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Can We Modify Maladaptive Attributions for Fatigue?

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Abstract. Research has shown that those with insomnia focus primarily on their sleep as a cause of daytime fatigue rather than the multitude of other possible causes of fatigue. This can create sleep-related anxiety and further perpetuate the sleep disturbance. In order to lessen the increased focus on sleep, the present study investigated whether people could learn to consider other attributions for fatigue via an information-based manipulation. Undergraduate students ($N = 88$) were randomized to two information groups: They either received information about common factors that could explain daytime fatigue (the fatigue information condition) or received generic sleep-related information (the control condition). Each group was tested pre- and post-intervention. Fatigue information participants were significantly more likely to consider non-sleep-related attributions for fatigue at post-intervention, relative to control participants. These results demonstrate that attributions for fatigue may be amenable to change via an information-based intervention; thus, this research explores a preliminary step toward investigating refinements to insomnia treatments.
Key words: fatigue; insomnia; attributions; psychoeducation

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Insomnia is a highly prevalent disorder associated with considerable personal and societal costs (Edinger & Wohlgemuth, 1999; Ford & Kamerow, 1989; Ohayon, 2002). While it is often associated with night-time pathology, research today suggests that insomnia is a 24-hour disorder (Harvey, 2002; Moul et al., 2002). In fact, among poor sleepers, often the most prominent complaint is the resultant daytime fatigue (Riedel & Lichstein, 2002), which is a feeling of low energy during the daytime that can be caused by a multitude of factors, including poor sleep. To better understand, prevent and treat insomnia, identification of perpetuating factors, both at night and during the day, need further exploration. Research has consistently demonstrated that cognitive and behavioural processes interact with one another to exacerbate the insomnia (Bootzin, 1972; Espie, 2002; Harvey, 2002; Lundh & Broman, 2000; Webb, 1988). With respect to cognitive factors, poor sleepers often endorse a high degree of maladaptive beliefs about sleep, which are considered to be instrumental to the maintenance of the disorder (Carney & Edinger, 2006; Harvey, 2002; Morin, Blais, & Savard, 2002). An example of such a belief is the common notion that people have no control over their sleep, when in fact research has demonstrated that people are able to change their sleep by implementing the appropriate behavioural and cognitive strategies (Morin, 1993). The veracity or rigidity of one's beliefs about sleep can exacerbate sleep-related anxiety and further reduce the likelihood of obtaining a good night's sleep (Harvey, 2002). Thus, unhelpful beliefs about sleep are one type of mechanism that may work to further maintain the insomnia.

Attributions are a specific type of belief that too can work to perpetuate insomnia when used in an unhelpful manner (Morin, Stone, Trinkle, Mercer, & Remsberg, 1993). Many attributions concern functioning in the daytime, and how it relates to the previous night's

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sleep. For example, poor sleepers may *attribute* their daytime fatigue to the fact that they did not sleep well the night before. Indeed, research has begun to show that individuals with sleep disturbances often believe that fatigue is solely due to poor sleep (Morin et al., 1993). Regardless of the accuracy of these attributions, holding such attributions can have deleterious consequences for poor sleepers. For example, if negative daytime experiences are exclusively, or incorrectly attributed to poor sleep, it increases pressure to sleep well (i.e., to avoid further negative experiences during the day), and consequently reinforces anxiety in the pre-sleep period. Indeed, recent theoretical models agree that misattributions are significant precursors of heightened cognitive arousal and thus play an influential role in perpetuating the insomnia (Espie, 2002; Lundh & Broman, 2000).

To date, only preliminary research has examined the role of attributions for fatigue in the context of insomnia. Nevertheless, the Chronic Fatigue Syndrome (CFS) literature has looked at fatigue attributions among those suffering from this illness. In particular, this research has explored whether CFS patients are more likely to make attributions of their fatigue to somatic versus psychological factors. Several studies have found that there is an increased tendency for CFS patients to attribute their fatigue to physical factors (Butler, Chalder, & Wessely, 2001; Clements, Sharpe, Simpkin, Borrill, & Hawton, 1997), and there is some discussion as to whether this attributional tendency leads to the exacerbation of CFS (Butler et al., 2001; Chalder, Power, & Wessely, 1996). Thus, given that fatigue attributions may play a role in how patients experience CFS, and given the high rate of comorbidity among CFS and sleep disturbance (Abdel-Khalek, 2009; Unger et al., 2004), perhaps these fatigue attributions could play an important role in insomnia as well.

