Index	Pittsburgh Sleep Quality Index	Sleep Anticipatory Anxiety Scale	Sleep Self-Efficacy
DBAS	.49**	.52**	.33**	.32**	-.38**
Flinders Fatigue Scale		.47**			-.36**
Insomnia Severity Index					-.47**
Morningness-Eveningness					.28*
Pittsburgh Sleep Quality Index	.42**	.55**		.27*	-.51**
Sleep Anticipatory Anxiety	.32**	.34**			-.48**

Abbreviation: DBAS, dysfunctional beliefs and attitudes about sleep.

**Correlation is significant at the .01 level (2-tailed)

*Correlation is significant at the .05 level (2-tailed)

Table 4

Predictors of sleep efficiency at post-treatment and 3-month follow-up.

	Sleep efficiency					
	Posttreatment			3-month follow-up		
	r^a	B ^b	B2 ^c	r^a	B ^b	B2 ^c
Age	-.21 ^d	-.18 ^d	-.21 ^d	-.26 ^d	-.22 ^d	-.19 ^e
Duration of insomnia	-.07	-.06	-.08	-.04	-.03	-.07
DBAS	-.11	-.10	-.09	-.12	-.12	-.02
Flinders Fatigue Scale	.03	.01	.03	.01	-.02	.06
Insomnia Severity Index	-.20 ^d	-.09	-.11	-.26 ^d	-.12	-.06
Morningness-Eveningness	-.03	-.11	-.10	.02	-.07	-.16
Pittsburgh Sleep Quality Index	-.22 ^d	-.07	-.11	-.32 ^d	-.15	-.09
Sleep Anticipatory Anxiety	.04	.08	.07	-.01	.04	.16
Sleep Self-Efficacy	.07	-.03	-.10	.34 ^d	.23 ^d	.29 ^d

Abbreviation: DBAS, dysfunctional beliefs and attitudes about sleep.

^a indicates a significant relationship between the predictor variable and sleep efficiency at either posttreatment or 3-month follow-up.

^b indicates only age as a predictor of improvement at both posttreatment times and Sleep Self-Efficacy a significant predictor at 3-month follow-up.

^c indicates the predictor variable of interest explains significant

unique variance above and beyond that explained by both pretreatment sleep efficiency and all other predictor variables.

^d indicates $P < .05$.

^e indicates $P = .06$ at the 1-tailed level.