Examining maladaptive beliefs about sleep across insomnia patient groups

Colleen E. Carney\textsuperscript{a},*, Jack D. Edinger\textsuperscript{b}, Charles M. Morin\textsuperscript{c}, Rachel Manber\textsuperscript{d}, Bruce Rybarczyk\textsuperscript{e}, Edward J. Stepanski\textsuperscript{f}, Helen Wright\textsuperscript{g}, Leon Lack\textsuperscript{g}

\textsuperscript{a}Ryerson University, Toronto, Ontario, Canada
\textsuperscript{b}Duke University Medical Center, Durham, NC, USA
\textsuperscript{c}Laval University, Quebec, Canada
\textsuperscript{d}Stanford University, Palo Alto, CA, USA
\textsuperscript{e}Virginia Commonwealth University, Richmond, VA, USA
\textsuperscript{f}Accelerated Community Oncology Research Network, Inc., Memphis, TN, USA
\textsuperscript{g}Flinders University, Adelaide, Australia

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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 \( \geq 3.8 \) 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.

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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-
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 insomnia, 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 depend-
ence, 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 \(\alpha\)) 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
(MANOVA) 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>
<thead>
<tr>
<th>Group/site</th>
<th>Source of diagnosis</th>
<th>Sleep interview</th>
<th>Medical evaluation</th>
<th>Psychological evaluation</th>
<th>Research- respondent</th>
<th>Clinic-referred</th>
<th>Treatment-seeking</th>
<th>Exclusionary conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Good sleepers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Durham VA and Duke University Medical Centers</td>
<td>Self-identified</td>
<td>Clinical interview; SIS-D</td>
<td>Yes</td>
<td>SCID</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>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</td>
</tr>
<tr>
<td>Flinders University</td>
<td>Self-identified plus sleep diary SOL and WASO &lt;30 min</td>
<td>Clinical interview</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td></td>
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<tr>
<td><strong>Primary insomnia</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Durham VA and Duke University Medical Centers</td>
<td>Sleep specialist</td>
<td>Clinical interview; SIS-D</td>
<td>Yes</td>
<td>SCID</td>
<td>Yes</td>
<td>Yes</td>
<td>Some</td>
<td>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</td>
</tr>
<tr>
<td>Flinders University</td>
<td>Sleep specialist</td>
<td>Clinical interview</td>
<td>No</td>
<td>Self-report (CES-D and STAI)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Current psychopathology; self-reported history of sleep disorder other than insomnia</td>
</tr>
<tr>
<td><strong>Hypnosis-dependent</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Laval University</td>
<td>Sleep specialist</td>
<td>Clinical interview</td>
<td>Yes</td>
<td>SCID</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>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</td>
</tr>
<tr>
<td><strong>Medical insomnia</strong></td>
<td></td>
<td></td>
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<tr>
<td>Rush Medical Center</td>
<td>Self-identified plus at least six episodes of SOL ≥30, WASO ≥60, or total sleep time &lt;6.5 h on a 2-week diary</td>
<td>Clinical interview</td>
<td>Yes</td>
<td>Self-report Brief Symptom Inventory and Geriatric Depression Scale</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>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</td>
</tr>
<tr>
<td><strong>Community sleep clinic</strong></td>
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</tr>
<tr>
<td>Stanford Insomnia Clinic</td>
<td>Sleep specialist</td>
<td>Clinical interview</td>
<td>Some</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Any active untreated severe medical or psychiatric pathology</td>
</tr>
<tr>
<td>Repatriation General Hospital</td>
<td>Sleep specialist</td>
<td>Clinical interview</td>
<td>Some</td>
<td>CES-D, STAI</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Any active untreated severe medical or psychiatric pathology</td>
</tr>
</tbody>
</table>

AHI=apnea hypopnea index; PLMI=periodic limb movement index; CES-D=Center for Epidemiologic Studies Depression Scale; STAI=State–Trait Anxiety Scale.
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=0.001), 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
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 16.