As previously stated, research in insomnia has begun to show that individuals struggling with their sleep often believe that fatigue is solely due to poor sleep, that is, they tend to *attribute* their fatigue exclusively to their poor sleep (Morin et al., 1993). While this is a plausible explanation, there are a many additional, non-sleep-related reasons for experiencing fatigue throughout the day. Some examples include (1) boredom and low stimulation (Grandjean, 1979), (2) physical under- or over-activity (Puetz, O'Connor, & Dishman, 2006), (3) illnesses such as a virus or anaemia (Sobrero et al., 2001), (4) caffeine withdrawal (Juliano & Griffiths, 2004), and (5) low blood sugar levels and poor diet (Newsholme, Blomstrand, & Ekbolm, 1992). Nevertheless, poor sleepers tend to ignore these other causes of fatigue and focus exclusively on sleep as an explanation for their tiredness. For example, Morin et al. (1993) found that individuals with insomnia made stronger attributions of mood disturbance and low energy to poor sleep than did good sleepers. Further, they found that good sleepers disagreed with the statement, "one can hardly function during the day without a good night's sleep" more strongly relative to poor sleepers. Other researchers agree that people with insomnia tend to misattribute daytime symptoms to sleep more often than do those without sleep disturbances (Carney & Edinger, 2006; Espie, 2002).

When considering these research findings, it is important to understand why people with insomnia are more likely to attribute fatigue exclusively to poor sleep and what the consequences are of these mis- or over-attributions. Harvey (2002) suggests that as a result of chronic sleep difficulty, those with insomnia tend to focus their attention on sleep, which often leads them to monitor for sleep-related threats both during the night and in the daytime. In this sense, fatigue can be considered a sleep-related threat that occurs during the daytime. In the context of a preoccupation with sleep, the fatigue will likely be attributed to poor sleep, rather than the other myriad of possibilities. This process of attributing fatigue solely to a poor night's sleep will again lead to negative cognitive activity related to sleep, and as a result, they feel pressured to sleep better in order to overcome their daytime fatigue problems (Harvey, 2002). As such, efforts to fall asleep at night are increased, which, as the literature has demonstrated, increases the likelihood of the problem persisting (Broomfield & Espie, 2005; Espie, 2002).

In light of theoretical models (e.g., Espie, 2002; Harvey, 2002) which suggest that attentional bias towards sleep-threatening

factors, including attending to poor sleep as the exclusive cause of fatigue, could perpetuate insomnia, it might be important for poor sleepers to attend to other potential explanations for daytime fatigue. Doing so may reduce anxiety about sleep and decrease the likelihood of further maintaining the insomnia. Thus, the purpose of this study was to determine whether presenting alternative explanations for fatigue, via a brief psychoeducation intervention, would increase the likelihood that participants would attribute their day-to-day experiences of fatigue to reasons other than sleep. To answer this research question, participants were randomized to either a fatigue information (FI) group or a control information (control) group. Participants in the FI group were given information related to possible causes of fatigue, whereas the control group was provided with information related to sleep but unrelated to the causes of fatigue. Attributional change was determined via pre- and post-intervention outcome measures designed for the purpose of this study, which were as follows: (1) a participant-generated list of attributions that account for them feeling tired, (2) a ranking of the frequency (i.e., in accounting for their fatigue) of the participant-generated attributions and (3) the participants' rating of the likelihood that each of these participant-generated factors contributes to their fatigue. In order to determine whether participants could adopt other non-sleep-related attributions for fatigue via a brief information intervention, the following hypotheses were proposed: (1) the number of generated sleep-related attributions for feeling tired during the day, relative to non-sleep-related attributions, in the list of attributions task, would decrease for those in the FI condition only; (2) the rank and proportion allotted to sleep-related attributions, relative to non-sleep-related attributions, in the generated list would decrease after FI. In order to determine whether the two groups differed on any important variables pre-treatment, we assessed baseline levels of fatigue, insomnia, depression and maladaptive beliefs about sleep.

