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Individuals with clinically significant insomnia symptoms are characterised by a negative sleep-related expectancy bias: Results from a cognitive-experimental assessment

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ABSTRACT

Cognitive models of insomnia consistently suggest that negative expectations regarding the consequences of poor sleep contribute to the maintenance of insomnia. To date, however, no research has sought to determine whether insomnia is indeed characterised by such a negative sleep-related expectancy bias, using objective cognitive assessment tasks which are more immune to response biases than questionnaire assessments. Therefore, the current study employed a reaction-time task assessing biased expectations among a group with clinically significant insomnia symptoms (n = 30) and a low insomnia symptoms group (n = 40). The task involved the presentation of scenarios describing the consequences of poor sleep, and non-sleep related activities, which could be resolved in a benign or a negative manner. The results demonstrated that the high insomnia symptoms group were disproportionately fast to resolve sleep-related scenarios in line with negative outcomes, as compared to benign outcomes, relative to the low insomnia symptoms group. The two groups did not differ in their pattern of resolving non-sleep related scenarios. This pattern of findings is entirely consistent with a sleep-specific expectancy bias operating in individuals with clinically significant insomnia symptoms, and highlights the potential of cognitive-experimental assessment tasks to objectively index patterns of biased cognition in insomnia.

An estimated 10%–33% of the population experience symptoms of insomnia at any given point in time (Bartlett, Marshall, Williams, & Grunstein, 2008; Lack, Miller, & Turner, 1988; Olson, 1996). Poor sleep is often accompanied by undesirable symptoms such as daytime fatigue, decreased alertness and concentration, poor memory, lack of motivation or emotional disturbances (Orzel-Gryglewska, 2010). Individuals who experience chronic sleep problems are known to be at an increased risk of developing numerous psychological and physiological conditions. For example, those with insomnia are twice as likely to develop depression (Baglioni et al., 2011), and are at an increased risk of poor physical health (Cheng, Pillai, Mengel, Roth, & Drake, 2015). It is therefore unsurprising that the financial burden of insomnia is extremely high; a conservative estimate placed the direct insomnia-related costs in the United States alone at between $30 to US$35 billion per year (Walsh & Engelhardt, 1999) with the more substantial indirect costs (e.g. physical health, accident risk, diminished workplace performance) bringing this estimate closer to $100 billion (Wickwire, Shaya, & Scharf, 2016). However, despite the significant burden to individuals and society more generally, the factors that underlie the development and maintenance of insomnia remain poorly understood, underscoring the need to enhance current knowledge regarding the mechanisms that underpin insomnia (Morin et al., 2015).

Cognitive models consistently implicate the role of information processing biases in the maintenance of insomnia (Espie, Broomfield, MacMahon, Macphee, & Taylor, 2006; Harvey, 2002). While there has been a key focus on the role of biased attention to sleep-related negative information in recent years (Harris et al.,

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2015), such models also emphasise the role of biased expectations regarding the negative consequences of poor sleep. For example, Harvey's (2002) cognitive model of insomnia describes a cycle involving dysfunctional patterns of cognition, triggering an autonomic response that heightens arousal and anxiety leading to disruption in sleep onset and/or maintenance. In particular, the model proposes that negative cognitions (operating both during the day and immediately preceding sleep) concerning the negative daytime consequences of poor sleep can serve to elevate cognitive and physiological arousal and interfere with sleep onset and quality (Harvey, 2002). This model therefore clearly emphasises the influence of negatively biased expectations regarding the outcome of poor sleep as a maintaining factor for insomnia.

Other models, such Espie et al.'s (2006) attention-intention model, which place greater emphasis on biased attention in insomnia, also acknowledge the potential role of biased expectations regarding the consequences of poor sleep. This has been informed by past findings revealing that the content of pre-sleep cognitions among individuals with elevated insomnia symptoms is consistently characterised by a focus on the anticipated consequences of disrupted sleep, which in turn is associated with longer duration to attain sleep onset (Wicklow & Espie, 2000). This focus on biased expectancies is also reflected in many measures employed in insomnia research. For example, the Dysfunctional Beliefs and Attitudes about Sleep scale (DBAS; Morin, Vallières, & Ivers, 2007) includes items such as: "After a poor night's sleep, I know that it will interfere with my daily activities on the next day" (Item 5).