### Table 3

<table>
<thead>
<tr>
<th>DBAS-16 items</th>
<th>Groups</th>
<th>GS</th>
<th>All insomnia groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I need 8 hours of sleep to function</td>
<td>Mean (S.D.)</td>
<td>5.63 (2.94)</td>
<td>6.06 (3.19)</td>
</tr>
<tr>
<td>ITC</td>
<td>316</td>
<td>325</td>
<td></td>
</tr>
<tr>
<td>2. Need to catch up on sleep loss</td>
<td>Mean (S.D.)</td>
<td>4.84 (2.83)</td>
<td>5.03 (3.21)</td>
</tr>
<tr>
<td>ITC</td>
<td>.342</td>
<td>329</td>
<td></td>
</tr>
<tr>
<td>3. Concerned about health consequences</td>
<td>Mean (S.D.)</td>
<td>4.62 (3.32)</td>
<td>6.57 (2.98)</td>
</tr>
<tr>
<td>ITC</td>
<td>.391</td>
<td>476</td>
<td></td>
</tr>
<tr>
<td>4. Worried I may lose control over my ability to sleep</td>
<td>Mean (S.D.)</td>
<td>1.65 (2.22)</td>
<td>5.02 (3.28)</td>
</tr>
<tr>
<td>ITC</td>
<td>.328</td>
<td>.537</td>
<td></td>
</tr>
<tr>
<td>5. A poor night’s sleep will interfere with my activities the next day</td>
<td>Mean (S.D.)</td>
<td>5.36 (2.77)</td>
<td>6.80 (2.82)</td>
</tr>
<tr>
<td>ITC</td>
<td>.400</td>
<td>.579</td>
<td></td>
</tr>
<tr>
<td>6. Better off taking a sleeping pill</td>
<td>Mean (S.D.)</td>
<td>1.78 (2.27)</td>
<td>4.35 (3.52)</td>
</tr>
<tr>
<td>ITC</td>
<td>.265</td>
<td>428</td>
<td></td>
</tr>
<tr>
<td>7. Negative mood is due to poor sleep</td>
<td>Mean (S.D.)</td>
<td>3.48 (2.66)</td>
<td>6.10 (2.95)</td>
</tr>
<tr>
<td>ITC</td>
<td>.470</td>
<td>543</td>
<td></td>
</tr>
<tr>
<td>8. One night will disturb the whole week</td>
<td>Mean (S.D.)</td>
<td>1.73 (2.38)</td>
<td>2.85 (2.67)</td>
</tr>
<tr>
<td>ITC</td>
<td>.413</td>
<td>429</td>
<td></td>
</tr>
<tr>
<td>9. Without adequate sleep, I can hardly function the next day</td>
<td>Mean (S.D.)</td>
<td>2.53 (2.39)</td>
<td>4.46 (2.92)</td>
</tr>
<tr>
<td>ITC</td>
<td>.554</td>
<td>590</td>
<td></td>
</tr>
<tr>
<td>10. Cannot predict whether I will have a good or poor night’s sleep</td>
<td>Mean (S.D.)</td>
<td>4.23 (3.09)</td>
<td>7.00 (3.02)</td>
</tr>
<tr>
<td>ITC</td>
<td>.216</td>
<td>.073</td>
<td></td>
</tr>
<tr>
<td>11. Little ability to manage the negative consequences of disturbed sleep</td>
<td>Mean (S.D.)</td>
<td>3.70 (2.63)</td>
<td>5.49 (2.91)</td>
</tr>
<tr>
<td>ITC</td>
<td>.412</td>
<td>406</td>
<td></td>
</tr>
<tr>
<td>12. Feeling tired, no energy, or not functioning well is due to poor sleep</td>
<td>Mean (S.D.)</td>
<td>5.25 (2.67)</td>
<td>6.99 (2.60)</td>
</tr>
<tr>
<td>ITC</td>
<td>.449</td>
<td>.505</td>
<td></td>
</tr>
<tr>
<td>13. I think insomnia is due to a chemical imbalance</td>
<td>Mean (S.D.)</td>
<td>4.25 (2.05)</td>
<td>4.31 (2.59)</td>
</tr>
<tr>
<td>ITC</td>
<td>.127</td>
<td>271</td>
<td></td>
</tr>
<tr>
<td>14. Insomnia is ruining my life</td>
<td>Mean (S.D.)</td>
<td>2.43 (2.57)</td>
<td>5.23 (3.34)</td>
</tr>
<tr>
<td>ITC</td>
<td>.515</td>
<td>647</td>
<td></td>
</tr>
<tr>
<td>15. Medication is the only solution</td>
<td>Mean (S.D.)</td>
<td>1.23 (1.85)</td>
<td>3.29 (3.10)</td>
</tr>
<tr>
<td>ITC</td>
<td>.235</td>
<td>391</td>
<td></td>
</tr>
<tr>
<td>16. I avoid/cancel obligations after a poor night’s sleep</td>
<td>Mean (S.D.)</td>
<td>1.67 (2.35)</td>
<td>3.27 (3.05)</td>
</tr>
<tr>
<td>ITC</td>
<td>.477</td>
<td>.339</td>
<td></td>
</tr>
</tbody>
</table>