We opted to test this intervention in undergraduate students because attributional errors are expected to exist on a continuum, and this group would have a range of sleep symptom severity. Selecting those with a range of sleep quality as a first step towards understanding a particular construct or manipulation has been argued successfully by Harvey and colleagues (Ree, Pollitt, & Harvey, 2006); this approach is also well established in other areas such as depression (Flett, Vredenburg, & Krames, 1997) and anxiety (Stopa & Clark, 2001). Additionally, undergraduate students are a uniquely vulnerable population, particularly with respect to the development of an insomnia diagnosis (Buboltz, Brown, & Soper, 2001; Coren, 1994). Several studies have shown that this group has increased stress levels, irregular sleep–wake schedules and sleep that can range from insomnia symptoms to an insomnia disorder (Carney, Edinger, Meyer, Lindman, & Istre, 2006; Verlander, Benedict, & Hanson, 1999). Such characteristics make this group an ideal population for a pilot intervention.

Method

Design

This study used a randomized 2 × 2 experimental design with one between-subject variable (FI and control groups) and "time" as the within-subject variable (pre- and post-intervention). In this design, an interaction between condition and time was expected. That is, the study hypotheses predicted that attributional change on the dependent variables would occur between pre- and post-intervention for the FI group, but not for the control group. The study procedures were completed within a 1-hour testing session.

Participants

Participants were undergraduate students enrolled in an introductory psychology course at Ryerson University. The students were recruited via the psychology department's online recruitment system, whereby participants were asked if they were interested in participating in a study about their thoughts about fatigue. Students who were interested in this study volunteered to participate in partial fulfilment of their introductory psychology course requirement. All students enrolled in introductory psychology were eligible to participate. Five participants' data were not included in the analyses. Two participants were younger than 18 years and thus their data

was not used, one participant did not complete the demographic information, and two participants did not complete the outcome measures in a way that would allow us to obtain a total score. After excluding these participants' data, the final sample consisted of 88 participants, aged 18–38 years ($M = 20$, $SD = 4.3$). There were 44 participants in each group. Participant demographics are presented in Table 1.

Self-Report Measures

The Insomnia Severity Index (ISI; Morin, 1993). The ISI is the recommended self-report measure for assessing insomnia (Buysse, Ancoli-Israel, Edinger, Lichstein, & Morin, 2006). It is a 7-item scale assessing the severity of insomnia, which is measured on a 5-point Likert scale ranging from 0 (*not at all*) to 5 (*extremely*). Total scores range from 0 to 28, with higher scores suggesting increased insomnia severity. The ISI has been found to have good internal consistency (alphas range from .74 to .90) and good concurrent validity, as it correlates with sleep diary measures and polysomnography (Bastien, Vallieres, & Morin, 2001; Morin, Belleville, Belanger, & Ivers, 2011).

The Multidimensional Fatigue Inventory (MFI; Smets, Garssen, Bonke, & De Haes, 1995). The MFI is a 20-item scale that assesses various dimensions of fatigue, including general, physical, mental, reduced motivation and reduced activity. These five dimensions represent distinct subscales of the MFI, each of which contains four items. Responses range on a 5-point scale from *yes that is true* to *no that is not true*. The MFI has good internal validity (Cronbach's alpha = .84) and adequate convergent validity, as was demonstrated by correlations between the MFI and Visual Analog Scales measuring fatigue (Smets et al., 1995). The MFI has been used in insomnia populations with breast cancer (Quesnel, Savard, Simard, Ivers, & Morin, 2003) and with comorbid alcohol dependence (Arnedt et al., 2007). The present study used the General Fatigue subscale (GF) as the primary measure of fatigue, which is recommended when using only one subscale in insomnia research (Buysse et al., 2006). This subscale contains 4 items, with possible scores ranging from 4 to 20 (Smets et al., 1995).

The Dysfunctional Beliefs and Attitudes About Sleep Scale (DBAS-16; Morin, Vallieres, & Ivers, 2007). The DBAS-16 is a self-report measure assessing unhelpful sleep-related beliefs, including beliefs about the consequences of insomnia, worry about sleep, sleep expectations, and causal attributions for insomnia. The individual rates his/her level of agreement with each statement on a 10-point scale ranging from 0 (*strongly disagree*) to 10 (*strongly agree*). The total score is obtained via a mean item score, with higher mean scores representing more maladaptive sleep beliefs. The DBAS-16 demonstrates adequate internal consistency (Cronbach's alpha = .79) and has appropriate convergent validity with the ISI, sleep diaries and polysomnography (Morin et al., 2007). It can also effectively discriminate between those who do and do not have clinical levels of unhelpful sleep beliefs via a cut-off score of 3.8, which maximized both sensitivity (80%) and specificity (76%) based on an ROC curve analysis (Carney et al., 2010).

