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Examining maladaptive beliefs about sleep across insomnia patient groups

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Abstract

Objectives: Unhelpful beliefs about sleep have been linked to insomnia, and increasing one's cognitive flexibility about sleep has been linked to posttreatment sleep improvement. This study evaluated whether levels of such beliefs differ across insomnia groups and whether there are particular beliefs that differ for specific insomnia subtypes. **Methods:** Participants (N=1384) were people with insomnia and good sleepers ranging from 18 to 89 years old (mean=42.6; S.D.=19.4). Data from previous studies at five insomnia clinical sites were pooled to examine responses on the Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS) across differing insomnia groups. **Results:** Group analyses revealed that those from community-based insomnia clinics and those who are hypnotic-dependent generally had the highest levels of unhelpful sleep-related beliefs. With the exception of beliefs about sleep needs (wherein only community sleep clinic patients had high scores relative to good sleepers), all insomnia groups had higher scores on the 16-item DBAS (DBAS-16) than good sleepers. A validity analysis suggested that a DBAS-16 index score of >3.8 represented the level of unhelpful beliefs associated with clinically significant insomnia, although a slightly lower cutoff may be useful for identifying an unhelpful degree of sleep-related beliefs in highly screened primary-insomnia-only and medical patient groups. **Conclusions:** This study offers descriptive data for the use of DBAS-16 across insomnia subgroups, which will help the user understand what degree of maladaptive sleep beliefs is most strongly associated with clinically significant levels of insomnia. Results also may have implications for cognitive targeting during treatment for particular insomnia groups.

Keywords: Beliefs about sleep; Cognitive–behavioral therapy; Insomnia; Sensitivity and specificity

Introduction

Having rigidly held beliefs or unrealistic expectations about sleep is thought to be important in the maintenance of some insomnias [1–5]. Several studies have established a greater propensity to have an unhelpful degree of sleep-incongruent beliefs in those with poor sleep relative to those with good sleep [1–3,5]. For example, a belief that 8 h of sleep is needed to function can increase anxiety when the desired sleep amount is not met and can lead to increased attention to daytime deficits to confirm the belief that a certain amount of sleep is needed. In an attempt to compensate for real or perceived sleep loss, patients can engage in sleep-interfering behaviors such as spending an excessive amount of time in bed. Given the presumed mechanistic role in the maintenance of insomnia, these sleep-

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related beliefs are targeted for modification in cognitive–behavioral therapy (CBT) for insomnia. Clinical trials of CBT with primary insomnia patients have demonstrated that elevated maladaptive beliefs about sleep decline with treatment and are related to other indices of clinical improvement [2,3,6]. Given the role of these beliefs in the protraction of insomnias, clinicians regularly assess for unhelpful sleep-related cognitions as part of their remedial efforts with these patients.

The tool most widely used for assessing the purported maladaptive beliefs in insomnia is the Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS). The newest version of DBAS (DBAS-16) [7] consists of 16 statements relating to maladaptive sleep-related beliefs such as "One poor night's sleep will ruin the rest of the week." DBAS-16 has a 10-point Likert scale ranging from 0 to 10. For each of the 16 beliefs, the number corresponding to the degree of belief (i.e., 10=*agree completely*) is circled. The DBAS-16 index score is a mean item score (i.e., item scores are summed and divided by 16). The authors of DBAS-16 propose a four-factor structure with subscales that assess: (a) sleep-related worry and helplessness; (b) beliefs about sleep medications; (c) expectations about sleep need; and (d) beliefs about the consequences/effects of insomnia. Scores for the subscales are calculated by summing the item responses and dividing by the number of items in the scale. The shorter length reduces administration time and appears to maintain the psychometrics of the original 30-item version of DBAS (DBAS-30). Furthermore, several of the DBAS-16 items have demonstrated clinical utility in that they discriminate good sleepers from those with insomnia, decline with beliefs-targeted treatment (i.e., CBT for insomnia), and/or relate to several other indices of clinical improvement [1]. Although there is preliminary support for this version of the instrument [7], evaluating the instrument in a large sample of heterogeneous insomnia subtypes would help us to further understand this measure's properties. Moreover, it would be helpful to evaluate this instrument across a range of insomnia types (e.g., those with medical and psychiatric comorbidities, those with hypnotic dependence, and those presenting at a community insomnia clinic) that may complete the measure.

