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Safety behaviors and dysfunctional beliefs about sleep: Testing a cognitive model of the maintenance of insomnia

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Abstract

Objective: Our aim was to determine if insomnia severity, dysfunctional beliefs about sleep, and depression predicted sleep-related safety behaviors. **Method:** Standard sleep-related measures (such as the Insomnia Severity Index; the Dysfunctional Beliefs About Sleep scale; the Depression, Anxiety, and Stress Scale; and the Sleep-Related Behaviors Questionnaire) were administered. Additionally, 14 days of sleep diary (Pittsburg Sleep Diary) data and actual use of sleep-related behaviors were collected. **Results:** Regression analysis revealed that dysfunctional beliefs about sleep predicted sleep-related safety behaviors. Insomnia severity did not predict sleep-related safety behaviors. Depression accounted for the greatest amount of unique variance in the prediction of safety behaviors, followed by dysfunctional beliefs. Exploratory analysis revealed that participants with higher levels of depression used more sleep-related behaviors and reported greater dysfunctional beliefs about their sleep. **Conclusion:** The findings underlie the significant influence that dysfunctional beliefs have on individuals' behaviors. Moreover, the results suggest that depression may need to be considered as an explicit component of cognitive–behavioral models of insomnia.

Keywords: Insomnia; Dysfunctional beliefs about sleep; Sleep-related safety behaviors; Sleep-Related Behaviors Questionnaire

Introduction

Dysfunctional beliefs about sleep and maladaptive coping behaviors are considered important factors in a number of cognitive models that explain the onset and maintenance of chronic insomnia [1,2]. One model, recently presented by Harvey [3], proposes that dysfunctional beliefs about sleep facilitate the adoption of sleep-specific safety behaviors. These behaviors act to maintain and perpetuate insomnia by reinforcing pre-existing dysfunctional beliefs about sleep [3]. To date, however, the link proposed in Harvey's model has not been empirically tested. Therefore, the present research is the first attempt to provide empirical support for this link. Drake et al. [4] have recently reiterated that further studies of the influence of dysfunctional beliefs and behaviors in maintaining the cycle of insomnia are required.

The theoretical model developed by Harvey [3] describes the processes involved in the maintenance of insomnia rather than the initial cause. It is based on evidence that individuals with insomnia tend to think excessively about their sleep and the consequences for the following day after not getting enough sleep. According to the model, negative cognition facilitates autonomic arousal and emotional distress, resulting in high anxiety. This anxiety creates an attentional bias toward a perceived threat such that the anxious state causes the individual to focus only on sleep-related cues [5]. Consequently, concern about poor sleep and associated negative consequences increases. This provides reinforcement for pre-existing dysfunctional beliefs about sleep requirements [3].

Considerable research evidence suggests that dysfunctional beliefs about sleep and maladaptive coping behaviors are influential factors in maintaining insomnia [3,6–18]. Dysfunctional beliefs about sleep include beliefs such as "I

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must have a minimum of 8 h sleep or I will not function at all tomorrow." When compared to normal sleepers, poor sleepers report less realistic expectations about their sleep requirements. Such expectations are posited to increase cognitive and emotional arousal and to negatively influence sleep onset and sleep quality [1,6,8,13–19].

According to Harvey's model, pre-existing dysfunctional beliefs about sleep are likely to facilitate the use of sleep-related safety behaviors. Safety behaviors are a robust construct in the anxiety literature, which are defined as behaviors that are adopted to avoid a feared situation. In relation to insomnia, it has been suggested these sleep-related safety behaviors are used at night due to the fear of disturbed sleep, or during the day as coping mechanisms following a night of disturbed sleep [3]. This, in turn, reduces the likelihood of experiencing a situation that would have corrected the dysfunctional belief [20–22]. To illustrate, "I need 8 h sleep to perform (i.e., dysfunctional belief about sleep); without it, I will be tired, so I will need a lot of coffee or I will have to have a nap to cope (i.e., sleep-related safety behavior)" [3]. Therefore, adopting such sleep-related behaviors prevents the feared outcome (e.g., fatigue) from becoming a reality, which strengthens the association between the dysfunctional belief and the sleep-related safety behavior [3]. However, it is not known if these sleep-related safety behaviors result in consequences that contribute directly to the maintenance of insomnia. Therefore, in the context of Harvey's model, it was predicted that dysfunctional beliefs about sleep and insomnia severity would predict the use of sleep-related safety behaviors [3].