The Beck Depression Inventory, Second Edition (BDI-II; Beck, Steer, & Brown, 1996). The BDI-II is a 21-item measure that assesses common depressive symptoms, such as depressed mood, hopelessness, suicidal ideation, sleep disturbance, and appetite change. Total scores range from 0 to 63, with higher scores representing greater levels of depression. The BDI-II has very good internal consistency (split half Pearson = .93) and is correlated with similar measures of depression, such as the Hamilton Rating Scale for Depression ($r = .71$; Beck et al., 1996). It also

Table 1. *Participant demographics*

	Proportion (%)
Sex	
Female	81.6
Male	18.4
Age	
M (*SD*)	20.0 (4.3)
Range	18–38
Ethnicity	
Caucasian	34.1
Asian	31.8
Black	9.1
Middle-Eastern	3.4
Aboriginal	2.3
Other	19.3

has well-established content validity and is good at differentiating between depressed and non-depressed individuals (Beck et al., 1996; Richter, Werner, Heerlein, Kraus, & Sauer, 1998). The psychometric properties of the BDI-II have been investigated previously in insomnia patients (Carney, Ulmer, Edinger, Krystal, & Knauss, 2009).

Outcome measure

List of attributions task (LAT). Participants were instructed to fill in a chart representing their attributions for fatigue, which was developed for the purposes of this study. (See Figure 1 for an example of a completed LAT form.) In the first column, participants were asked to list factors that could account for them feeling tired during the day. The purpose of this list was to determine whether the attributions were related or unrelated to sleep. To this end, the data were coded according to sleep-related versus non-sleep-related attribution categories. In the example provided, "not enough sleep" would be coded as a sleep-related attribution, whereas "busy day", "did not eat breakfast" and "stressed out" would be coded as non-sleep-related attributions. In order to come up with a single aggregate score for each participant, the number of attributions in each category (i.e., sleep-related and non-sleep-related) were added together for both pre- and post-intervention. The score was computed by dividing the number of sleep-related attributions by the total number of attributions, producing a score that represents the proportion of sleep-related attributions. This score will be subsequently referred to as NumberAttributionScore.

In the second column, participants rank ordered each listed attribution in order of frequency of occurrence, by assigning a rank of 1 to the factor that accounts for their fatigue most *often*. The rankings were scored in such a way that each rank would get a score from 1 to 10, with a score of 10 representing the highest ranked attribution and a score of 1 representing the lowest ranked attributions (i.e., a rank of 1 was given a score of 10 and a rank of 2 was given a score of 9). This scoring system allowed for sufficient variability of scores, as most participants did not list more than 10 attributions. The resulting scores for the sleep-related attributions were then added together to compute an aggregate score representing the frequency with which sleep-related attributions account for their fatigue. This variable will be referred to as FrequencyScore.

In the third column, participants were asked to indicate the likelihood that each factor accounts for their fatigue. To this end, participants were able to allocate a specific proportion (out of 100%) to each attribution, with allocating a greater proportion to those factors that were considered to be more *important* or more *likely* in accounting for their fatigue. The aggregate score was computed in the same manner as was done in the first column: The total proportion for sleep-related items was divided by the total proportion for all attributions in order to retrieve a single score, which will be referred to as ImportanceScore.

Intervention materials

Fatigue information (FI) intervention. The FI intervention consisted of a sheet containing information regarding common factors that can explain feeling fatigued during the day. This information was obtained from several studies throughout the literature examining common causes of fatigue (e.g., Dinges, 1989; Grandjean, 1979; Juliano & Griffiths, 2004; Newsholme et al., 1992; Puetz et al., 2006; Sobrero et al., 2001). Some examples include caffeine rebound, boredom, physical inactivity and post-lunch changes in body temperature.

What factors account for my feeling tired?	Rank in order of frequency	Likelihood (0–100%) that this factor accounts for you feeling tired?
Busy day	*1*	*90%*
Not enough sleep	*2*	*75%*
Didn't eat breakfast	*3*	*75%*
Stressed out	*4*	*40%*

Figure 1. Sample responses to list of attributions task.

Along with each listed factor was a short blurb explaining how fatigue can be caused by that particular factor.