Providing descriptive statistics across varied types of insomnia patients, as well as determining a cutoff score most associated with clinically relevant levels of maladaptive sleep beliefs, would increase the usefulness of DBAS-16. Supportive of the validity of this measure are two previous studies conducted with the 30-item version of DBAS. The first of these [8] showed a moderately high correlation between DBAS-30 and both the Pittsburgh Sleep Quality Index [9] and the Sleep Impairment Index [5]. The second study [10] examined the ability of the DBAS-30 total score to detect the presence of insomnia and compared it with three other sleep-related measures. The study employed a relatively small sample (N=38) of young, mainly female, university students. Receiver operating characteristic (ROC) curve analyses suggested a cutoff score of 34.9 (3.5 for a 10-point Likert format), yielding high accuracy [area under the curve (AUC)=0.92; P<.001] and good sensitivity (89%) and specificity (78%). Unfortunately, research of this nature has yet to be conducted with DBAS-16, so similar studies are needed to describe the properties of this scale across a variety of insomnia sufferers. The stability of the results will be enhanced if such studies include samples with a wider age range, better representation of males, and inclusion of treatment-seeking people with insomnia.

Recognizing the importance of assessing beliefs across insomnia subtypes, we initiated this investigation to examine DBAS-16's properties among various insomnia sufferers. In the first set of analyses, we examined its internal consistency (i.e., Cronbach's α) and interitem reliability (i.e., mean interitem correlations) of the full scale and its subscales across insomnia groups. Our main aim was to explore whether patient groups differed on specific beliefs about sleep, so we conducted a multivariate analysis of covariance (MANCOVA) of DBAS and its subscales. Lastly, an ROC curve analysis was employed to determine the level of beliefs associated with clinically significant levels of insomnia (i.e., those with an insomnia diagnosis).

Methods

Participants

These analyses used data previously collected from five major centers for insomnia treatment (Duke University Insomnia and Sleep Research Program, Laval University Sleep Disorders Center, Rush University Medical Center, Stanford University Medical Center Sleep Clinic, and Flinders University in Australia). The samples were divided into the following groups: Good Sleepers (GS), Primary Insomnia Only (PI), Insomnia with Comorbid Medical Conditions (MED), Hypnosis-Dependent Insomnia (HYP), and Outpatients Presenting at Community Sleep Clinics (CSC). Data were collected from all sites with Institutional Review Board approval, and informed consent was obtained from all participants. Table 1 contains a summary of the assessment and recruitment characteristics for each site, and Table 2 contains the demographic data for each group.

GS group

There were a total of 104 good sleeper participants from Durham VA and Duke University Medical Centers and 231 good sleeper participants from Flinders University. The GS group from Durham VA and Duke University Medical Centers was selected from a study that was originally designed to compare home and laboratory sleep indices in insomnia sufferers. They were screened for the presence of insomnia, psychiatric disorders, or medical disorders with associated sleep disruption using the Structured Interview for Sleep Disorders (SIS-D) [11], the Structured Clinical

Table 1
Site-specific summary of sample recruitment and assessment

Group/site	Source of diagnosis	Sleep interview	Medical evaluation	Psychological evaluation	Research- respondent	Clinic-referred	Treatment-seeking	Exclusionary conditions
Good sleepers								
Durham VA and Duke University Medical Centers	Self-identified	Clinical interview; SIS-D	Yes	SCID	Yes	No	No	Self-reported insomnia or any other sleep disorder; AHI≥15; terminal or sleep-interfering medical conditions; past or current Axis I disorder; current psychotropic medication
Flinders University	Self-identified plus sleep diary SOL and WASO <30 min	Clinical interview	No	No	Yes	No	No	Self-reported insomnia or other sleep disorders; medical conditions interfering with sleep
Primary insomnia								
Durham VA and Duke University Medical Centers	Sleep specialist	Clinical interview; SIS-D	Yes	SCID	Yes	Yes	Some	Terminal or sleep-interfering medical conditions; past or current Axis I disorder; current psychotropic medication; hypnosis-dependent; self-reported history of sleep disorder other than insomnia; AHI≥15; PLMI≥15
Flinders University	Sleep specialist	Clinical interview	No	Self-report (CES-D and STAI)	Yes	No	Yes	Current psychopathology; self-reported history of sleep disorder other than insomnia
Hypnosis-dependent								
Laval University	Sleep specialist	Clinical interview	Yes	SCID	Yes	Yes	Yes	Insomnia was directly related to a medical or psychiatric disorder; presence of severe psychopathology (e.g., unipolar or bipolar disorder, psychosis); use of psychotropic drugs other than benzodiazepines for sleep; AHI>15; PLMI>15
Medical insomnia								
Rush Medical Center	Self-identified plus at least six episodes of SOL>30, WASO>60, or total sleep time <6.5 h on a 2-week diary	Clinical interview	Yes	Self-report Brief Symptom Inventory and Geriatric Depression Scale	Yes	No	No	Self-reported history of sleep disorder other than insomnia; AHI>15; PLMI>30; clinically elevated Brief Symptom Inventory scores; GDS>15; taking greater than a standard dose of a hypnotic
Community sleep clinic								
Stanford Insomnia Clinic	Sleep specialist	Clinical interview	Some	Yes	No	Yes	Yes	Any active untreated severe medical or psychiatric pathology
Repatriation General Hospital	Sleep specialist	Clinical interview	Some	CES-D, STAI	No	Yes	Yes	Any active untreated severe medical or psychiatric pathology