The final construct investigated was depression. Insomnia and depression co-occur frequently [12,23–30]. For example, Hamilton [31] reported that 61.2% of women and 68.6% of men with depression also reported sleep disturbance. All major diagnostic classifications (including DSM-IV) list insomnia as one of the major symptoms of depression. Depression and insomnia also share complex theoretical and clinical relationships. Not only are the symptoms of each condition entangled, but epidemiologic research also indicates that insomnia symptoms are a risk factor for depression and that clinical studies show a high prevalence of previous bouts of depression in individuals with insomnia [23]. For example, 40–60% of people with insomnia also report depression, and the prevalence of depression is much higher when the individual suffers from insomnia [12,26]. As yet, there is no established theoretical model that explicitly incorporates depression in the framework of chronic insomnia.

The current study sought to assess the use of sleep-related safety behaviors using the Sleep-Related Behaviors Questionnaire (SRBQ) [32] across a sample of good and poor sleepers. Because the SRBQ is a new measure, its aim was to identify the factors that predicted the use of sleep-related safety behaviors. It was hypothesized that sleep-related safety behaviors are predicted by insomnia severity, depression, and dysfunctional beliefs about sleep.

Method

Participants

Participants were first-year psychology students who were recruited through the University of Queensland's student intranet: The advertisement requested good and poor sleepers. The University of Queensland's School of Psychology Ethics committee granted ethical clearance for the current study. Prior to commencing, participants signed a consent form. Questionnaires were administered in a laboratory setting, with the researcher present in all sessions. Participation was on an anonymous basis, and it was rewarded with course credit points. Of the 40 participants, 29 (72.5%) were female and 11 (27.5%) were male; the mean age was 19.88 years (S.D.=3.6, range=17–33 years).

Measures

SRBQ

The SRBQ designed by Ree and Harvey [32] comprises 58 items that were previously identified as strategies used to cope with insomnia [3]. For example, the items included: "I try to keep all disturbing thoughts and images out of my mind while in bed"; "I avoid talking about my sleep"; "I look at the clock upon waking to calculate how many hours of sleep I got"; "I plan to get an early night." Participants rated these strategies on a 5-point Likert scale (0=*almost never applies to me*; 4=*applies to me almost always*). Recent studies have reported a high scale reliability of the SRBQ (α=.92) [32].

Dysfunctional Beliefs About Sleep (DBAS) scale

The DBAS was used to determine irrational thoughts, attitudes, expectations, and attributions about sleep [1]. This is a 30-item scale. Participants were asked to mark their level of agreement or disagreement with each item on a 100-mm visual analog scale, with poles at either end labeled as 0=*strongly disagree* and 100=*strongly agree*. Higher scores represent greater dysfunctional beliefs about sleep, except for item 23, which is reverse-scaled. In the current study, mean scores were calculated for participants [1]. This scale has been reported as reliable [1,11].

Insomnia Severity Index (ISI)

In the current sample, severity of insomnia was determined using the ISI [33]. The ISI items are: (1) severity of sleep onset; (2) sleep maintenance and early morning wakings; (3) satisfaction with current sleeping patterns; (4) interference with daily functioning; and (5) noticeability of sleep impairment and the associated degree of worry and anxiety. Participants rated their perception of each ISI item on a 5-point scale (0=*not at all*; 4=*very much*) [33]. Scores range between 0 and 28. Higher scores indicate a high perception of insomnia. Each ISI item addresses the

DSM-IV criteria of insomnia [33]. The recommended scoring guidelines were used in the current study: 0–7=*no clinically significant insomnia*; 8–14=*subclinical threshold*; 15–21=*moderate clinical insomnia*; 22–28=*severe clinical insomnia*. The internal consistency of the scale is considered high [33].