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 16.

### Table 4

<table>
<thead>
<tr>
<th>DBAS-16 scores</th>
<th>Groups</th>
<th>GS (n=335)</th>
<th>All insomnia groups (n=1049)</th>
<th>PI group (n=329)</th>
<th>MED group (n=114)</th>
<th>HYP group (n=76)</th>
<th>CSC group (n=530)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expectations scale (Items 1 and 2)</td>
<td>Mean</td>
<td>5.17</td>
<td>5.50</td>
<td>5.06</td>
<td>4.55</td>
<td>5.51</td>
<td>6.18</td>
</tr>
<tr>
<td>S.D.</td>
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<td>.265</td>
<td>.270</td>
<td>.269</td>
<td>2.29</td>
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<tr>
<td>α</td>
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<td>.581</td>
<td>.560</td>
<td>.517</td>
<td>.570</td>
<td>.578</td>
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<td>Effects scale (Items 5, 7, 9, 12, and 16)</td>
<td>Mean</td>
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<td>5.57</td>
<td>4.85</td>
<td>4.77</td>
<td>5.06</td>
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<tr>
<td>S.D.</td>
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<td>2.05</td>
<td>2.16</td>
<td>2.05</td>
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<td>.750</td>
<td>.787</td>
<td>.749</td>
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<td>.689</td>
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<tr>
<td>Worry scale (Items 3, 4, 8, 10, 11, and 14)</td>
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<td>5.46</td>
<td>4.55</td>
<td>4.47</td>
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<td>1.87</td>
<td>1.62</td>
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<tr>
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<td>.660</td>
<td>.581</td>
<td>.609</td>
<td>.754</td>
<td>.595</td>
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<tr>
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<td>Mean</td>
<td>2.28</td>
<td>4.05</td>
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<td>2.84</td>
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<tr>
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<td>1.89</td>
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<tr>
<td>α</td>
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<td>.470</td>
<td>.466</td>
<td>.318</td>
<td>.140</td>
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<tr>
<td>DBAS-16 score</td>
<td>Mean</td>
<td>2.96</td>
<td>5.23</td>
<td>4.38</td>
<td>4.27</td>
<td>5.14</td>
<td>6.16</td>
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<td>1.43</td>
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<tr>
<td>α</td>
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<td>.821</td>
<td>.798</td>
<td>.786</td>
<td>.802</td>
<td>.772</td>
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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.=0.02). 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.=0.027). 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.

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 \( [F(4,1378)=3.3, P=0.1] \), 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 \( (\text{mean}=3.98, S.D.=1.27) \) had scores higher than those of good sleepers at Duke University \( (\text{mean}=2.96, S.D.=1.26) \). Those in the PI group at Flinders University had DBAS-16 scores \( (\text{mean}=4.96, S.D.=1.55) \) higher than those in the PI group at Duke University \( (\text{mean}=4.18, S.D.=1.31) \). Those in the CSC group at Stanford University had DBAS-16 scores \( (\text{mean}=6.16, S.D.=1.34) \) higher than those in the CSC group at Flinders University \( (\text{mean}=5.59, S.D.=1.44) \). The effect sizes for the comparison of the GS, PI, and CSC groups were very small \( (\eta^2=0.05, 0.05, \text{and } 0.03, \text{respectively}) \).
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 \( \alpha \) and ITCs) confirmed the previously reported acceptable reliability of the full DBAS-16 scale and, overall, Cronbach’s \( \alpha \) 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 \( \alpha \) 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 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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References