AHI=apnea hypopnea index; PLMI=periodic limb movement index; CES-D=Center for Epidemiologic Studies Depression Scale; STAI=State–Trait Anxiety Scale.

Table 2
Demographic information for each of the groups (*N*=1384)

Variable	GS group (*n*=335)	PI group (*n*=329)	MED group (*n*=114)	HYP group (*n*=76)	CSC group (*n*=530)
% Female within the group	60	55	70	50	63
Age in years (range)	20–79	18–79	55–89	55–82	18–83
Age in years [mean (S.D.)]	30.2 (15.9)	47.0 (16.0)	68.8 (8.4)	62.5 (6.3)	44.02 (16.2)
Self-reported sleep [a]					
Total sleep time [mean (S.D.)]	462.2 (69.1)	363.6 (63.7)	345.6 (70.8)	358.5 (74.4)	347.7 (89.9)
SOL [mean (S.D.)]	19.0 (13.95)	37.9 (34.4)	41.5 (39.9)	34.9 (26.4)	48.8 (32.5)
WASO [mean (S.D.)]	14.4 (20.2)	73.8 (50.3)	55.3 (39.5)	51.1 (39.2)	96.0 (61.7)
SE (%) [mean (S.D.)]	93.2 (5.15)	76.2 (10.9)	72.0 (12.9)	71.4 (13.8)	68.8 (17.3)

SE=sleep efficiency (time in bed/time spent asleep×100).

[a] Good sleeper self-reported sleep estimates for the Durham VA and Duke University Medical Centers site only (*n*=104) were the mean values of prospective 2-week sleep logs. Self-reported sleep estimates for the Flinders University clinic (*n*=231) were retrospective mean sleep estimates. Self-reported sleep values for the PI, MED, and HYP groups were mean values of prospective 2-week sleep logs. CSC group self-reported sleep estimates include data for the Stanford University site only (*n*=360), as data for the Flinders University clinic were unavailable.

Interview for DSM-III R (SCID) [12], and medical evaluation. These data have been published in both peer-reviewed manuscripts [13,14] and abstract format [15]. The GS subgroup participants from Flinders University were undergraduate students (18 years or older), each of whom self-identified as a "good sleeper." In addition to self-identifying as a good sleeper, they also had to have a mean estimated sleep diary sleep onset latency (SOL) and wakefulness after sleep onset (WASO) of less than 30 min.

PI group

The PI group (*n*=329) is composed of respondents to advertisements for insomnia research or clinic-referred patients at Durham VA and Duke University Medical Centers (*n*=243) [13,16,17] or Flinders University (*n*=86) [18]. All participants underwent screening procedures to establish a diagnosis of primary insomnia and to rule out other causes of insomnia such as psychiatric disorders, sleep-disruptive medical conditions, or other primary sleep disorders. As the nature of these screening procedures and the inclusion/exclusion criteria used in selecting each of these samples have been reported elsewhere [13,16–18], they will not be reiterated here.

HYP group

The participants for the HYP group (*n*=76) were research participants at the Laval University Sleep Clinic. These participants have been described elsewhere [19]. Briefly, they were treatment-seeking older adult (55 years or older) outpatients with prolonged use of benzodiazepine medication for sleep on more than half the nights for at least 3 months and with a subjective complaint of difficulty initiating and/or maintaining sleep for at least three nights per week for at least 6 months, accompanied by marked distress over subjective daytime impairment.

MED group

The participants for the MED group (*n*=114) were part of a clinical trial of CBT for insomnia in those with comorbid medical conditions (e.g., coronary artery disease, chronic obstructive pulmonary disease, or osteoarthritis) at Rush Medical Center (see Rybarczyk et al. [20] and Table 1 for details of inclusion/exclusion criteria).