Depression, Anxiety and Stress Scale (DASS-21)

DASS-21 is the short version of the DASS 42-item scale [34]; the short version has been reported to adequately discriminate between the major factors of depression (physical arousal and psychological stress) [35,36]. It is a 21-item scale with three factors that measure: (1) three negative emotional states of depression (seven items); (2) anxiety (seven items); and (3) stress (seven items) [34]. Participants rated the symptoms described on a 4-point Likert scale (0=*did not apply to me at all*; 3=*applied to me very much, or most of the time*). There is evidence that the DASS-21 has good internal reliability [35,36].

Pittsburg Sleep Diary (PghSD)

The PghSD is recognized as a valid and reliable measure of insomnia [37–40]. For the current sample, the PghSD was completed at both wake time and bedtime for 14 consecutive days. The PghSD captures the subjective experience of sleep [8]. The following information was recorded at bedtime: time of breakfast, lunch, and dinner; intake of caffeine, alcohol, and tobacco; medication taken; and duration of both exercises and naps. At wake time, the following information was recorded: time of going to bed, sleep onset latency, and awaking; method of waking; the incidence, duration, and reason for waking after sleep onset; sleep quality; and mood and level of alertness upon awakening. In the current study, the PghSD provided subjective estimates of the following sleep parameters: sleep onset latency (SOL); frequency and duration of waking after sleep onset (WASO); time in bed (TIB; total time elapsed from initial lights-out to rising time); total sleep time (TST); and sleep efficiency (SE), obtained by dividing TST by TIB and multiplying by 100% [16]. These subjective estimates (i.e., sleep parameters) produce a reliable and valid index of insomnia [8]. There is evidence of test–retest reliability (r=.60–.80) [37] and evidence supporting the validity of the PghSD as an objective sleep measure (r=.43) [37].

Procedure

Participant data were collected via an intake battery of questionnaires (N=40), which included the ISI [1,33], DBAS [1], DASS [34], and SRBQ [32]. The questionnaires were counterbalanced using a Latin square design to minimize order effects. The researcher facilitated all sessions. Additionally participants were given the PghSD [37] and were instructed to complete it on the evening before going to bed and on each morning for 14 days. Participants were also given a copy of the SRBQ [32] and instructed to record the sleep-related behaviors used each day for 14 days. In total, 35 PghSDs were returned completed (i.e., 87.5%).

Results

Preliminary analyses

Participant characteristics

Forty participants completed the intake battery of questionnaires (29 females and 11 males). The average age was 19.88 years (S.D.=3.6, range=17–33 years). Because this sample differed from traditional treatment-seeking samples used in the majority of insomnia research, preliminary analyses were conducted to examine participant characteristics: (1) participants were categorized according to ISI guidelines to test the validity of the sampling strategy [33]; (2) mean sleep parameters for each ISI category were calculated based on the PghSD data (i.e., SOL, WASO, TST, and SE [37]); and (3) levels of depression, anxiety and stress were calculated for each participant using recommended cutoff scores for the DASS-21 scale [34].

Insomnia severity

To check the validity of the sampling strategy (i.e., to check the sample comprised of good and poor sleepers), participants were categorized according to the ISI guidelines, which resulted in three categories: (1) no insomnia; (2) subthreshold insomnia; or (3) moderate severity insomnia [18,33,41]. Results confirmed that these three categories were statistically different in terms of insomnia severity [$F(2, 37)=105.07$, P=.0001]. Effect size was calculated using η^2, revealing a large effect (η^2=0.85) [44]. Post hoc comparisons using the Tukey Honestly Significant Differences test indicated that the mean scores of the three insomnia severity categories differed significantly. Thus, the current sample included participants with self-reported sleep quality ranging from no indication of insomnia to probable severe clinical insomnia.