Sleep control (control) intervention. The control intervention consisted of a comparable amount of information to the FI condition; however, the information was about sleep and unrelated to the causes of fatigue. For example, this information session included information regarding sleep stages. The control condition was necessary to control for the amount of time and sleep-related information inherent in the FI condition, but there should not have been any reason for the control group to alter their subsequent fatigue attributions or VAS ratings on the basis of the sleep information.

Procedure

Participants completed this study in a 1-hour session in the Sleep and Depression Laboratory at 105 Bond Street, Ryerson University. To determine which information session they would receive, a Microsoft Excel random number generator was used to randomize participants into the two conditions. First, all participants completed the baseline measures, including the self-report questionnaires (ISI, MFI, DBAS-16 and BDI-II) and outcome measure (LAT), and then received information either about reasons for fatigue (FI condition) or about generic sleep (control condition). The study investigator read the information sheet alongside each participant individually, after which all of the participants once again filled out the LAT. Once the participants completed the study, they were debriefed and had the opportunity to ask the researcher any further questions regarding the study.

The written responses on the LAT were coded into either sleep-related or non-sleep-related attribution categories by a laboratory volunteer, who had a BA in psychology and who was blind to the study hypotheses. The study investigator then reviewed the categories while being blind to participants' random assignment to ensure that there was agreement. Responses on which there was discrepancy between the laboratory volunteer and the study investigator were flagged and were discussed. The majority of such items were responses that identified environmental issues related to sleep, such as "uncomfortable bed" or "loud roommate during the night". It was decided that these responses would fall under the category of "sleep-related attributions", given that they would interfere with sleep. In total, only 12 responses out of 870 were changed, representing 1.38% of all item responses in the database. Once the attributions were coded into the appropriate categories, aggregate scores for the dependent variables on the LAT were created in order to test the study hypotheses.

Analyses

Independent *t* tests and chi-square analyses were used to assess for any pre-existing group differences between those in the FI and the control group. For the main analyses, mixed within-between analyses of variance (ANOVAs) were conducted to determine whether participants' attributions for fatigue, based on the LAT, changed from pre- to post-intervention for those in FI relative to the control group. In each of the main analyses, the hypothesis was that there would be a significant group × time interaction, that is, the FI group would alter their post-treatment cognitive responses in the hypothesized direction, whereas the control group would not change their responses significantly.

Results

Participant demographic characteristics, mean scores and estimates of internal consistency (i.e., Cronbach's alpha) for the self-report questionnaires are displayed in Tables 1 and 2, respectively. As demonstrated in Table 2, the mean scores for the ISI, BDI-II and DBAS-16 in this sample were at or above the mild

Table 2. *Means, standard deviations and Cronbach's alphas for pre-intervention scores*

Self-report measures	*M*	*SD*	*Cronbach's α*
ISI	9.98	4.71	.80
MFI-GF	13.28	3.53	.89
DBAS-16	4.91	1.6	.85
BDI-II	14.69	9.32	.89

Note. *ISI, Insomnia Severity Index; MFI-GF, Multidimensional Fatigue Inventory General Fatigue Subscale; DBAS-16, Dysfunctional Beliefs and Attitudes about Sleep Scale; BDI-II, Beck Depression Inventory.*

clinical cut-offs as per the guidelines suggested in the literature (Morin et al., 2011; Beck et al., 1996; Carney et al., 2010). While there is no published clinical cut-off for the MFI, the mean fatigue level at baseline was 13.28, which is commensurate with the mean level of general fatigue among insomnia patients (i.e., 13.2) reported in Buysse et al. (2006).

The FI and control groups did not differ significantly with respect to age [$t\,(86) = -.89$, $p = .38$] or ethnicity [$\chi^2\,(1) = 1.20$, $p = .88$]. There were equal numbers of men and women in each group. No significant pre-intervention group differences were found on levels of insomnia, fatigue, depressed mood or dysfunctional beliefs about sleep. There were also no significant group differences on the LAT outcome measures at baseline. Because there were no pre-existing group differences, no covariance analyses were conducted.