CSC group

Participants for the CSC sample (*n*=530) were treatment-seeking community-based sleep clinic patients at either Stanford University Medical Center (*n*=360) or the Sleep Disorders Clinic at the Repatriation General Hospital (Adelaide, Australia) (*n*=170). Patients at both sites were diagnosed by a sleep clinician as having a disorder of initiating and/or maintaining sleep. Participants could have a variety of comorbid medical or psychiatric conditions so long as they were not requiring imminent treatment of their comorbid condition. Participants also could have primary insomnia alone. All participants in this cohort were initially evaluated by a sleep specialist by means of clinical interview and subsequently were referred to CBT for insomnia.

Measures

The 16 items of DBAS were extracted from the 30-item version of DBAS that the participants had completed at their respective study sites prior to the initiation of treatment. At sites except Flinders University, DBAS-16 item scores were converted from the original 100-point scale into a 10-point Likert scale by dividing the item score by 10 and rounding to the nearest whole number. However, at the Flinders University site, a different conversion procedure was needed, since a 5-point Likert scale for responding to each item was used. Scores from this site were converted into a 10-point Likert by employing the following linear transformation: $(x-1)\times 2.5$. This linear transformation produced five possible scores ranging from 0 to 10, with a 2.5-point distance between adjacent points on the transformed scale. Such a transformation thus allowed for a distribution of scores across a 10-point range, yet preserved the intended responses of those subjects who chose the lowest score on

the original 5-point scale. It was important to preserve the lower end point, as we were including samples of good sleepers, who frequently select the lowest score (i.e., if a doubling procedure were used, the lowest possible score would be a 2). Following these various score conversion procedures, the total DBAS-16 score was calculated as the mean across all 16 items for each participant. The subscales were computed by taking the mean of the items of the scale.

Analyses

Internal consistency

To provide users of the instrument information about its properties in various insomnia subtypes, we computed Cronbach's α for the total score and the four subscales, as well as item and subscale means and standard deviations, and corrected item–total correlation coefficients (ITCs). The ITC is an index of the utility of an item, as it is the correlation between the item and the total score after controlling for the item of interest. Analysis of covariance (ANCOVA) tested whether the group means differed on individual items using Bonferroni correction (0.05/16=0.003) to reduce the likelihood of a type I error. Because two of our groups included older insomnia sufferers and MANOVA revealed a statistically significant age effect (P=.001), we entered age as a covariate.

Construct validity/group differences

Insomnia sufferers have been described as a group with elevated levels of unhelpful beliefs that contribute to sleep difficulties, and previous studies have shown that persons with insomnia obtain a significantly higher DBAS-30 total score than do matched normal sleepers. Assuming that DBAS-16 remains a valid measure of unhelpful sleep-related beliefs, the total score on this instrument should discriminate those with insomnia from those without insomnia. Hence, as a test of DBAS-16's validity, we conducted ROC curve analyses, with membership in any of the insomnia groups as the criterion variable. We derived cutpoints by plotting the relation between the sensitivity and the 1−specificity of the DBAS-16 total score over all possible values on an ROC curve and by selecting a clinical cutoff score that maximized both values. Sensitivity represents the probability of detecting insomnia when it is present, and specificity represents the probability of not detecting insomnia when it is indeed *not* present. The further the ROC curve lies above a reference line, the more accurately a chosen cutoff score classifies positive and negative cases in a chosen sample [21]. We also computed the AUC to determine the probability that the DBAS score for a randomly chosen insomnia case would exceed the result for a good sleeper case. We calculated the AUC using SPSS software and tested it for statistical significance. Classification accuracy was evaluated using the following recommended ranges: AUC<0.7 (*low accuracy*), AUC between 0.7 and 0.9 (*moderate accuracy*), and AUC>0.9 (*high accuracy*) [22].

Although the CSC group did not employ standardized diagnostic tools, we opted to include this group in our ROC analyses because they were referred for insomnia treatment, verified via subjective self-report of insomnia and clinical interview, and subsequently treated for insomnia. We also thought it important to include this sample, as it is a community-based sleep clinical sample, and DBAS-16 is intended for both clinical and research settings. Similarly, although the GS subgroup from Flinders University was not screened with standardized diagnostic tools, we opted to include them in our classification analysis because, in addition to not complaining of insomnia, they did not have pathological levels of SOL or WASO. Thus, the criterion used to define an insomnia case was a sleep specialist *Diagnostic and Statistical Manual of Mental Disorders* (DSM) insomnia diagnosis, and the criterion used to define a noninsomnia case was self-identification as a normal sleeper and either (a) failure to meet DSM diagnostic criteria for an insomnia diagnosis, or (b) mean SOL and WASO below 30 min.