Sleep parameters

Self-reported habitual sleep across 14 nights was used to identify the sleep parameters for each participant (i.e., SOL, WASO, and SE). Difficulty initiating sleep was operationalized as SOL≥30 min occurring three or more nights per week. Difficulty maintaining sleep was operationalized as WASO≥30 min occurring three or more nights per week [1,33]. Of the current sample (n=35), 31.4% reported difficulty initiating sleep (SOL) and 14.3% reported difficulty maintaining sleep (WASO). SE was calculated as 95%.

Levels of depression, anxiety, and stress

Depression

In the current sample, 12 (30%) of 40 participants were identified as having clinical depression, using recommended cutoff scores for the DASS-21 scale [34]. Five (12.5%) participants were identified as having mild depression, and seven (17.5%) had moderate clinical depression. There was evidence of comorbidity, with 8 (29.63%) of 27 participants who were categorized with insomnia (i.e., based on the ISI) also having clinical depression [34].

Anxiety

Eighteen (45%) of 40 participants were identified as having clinical anxiety, using the DASS-21 [34]. Specifically, 7 (17.5%) participants had mild clinical anxiety, 10 (25%) had moderate clinical anxiety and 1 participant had severe clinical anxiety. There was evidence of comorbidity, with 17 (62.96%) of 27 participants having both insomnia and anxiety [34].

Stress

Six (15%) of 40 participants were identified as having clinically mild stress, using the DASS-21 [34]. There was evidence of comorbidity, with 6 (22.22%) of 27 participants who were categorized as having insomnia also having mild clinical stress [34]. Additionally, 7 (25.93%) of 27 participants with insomnia also had clinical depression, anxiety, and mild stress [34].

Actual use of sleep-related safety behaviors in the current sample

The self-reported use of sleep-related behaviors over 14 days was used to calculate the frequency of each item in the SRBQ (n=35). This revealed that the sleep-related behaviors used most often were (in descending order): (1) "I remain in bed for as long as it takes to fall asleep"; (2) "I sleep alone (e.g., away from partner)"; (3) "I put tasks off until tomorrow"; "I sleep in so I can catch up on sleep"; (4) "I try to keep all disturbing thoughts and images out of my mind while in bed"; and (5) "I look at the clock upon waking so I can calculate how many hours of sleep I got." By contrast, the sleep-related behaviors used least often were: (1) "I avoid excitement during the day"; (2) "I use alcohol to help me sleep"; (3) "I wear earplugs to block out all sounds that might wake me up/prevent me from falling asleep"; (4) "I take sleeping pill(s)"; and (5) "I take herbal remedies to aid sleep."

Scale properties of the SRBQ

The internal consistency of the SRBQ was investigated through SPSS reliability analysis. This revealed a Cronbach α coefficient of .83; therefore, in the current study, the SRBQ was reliable. This is consistent with the preliminary data (α=.92) reported by Ree and Harvey [32]. The external reliability of the SRBQ was examined through correlational analysis of SRBQ scores (i.e., from the intake questionnaire) and actual use of sleep-related behaviors, which participants recorded daily for 14 days. However, this relationship was not significant (r=.11, P=.54).

Examining the factors that predict the use of sleep-related safety behaviors

To test the hypothesis that insomnia severity, dysfunctional beliefs about sleep and depression predict the use of sleep-related safety behaviors, a standard multiple regression was conducted using DBAS, depression, anxiety, and

Table 1
Standard multiple regression statistics for the dependent variable SRBQ, with independent variables DBAS, ISI, depression, anxiety, and stress scores

				95% Confidence interval for β			
	B	β	t (df=34)	Lower	Upper	sr^2 (%)	RW (%)
Intercept	112.07						
DBAS	0.49	.321	2.10	0.17	0.48	6.86	33.2
ISI	0.25	.074	0.55	−0.06	0.21	0.47	2.1
Depression	1.97	.611	3.47	0.43	0.79	18.74	80.3
Anxiety	−0.32	−.079	−0.39	−0.29	0.13	0.24	7.4
Stress	−0.48	−.117	−0.67	−0.30	0.06	0.69	8.2
R	.69*						
R^2	.47						
Adjusted R^2	.39						
F	6.03*						
df	(5, 33)						