The mixed between-within subjects ANOVA results are as follows: For NumberAttributionScore, there was a significant interaction between group and time [F (1, 86) = 5.17, $p = .026$] such that the number of sleep attributions relative to the total number of attributions decreased for those in FI (pre: $M = .32$, $SD = .23$; post: $M = .23$, $SD = .22$), but not for those in the control group, (pre: $M = .29$, $SD = .25$; post: $M = .31$, $SD = .26$) (see Figure 2). There was no main effect of group or of time. With regard to FrequencyScore, there was a significant interaction between group and time [F (1, 86) = 10.68, $p = .002$] (see Figure 3). Thus, the rankings of how frequently sleep-related attributions contribute to daytime fatigue significantly decreased for the FI group (pre: $M = 13.22$, $SD = 9.54$; post: $M = 8.66$, $SD = 7.50$), whereas no significant changes were found in the control group (pre: $M = 11.80$, $SD = 9.73$; post: $M = 12.32$, $SD = 10.28$). There was also a significant main effect of time [$F\,(1, 86) = 6.75$, $p = .01$] and no main effect for group. Finally, a significant interaction was found for ImportanceScore [F (1, 86) = 5.02, $p = .028$] such that compared to the control group (pre: $M = .35$, $SD = .29$; post: $M = .35$, $SD = .31$), the proportion of importance allotted to sleep-related attributions relative to the total proportion significantly decreased at post-intervention for those in the FI group (pre: $M = .39$, $SD = .28$; post: $M = .27$, $SD = .25$) (see Figure 4). There was a significant main effect of time [$F\,(1, 86) = 6.76$, $p = .02$] and no main effect for group.

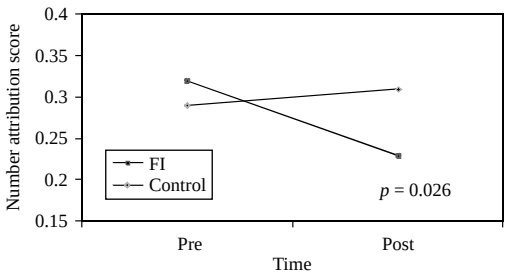

Figure 2. Number of sleep-related attributions relative to the total number of attributions for FI and control at pre- and post-intervention.

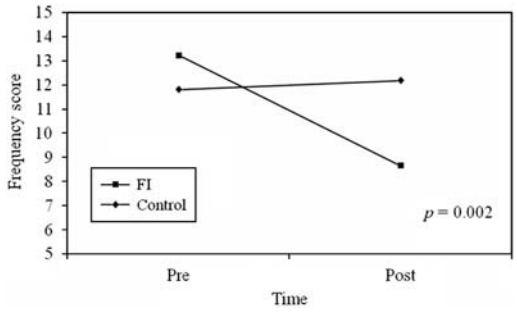

Figure 3. Rank scores of sleep-related attributions for fatigue information (FI) and control at pre- and post-intervention.

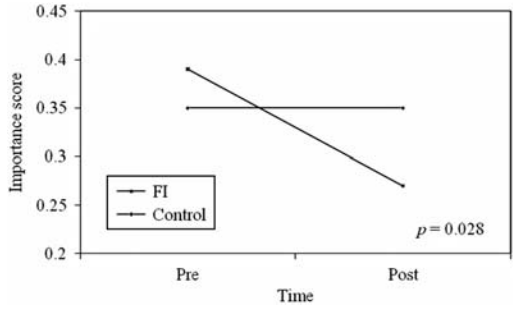

Figure 4. Proportion of importance allotted to sleep-related attributions relative to total proportion for fatigue information (FI) and control at pre- and post-intervention.

Discussion

The findings demonstrated that educating people about the many causes of daytime

fatigue was successful in broadening their scope of non-sleep-related fatigue attributions; in contrast, those learning about sleep did not consider reasons other than sleep. Participants who were provided with fatigue-related information made a lower number of sleep-related attributions and a greater number of non-sleep-related attributions at post-intervention. Furthermore, the significant time × group interaction for the frequency and proportion of importance scores suggests that those who received information about the causes of fatigue were less likely to consider sleep-related attributions as the more common or more important causes of fatigue. Taken together, the expected findings for the primary hypotheses suggest that the minimal cognitive intervention used in this study was sufficient to create a change in people's reported attributions for their daytime fatigue.

Even though this is merely a preliminary step in testing an attribution intervention, there are several possible treatment implications that can be drawn from the study findings. While cognitive behavioural therapy (CBT) for insomnia addresses maladaptive sleep beliefs, unhelpful attributions for daytime fatigue currently is not an important target of treatment. However, the study findings demonstrated that misattributions of fatigue to poor sleep are amenable to change with a minimal psychoeducational intervention. Given that attributing fatigue exclusively to poor sleep could increase sleep-related preoccupation and anxiety (Espie, 2002; Harvey, 2002; Lundh & Broman, 2000), this type of intervention may prove to be a helpful component within CBT. Indeed, as this intervention was conceived as a minimal psychoeducational manipulation, future research that tests this intervention in clinical groups could determine whether this is a worthwhile adjunct to CBT for insomnia.