As the main purpose of the study was to describe beliefs across differing insomnia groups, the means for each group for the total DBAS-16 score and subscales were compared using MANCOVA (age was entered as a covariate).

Results

Fig. 1 shows the distribution for DBAS score in the GS and PI groups. Scores ranged from 0.2 to 9.44, and the figure shows that the DBAS scores approximated normal distributions within each group, although, as we would expect, the distribution of the GS group reflected its lower levels of maladaptive sleep beliefs. Thus, there appears to be some slight flattening of the distribution and a slight skew towards the left. There were no outliers and no apparent problems with restriction of range.

Internal consistency

Table 3 depicts the item means, standard deviations, and ITCs. ITCs for the pooled insomnia groups ranged from .073

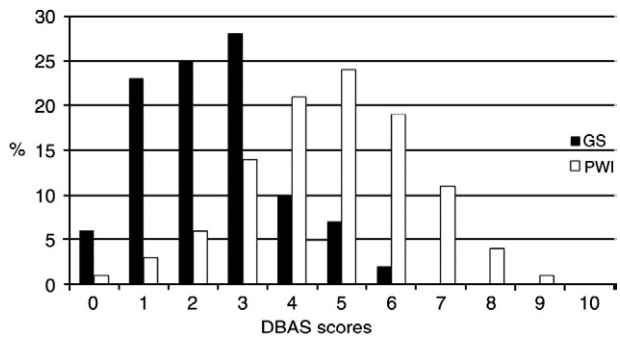

Fig. 1. Distribution of DBAS scores across the GS and people with insomnia (PWI) groups.

Table 3
Group item means, standard deviations, and mean item correlations

DBAS-16 items		Groups	
		GS	All insomnia groups
1. I need 8 hours of sleep to function	Mean (S.D.)	5.63 (2.94)	6.06 (3.19)
	ITC	.316	.325
2. Need to catch up on sleep loss	Mean (S.D.)	4.84 (2.83)	5.03 (3.21)
	ITC	.342	.329
3. Concerned about health consequences	Mean (S.D.)	4.62 (3.32)	6.57 (2.98)
	ITC	.391	.476
4. Worried I may lose control over my ability to sleep	Mean (S.D.)	1.65 (2.22)	5.02 (3.28)
	ITC	.328	.537
5. A poor night's sleep will interfere with my activities the next day	Mean (S.D.)	5.36 (2.77)	6.80 (2.82)
	ITC	.400	.579
6. Better off taking a sleeping pill	Mean (S.D.)	1.78 (2.27)	4.35 (3.52)
	ITC	.265	.428
7. Negative mood is due to poor sleep	Mean (S.D.)	3.48 (2.66)	6.10 (2.95)
	ITC	.470	.543
8. One night will disturb the whole week	Mean (S.D.)	1.73 (2.38)	2.85 (2.67)
	ITC	.423	.429
9. Without adequate sleep, I can hardly function the next day	Mean (S.D.)	2.53 (2.39)	4.46 (2.92)
	ITC	.554	.590
10. Cannot predict whether I will have a good or poor night's sleep	Mean (S.D.)	4.23 (3.09)	7.00 (3.02)
	ITC	.216	.073
11. Little ability to manage the negative consequences of disturbed sleep	Mean (S.D.)	3.70 (2.63)	5.49 (2.91)
	ITC	.412	.406
12. Feeling tired, no energy, or not functioning well is due to poor sleep	Mean (S.D.)	5.25 (2.67)	6.99 (2.60)
	ITC	.449	.505
13. I think insomnia is due to a chemical imbalance	Mean (S.D.)	4.25 (2.05)	4.31 (2.59)
	ITC	.127	.271
14. Insomnia is ruining my life	Mean (S.D.)	2.43 (2.57)	5.23 (3.34)
	ITC	.515	.647
15. Medication is the only solution	Mean (S.D.)	1.23 (1.85)	3.29 (3.10)
	ITC	.235	.391
16. I avoid/cancel obligations after a poor night's sleep	Mean (S.D.)	1.67 (2.35)	3.27 (3.05)
	ITC	.477	.339

to .647. All ITCs were greater than the suggested minimum value of .30 [23], with the exception of Items 10 and 13. Results for good sleepers were similar: ITC ranged from .127 to .554, and all ITCs were greater than .30, except for Items 10, 13 and 15. After controlling for age, there was a group effect on all ANCOVA at $P<.003$, except for Items 1, 2, and