Unique variability=27%; shared variability=20%.
The four independent variables contributed another .20 in shared variability to the prediction of safety behaviors. Altogether, 47% (adjusted R^2=39.2) of the variability in safety behaviors was predicted by knowing the scores on the four independent variables.
RW=relative weights (the relative importance of the predictors while taking shared variance into account). R^2 was partitioned into percentages using relative weights. sr^2=Unique variance in safety behaviors accounted for uniquely by each independent variable.
* P<.001.

Table 2
Intercorrelations for sleep-related behaviors, DBAS, ISI, depression, anxiety, and stress

Variables	SRBQ	DBAS	ISI	Depression	Anxiety	Stress
SRBQ	1.00					
DBAS	.49**	1.00				
ISI	.14	.22	1.00			
Depression	.62**	.39**	.07	1.00		
Anxiety	.44**	.57**	.30*	.64**	1.00	
Stress	.33*	.34*	.24	.61**	.64**	1.00

* $P<.05$.
** $P<.01$.

stress scores as independent variables and using SRBQ score as the dependent variable. As seen in Table 1, R (for regression) was significantly different from zero [$F(5, 33)=6.034$, $P<.001$]. Dysfunctional beliefs about sleep and depression contributed significantly to the prediction of safety behaviors, as indicated by the unique variances, relative weights, and β weights displayed in Table 1. Therefore, the hypothesis that dysfunctional beliefs about sleep and depression predict the use of safety behaviors was supported. In contrast, insomnia severity did not predict sleep-related safety behaviors (refer to Table 1).

Pearson correlations were calculated for the complete data set ($N=40$; see Table 2). Inspection of the correlation matrix revealed that DBAS, depression, anxiety, and stress scores were moderately correlated with SRBQ scores. The strongest correlation was between depression and SRBQ scores.

Exploratory analysis

In addition to planned analyses, an exploratory analysis was conducted to investigate the finding that depression was the most significant predictor of sleep-related safety behaviors. A one-way (group) multivariate analysis was conducted; the dependent variables were SRBQ, DBAS, ISI, stress, and anxiety scores. The grouping variable was depression (Group 1=no depression; Group 2=depression; these groups were formed by splitting the data at the median) [43]. SPSS GLM (multiple analysis of variance) was used to conduct the analyses with sequential adjustment for nonorthogonality. There were no univariate or multivariate within-cell outliers at $P<.001$. The results of evaluation of assumptions of normality, homogeneity of variance–covariance matrices, linearity, and multicollinearity were satisfactory [43].

With the use of Pillai's Trace criterion, the combined dependent variable was significantly affected by depression levels [$F(5, 34)=8.051$, $P=.000$; Pillai's Trace=0.54; $\partial\eta^2=0.54$). Multivariate follow-up testing showed that the two depression groups were significantly different. Univariate ANOVA with Tukey post hoc testing using a Bonferroni adjusted $\alpha=.01$ confirmed that the two depression groups differed significantly in terms of: SRBQ [$F(1, 38)=37.31$, $P=.000$], dysfunctional beliefs about sleep [$F(1, 38)=6.46$, $P=.010$], anxiety [$F(1, 38)=9.83$, $P=.003$], and stress [$F(1, 38)=8.65$, $P=.006$] (refer to Table 3).