Cognitive studies inevitably raise the issue of whether cognitive phenomena, such as maladaptive attributions, are an epiphenomenon of insomnia, such that these maladaptive beliefs are a simple consequence of the sleep problem and do not warrant treatment of their own. This study cannot resolve such a philosophical issue. However, previous studies have demonstrated that maladaptive sleep beliefs improve with belief-targeted CBT for insomnia to a significantly greater extent than they do with pharmacotherapy (Morin et al., 2002) or non-belief-targeted behavioural therapy (Carney & Edinger, 2006). Furthermore, these studies have shown that decreases in maladaptive sleep beliefs from pre- to post-treatment were associated with clinically relevant improvements in other sleep indices. Taken together, these findings suggest that unhelpful beliefs about sleep are likely not merely a by-product of poor sleep and may warrant their own attention with respect to both research and treatment.

This study has several limitations. Before thinking of the applications of these results to clinical groups, this intervention would need to be tested in a sample diagnosed with insomnia. However, although the sample in the current study consisted of undergraduate students, their mean scores on the self-report inventories suggested some impairment in these areas. In particular, the sample's mean scores for the ISI and DBAS-16 were at or above the suggested cut-offs for sleep disturbance and maladaptive beliefs, respectively (Morin et al., 2011; Carney et al., 2010). Indeed, research has shown that scores on the ISI and DBAS can effectively discriminate among young adults with and without diagnoses of insomnia (Smith & Trinder, 2001). Furthermore, undergraduate students are particularly vulnerable to insomnia and sleep is often adversely affected during the transition to university (Buboltz et al., 2001; Carney et al., 2006; Coren, 1994; Verlander et al., 1999). Thus, these findings suggest that this sample shares some characteristics with a clinical population. However, it is also possible that the online recruitment description of this study, which described the research as examining thoughts about fatigue, may have appealed to students specifically with fatigue or sleep disturbances. In either case, future studies, using diagnostic tools, are necessary to evaluate whether the results would be obtained in a carefully characterized clinical sample.

Another potential limitation of this study was the cross-sectional nature and brevity of the experiment. A longitudinal study design (e.g., follow-up period of 1–3 months) would have provided more information as to whether the attributional changes are maintained in the

FI group as well as how the control group evolved over time. A longer testing interval may have permitted greater consolidation of the material and would have reduced the likelihood of participants remembering what they wrote in the pre-intervention LAT measure.

In a similar vein, it is also possible that demand characteristics or priming played a role in FI participants' post-intervention responses on the LAT. Given the nature of this study's pre–post intervention design, the information-based intervention may have influenced participants to respond in a certain manner. Indeed, previous studies examining levels of maladaptive sleep beliefs before and after psychoeducation also acknowledged the possibility that implicit expectations could have played a role in participants decrease in such beliefs (e.g., Carney & Edinger, 2006). However, it is important to note that the LAT specifically instructed the participants to focus on themselves when listing their fatigue attributions. That is, the participants were told to list possible attributions related to their personal experiences with fatigue, rather than people's fatigue in general. Although participants in FI may have been primed to consider non-sleep causes of fatigue, the same can be said about the control condition which provided information about sleep. That is, those who received psychoeducation about sleep may have been primed to list more sleep-related attributions. However, the results clearly show that there were no significant pre–post differences in the control group; thus, it appears unlikely that priming would have significantly affected the attributional change in the FI group.

Given that disturbed sleep is the number one rated health problem facing people (Canals, Domenech, Carbajo, & Blade, 1997), maximizing the effectiveness of interventions is critically important work. While this study represents the first step towards possible refinements, establishing whether the inclusion of attribution-targeted interventions into CBT can improve treatment response rates is an important and long-term goal of this research. To this end, the promising findings of the present study revealed that people can learn to broaden their scope of fatigue attributions via a minimal cognitive-based intervention. In establishing that these cognitions are amenable to change, this study's findings are both important and necessary in order to inform future research whose end-goal is to improve treatment response and refine our treatments for insomnia.

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