Table 4
Group means, standard deviations, and Cronbach's α for DBAS-16 summary scores and subscales

DBAS-16 scores		Groups					
		GS (n=335)	All insomnia groups (n=1049)	PI group (n=329)	MED group (n=114)	HYP group (n=76)	CSC group (n=530)
Expectations scale (Items 1 and 2)	Mean	5.17	5.50	5.06	4.55	5.51	6.18
	S.D.	2.41	2.65	2.70	2.69	2.29	2.38
	α	.485	.581	.560	.517	.570	.578
Effects scale (Items 5, 7, 9, 12, and 16)	Mean	3.45	5.57	4.85	4.77	5.06	6.23
	S.D.	1.74	2.04	2.05	2.16	2.05	1.60
	α	.708	.750	.787	.749	.812	.689
Worry scale (Items 3, 4, 8, 10, 11, and 14)	Mean	2.15	5.46	4.55	4.47	5.39	6.41
	S.D.	1.56	1.87	1.62	1.70	1.87	1.58
	α	.635	.660	.581	.609	.754	.595
Medication scale (Items 6, 13, and 15)	Mean	2.28	4.05	2.83	2.84	4.60	5.52
	S.D.	1.31	2.20	1.76	1.89	1.71	1.95
	α	.304	.470	.466	.318	.140	.387
DBAS-16 score	Mean	2.96	5.23	4.38	4.27	5.14	6.16
	S.D.	1.26	1.60	1.42	1.47	1.43	1.32
	α	.797	.821	.798	.786	.802	.772

13. Table 4 depicts the unadjusted group means, standard deviations, and Cronbach's α for the four scales and total score. The internal consistency estimates for the total DBAS-16 score (Cronbach's α=.821) and effects subscale (.750) for the pooled insomnia groups were acceptable, but the Cronbach's α values for the pooled insomnia groups for the worry/helplessness (.660), expectations (.581), and medication (.470) subscales were poor.

Construct validity/group differences

Fig. 2 shows the ROC curve for combining all insomnia groups and testing against the good sleepers. The AUC (0.86) was moderately high and was statistically significant at $P<.001$. The 95% confidence interval was 0.82–0.89 (S.E.=.02). The ROC curve suggested that a clinical cutoff of 3.8 on a 10-point Likert scale maximized sensitivity (80%) and specificity (76%) for group classification. If we evaluate the cutoff (3.8) derived from the overall sample (true-positive rate=80%; false-positive rate=24%) in each group: (a) sensitivity for the CSC group increases to 92%, and specificity remains the same at 76% (AUC is improved to 0.93; S.E.=0.012); (b) sensitivity for the HYP group increases slightly to 84%, and specificity remains the same at 76% (AUC is slightly improved to 87%; S.E.=0.028); (c) sensitivity for the MED group decreases to 65%, and specificity remains about the same at 75% (AUC=0.76; S.E.=0.033); and (d) sensitivity for the PI group decreases to 66%, and specificity remains the same at 76% (AUC=0.78; S.E.=.027). Since the overall cutoff resulted in a much lower sensitivity (i.e., a 3.8 cutoff would have a false-negative rate of 35% for the MED group and 25% for the PI group), we examined other possible cutoffs.

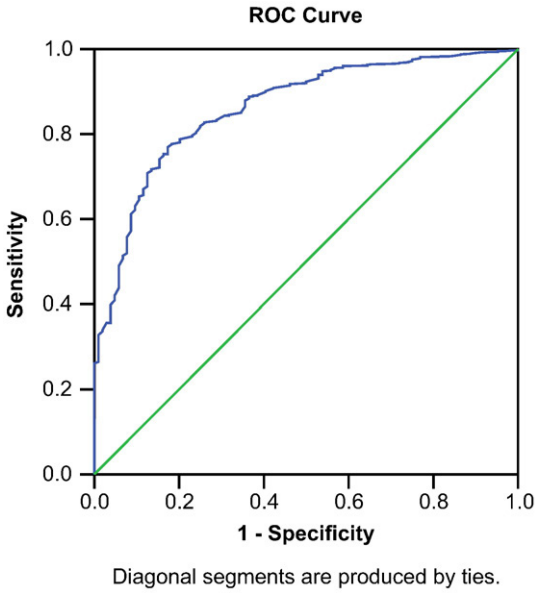

Fig. 2. ROC curve for DBAS-16.