Discussion

The present study examined whether sleep-related safety behaviors were predicted by insomnia severity, depression, and dysfunctional beliefs about sleep. There was evidence that dysfunctional beliefs about sleep contributed significantly to the prediction of sleep-related safety behaviors. However, the results revealed an unexpected finding. Depression accounted for the greatest amount of unique variance in the prediction of sleep-related safety behaviors, followed by dysfunctional beliefs. Indeed, correlational analysis revealed a strong significant relationship between depression and sleep-related safety behaviors. Results from exploratory analyses indicated that the two depression groups (i.e., participants without depression and participants with depression) differed significantly in terms of their: (1) use of sleep-related safety behaviors and (2) dysfunctional beliefs about sleep. Specifically, participants without depression used significantly fewer safety behaviors and had fewer dysfunctional beliefs about sleep compared to participants with depression. However, there was no significant difference between the two depression groups on the severity of insomnia. In this respect, the present study suggests that depression may need to be considered as an explicit component of cognitive–behavioral models of insomnia. This finding falls short of demonstrating that causal relationships and the amount of variance in safety behaviors explained by the level of depression were not great. Further research is necessary to determine the relative importance of depression in the maintenance of insomnia.

The relationship between dysfunctional beliefs about sleep and sleep-related behaviors was supported. Specifically, high scores on the SRBQ were related to high scores on the DBAS. However, this result needs to be interpreted cautiously until the scale properties of the SRBQ have been empirically supported.

There was no evidence that insomnia severity predicted the use of sleep-related behaviors. One explanation for this

Table 3
Group differences on SRBQ, DBAS, anxiety, and stress for participants without depression ($n=21$) and participants with depression ($n=19$)

Measures	Participants without clinical depression [mean (S.D.)]	Participants with depression [mean (S.D.)]
SRBQ	129.76 (2.93)	155.74[a] (3.08)
DBAS	1118.48 (74.94)	1394.00[a] (78.79)
Anxiety	3.38 (0.90)	7.47[a] (0.95)
Stress	6.33 (0.90)	10.16[a] (0.94)
ISI	9.76 (1.22)	11.47 (1.28)

[a] Significant differences between the groups.

finding could be that participants with insomnia were in the early phases of insomnia onset and had experienced fewer iterations of the insomnia maintenance cycle. Empirical evidence does suggest that insomnia severity increases with age [26]. It is not clear if a different age cohort would produce different results, but it is possible that insomnia severity would predict the use of safety behaviors in an older cohort. It should be noted that two conventional screening measures of insomnia (i.e., PghSD and ISI) were used to assess insomnia severity, and these measures revealed that the sample included participants with and without clinical insomnia. Another explanation is that the sleep-related safety behaviors identified by the SRBQ are not critical to the maintenance of insomnia in this young cohort. Further studies are needed to resolve these issues.

The findings of the present study are tempered by certain limitations. First, the cross-sectional design precludes any assessment of causality between sleep-related safety behaviors, dysfunctional beliefs, and depression. This limitation could be addressed by a longitudinal study. Second, in addition to the limited sample size, there may be a reasonable concern that university students are not representative of the clinical insomnia population [4,26]. However, young adults are a population with likely substantial prevalence and severity of clinical sleep disorders [45–47]. Extant literature typically neglects this important age group [48,49]. A benefit of the age cohort sampled is that it may help to disentangle the debate of whether depression precedes insomnia or whether it is the reverse, because the participants were early in the development of chronic insomnia [42]. A third limitation, which is common to insomnia research, was all variables were measured using self-report. Consequently, recent effects may have produced inflated correlations between safety behaviors and depression. However, it should be noted that the empirical evidence suggests that self-report measures of insomnia are generally highly correlated with objective measures such as PSG [18,41]. As a result, replications of the current study with traditional treatment-seeking patients (i.e., clinical insomniacs), different age cohorts, and a larger sample are necessary.

In conclusion, the current study elaborates on, and is consistent with, previous research into the influence of dysfunctional beliefs about sleep on the use of sleep-related behaviors that are adopted as coping mechanisms in insomnia. Indeed, dysfunctional beliefs about sleep predicted sleep-related safety behaviors. In addition, evidence that depression was the most significant predictor of safety behaviors suggests the possibility of an additional factor for the model of Harvey [3]. Therefore, this study represents a starting point for the generation of more focused research using cognitive–behavioral models to investigate insomnia. This study also provides evidence of the need for further research on the influence of dysfunctional beliefs and safety behaviors on the insomnia maintenance cycle.

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