Lowering the cutoff to 3.5 for each of these groups resulted in a slightly improved sensitivity rate of 70% for the MED group and 73% for the PI group, although some specificity is lost, too (69% and 70%, respectively).

We hypothesized that good sleepers would differ from those with insomnia on the DBAS-16 mean item score and subscales, but it was unknown whether the insomnia subgroups would differ from one another. Thus, we conducted a MANCOVA, entering age as a covariate on the DBAS index score and the four themes of DBAS-16 to evaluate any group differences. The MANCOVA was statistically significant [$F(20,4561)=22.3$, $P<.001$]; thus, we followed up the significant group effect with ANCOVA and pairwise comparisons to understand the differences. After controlling for age, the ANCOVA for DBAS [$F(4,1378)=69.3$, $P<.001$], effects [$F(4,1378)=40.5$, $P<.001$], worry/helplessness [$F(4,1378)=97.3$, $P<.001$], expectations [$F(4,1378)=3.3$, $P=.01$], and medication [$F(4,1378)=33.9$, $P<.001$] were all statistically significant. Table 4 presents the unadjusted group means. Follow-up group comparisons on the DBAS index score revealed that CSC=HYP>MED=PI>GS ($P<.001$). This same result was observed for the pairwise comparison for the worry/helplessness subscale (i.e., the CSC group had the highest score, followed by the HYP group, followed by not significantly different scores in the MED and PI groups, although both the MED group and the PI group had higher scores than the GS group). On the effects subscale: (a) the CSC group was significantly higher than all groups; (b) the MED, HYP, and PI groups did not differ significantly from each other, although (c) these three groups were significantly higher than the GS group. On the medication scale, the CSC and HYP groups were similarly high and significantly higher than the GS, PI, and MED groups (which did not statistically differ from each other). Lastly, the CSC group had significantly higher scores on the expectation subscale, and the GS, PI, HYP, and MED groups did not differ from each other.

Site differences

In addition to these analyses, we conducted a series of ANCOVA (covarying age) to assess differences within our subsamples due to study sites. Results of these analyses were all significant after controlling for age ($P<.05$), suggesting site effects. Good sleepers at Flinders University (mean=3.98, S.D.=1.27) had scores higher than those of good sleepers at Duke University (mean=2.96, S.D.=1.26). Those in the PI group at Flinders University had DBAS-16 scores (mean=4.96, S.D.=1.55) higher than those in the PI group at Duke University (mean=4.18, S.D.=1.31). Those in the CSC group at Stanford University had DBAS-16 scores (mean=6.16, S.D.=1.34) higher than those in the CSC group at Flinders University (mean=5.59, S.D.=1.44). The effect sizes for the comparison of the GS, PI, and CSC groups were very small (η^2=0.05, 0.05, and 0.03, respectively).

Discussion

Overall, this large multisite study of unhelpful sleep beliefs suggests that DBAS-16 is a reliable and valid tool for use across a range of insomnia patient groups, although it is important to understand that insomnia subtypes differ from one another in such beliefs. Reliability estimates (Cronbach's α and ITCs) confirmed the previously reported acceptable reliability of the full DBAS-16 scale and, overall, Cronbach's α values were similar across each study group. In addition, there were acceptable item correlations with the total for all but two items. Thus, the majority of item means both significantly correlated with the total score and discriminated those with insomnia from those without insomnia. In contrast to these findings, internal consistency indices for the various subscales, as originally conceived by Morin et al. [7], were less promising. In fact, only the effects scale had acceptable α values across the various samples included in this study. One consideration for the reliability of the subscales is the short scale length for the medication and expectations subscales. Longer scales tend to have higher reliability, and the medication and expectations subscales with poor internal consistency have three and two items, respectively. In general, the lack of support for the subscales (with the exception of the effects scale) would suggest that their use should be avoided.

Validity analyses confirmed that DBAS taps into sleep beliefs that discriminate those with insomnia from good sleepers. These results should not imply that DBAS-16 is a diagnostic or screening tool for insomnia. It is important to view this instrument as a measure for identifying clinically significant levels of unhelpful beliefs related to sleep, rather than as a screen for insomnia. The ROC curve analysis suggested that a DBAS-16 total score above 3.8 is associated with the degree of unhelpful beliefs found in those with clinical insomnia. This cutoff is slightly higher, but consistent with a previously reported cutoff (>3.5) in a smaller sample of young university students completing DBAS-30 [10]. The false-negative rate of 20% and the fact that the ROC analyses in the PI and MED groups had poorer sensitivity suggest that this cutoff may be too stringent for all insomnia groups. Indeed, these analyses do not take into consideration that the base rates for insomnia may be considerably lower for predominantly research-recruited people with insomnia than for those solely from a sleep clinic. It would have been interesting to examine these issues in those recruited solely for research with those from treatment centers only; unfortunately, with the exception of the CSC group, our groups have a combination of each referral source and thus preclude such testing. Future studies that provide normative data would be useful in determining the extent to which the current findings extend to positive cases and "controls" in the general population, as well as other types of insomnias from a variety of settings.

Generally, community sleep clinic patients tended to exhibit higher levels of maladaptive sleep beliefs than all other groups. This group is different from the other groups in several ways: (a) the clinics are tertiary settings; (b) there are no research respondents; and (c) there are multiple medical and psychiatric comorbidities. Hypnosis-dependent patients (HYP group) had similarly high levels of overall unhelpful beliefs and were comparable to those of the PI and MED groups on beliefs about the consequences/effects of insomnia and expectations about sleep needs. The HYP group had the highest (along with the CSC group) level of maladaptive beliefs about medications. Interestingly, only the CSC group had higher expectations about sleep needs than the GS group, a finding reported elsewhere [24]. This could mean that beliefs relating to sleep needs may need to be challenged only in clinical settings. However, given that modifications in these beliefs (i.e., decreases in scores on this scale) are associated with other indices of clinical improvement [1], it may be more likely that this difference is attributable to the unique characteristics of this group described above. For example, there were no research respondents, and it has been reported elsewhere that those volunteering for research studies tend to report less distress and preoccupation with sleep than those in clinics [25]. With this in mind, the fact that those who were hypnotic-dependent were mainly research respondents and had the most (or second most) strongly held beliefs of all insomnia groups suggests that cognitive restructuring might need to be of particular clinical focus for such patients. One other consideration is whether daytime symptoms (e.g., fatigue) could account for differences between the groups; this might be an interesting future area of exploration. While it is interesting to speculate on the reasons for the differences, because the groups differed on several characteristics (including comorbidity) and these were not statistically controlled, one must exercise caution in interpreting the results. In addition, as with many cognitive factors, the effect sizes are fairly small, so it is difficult to ascertain the full clinical significance of such results. Future studies could answer these questions more definitively.

A final point to mention is that our results also showed some within-group differences attributable to study site. Site differences were noted within our groups of normal sleepers, primary insomnia sufferers, and those composing the CSC group. Each of these comparisons included one Australian sample and one sample obtained from a site in the United States. Arguably, these noted site differences could be attributed to differences in sample selection methods and cultural differences between the two countries from whence the samples were selected. However, it is also possible that the difference in response options (i.e., a 5-point Likert scale in Australia vs. a 10-point or a 100-point scale in the United States) could have contributed to these differences as well. Although we attempted to convert all data into a standard 10-point scale, there are admittedly limitations to the mathematical algorithm we used. Furthermore, this was an archival study, and it is not certain whether the same results would have occurred if all participants had completed DBAS-16 (as opposed to completing the full version and extracting the 16

items). Thus, future cross-cultural studies with DBAS-16 would benefit from consistent use of the standard 10-point Likert scale, which is now standard on this instrument.

Overall, these results provide important information on how subgroups of people with insomnia score on this instrument. There was evidence of some poor item-specific results, although this may be attributable to the fact that some items selected for inclusion in DBAS-16 were chosen largely based on their presumed clinical usefulness rather than on any empirical basis [5]. It is important to note that although the total score of DBAS-16 is used as an index of a problematic level of sleep-disruptive beliefs, the individual items of DBAS-16 can also be used as a tool for the modification of specific beliefs. For example, some clinicians use responses to particular DBAS-16 items in therapy to orient the patient to possible overvalued ideation and to modify such sleep-disruptive beliefs [5]. Although some items lack strong individual psychometric support, their therapeutic value and relation to treatment outcome should not be underestimated. This was shown in a study finding that some DBAS items that do not discriminate insomnia sufferers from normal sleepers, decline significantly during CBT, and/or show treatment-related changes that correlate with other measures of insomnia improvement [1]. This suggests utility for these items, although they could benefit from further psychometric work. Nonetheless, the main index is reliable and useful for establishing a level of unhelpful beliefs characteristic of those with differing types of insomnia and demographic characteristics. More future large-scale collaborations aiming to provide normative and psychometric data for other insomnia measures would greatly advance the field.

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