Despite the apparent consensus about the role of negative expectancies in insomnia, we are aware of no research that has sought to confirm the presence of such a bias among individuals with clinically significant sleep difficulties using an objective cognitive assessment task. Computerised assessments can offer an objective method of evaluating the presence of cognitive biases in insomnia (Espie et al., 2006), and carry the advantage of being comparatively immune to response bias compared to self-report instruments (MacLeod, 1993). These tools can therefore also be useful in providing objective outcome assessments of interventions that seek to specifically target such cognitive processes. Thus, it is crucial to determine whether the self-reported presence of such a bias among individuals with sleep difficulties genuinely reflects the tendency to spontaneously generate negative expectations regarding the negative consequences of poor sleep.

While no other research we are aware of has sought to directly examine the presence of sleep-specific biased expectations in insomnia, two previous studies have employed computerised cognitive assessment tasks to assess the presence of biased interpretation in insomnia. Ree, Pollit, and Harvey (2006) initially examined whether poor sleepers showed a general, or sleep-specific negative interpretive bias compared to good sleepers. They presented participants with a number of ambiguous scenarios, half of which had an insomnia consistent interpretation, the other half could have been interpreted in a generally negative or benign (sleep-unrelated) manner. The presentation of the scenario was followed by an open-ended response where participants were asked to write down what they thought the sentence was describing, which was then followed by the presentation of two possible interpretations of the sentence. For example the sentence "Angela worried about how she would make it to work the following day" could be followed by "Angela is exhausted vs. Angela had a problem with her car" (Ree, Pollit & Harvey, 2006, p. 1360). This study found that the poor sleepers tended to make more negative interpretations overall, but did not show any specific tendency to make more sleep-related interpretations compared to the good sleepers.

Acknowledging the potential for the original task to be influenced by response bias, in a follow-up study, Ree and Harvey (2006) implemented a response-time variant of the scenario task. In this task, ambiguous scenarios (potentially sleep-relevant and sleep-irrelevant) were followed by a word or non-word to which they were required to perform a lexical decision to index the relative primed meaning of different interpretations. For example, the scenario "Rosemary tried to disguise the size of her bags" could be followed by the word "shopping" (insomnia-unrelated interpretation) or "eyes" (insomnia-related interpretation; Ree & Harvey, 2006, p. 252). The results of this study again indicated that while current sleepiness was associated with the general tendency to impose more negative interpretations, there was no specific tendency for individuals with insomnia to impose sleep-related interpretations.

Of relevance to these findings, while models of insomnia consistently implicate the role of biased expectations in the maintenance of sleep problems, it appears that there is comparatively little emphasis on biased interpretation (Espie et al., 2006; Harvey, 2002). This contrasts with models of anxiety which consistently emphasise a role of biased interpretation favouring negative resolutions of ambiguity (Williams, Watts, MacLeod, & Mathews, 1997). While interpretations involve resolving current emotionally ambiguous information in a negative or benign manner, biased expectations in contrast focus specifically on the future likelihood of negative or benign outcomes. Critically, neither Ree and Harvey (2006) or Ree et al. (2006) included a measure of biased expectations. As such, the absence of sleep-specific biased interpretations among poor sleepers in these previous studies could implicate alternative cognitive processes, such as biased expectations operating in insomnia.

As such, the primary aim of the current study was to determine the presence of biased expectations regarding the negative consequences of poor sleep among individuals with elevated levels of insomnia symptoms in comparison to good sleepers. Given the past findings of Ree and Harvey (2006) and Ree et al. (2006), in addition to the co-occurrence of anxiety and mood problems among individuals who experience sleep difficulties, it is also important to establish the relative specificity of biased expectancies. That is, whether individuals with clinically significant insomnia symptoms show biased expectations toward negative outcomes for a range of scenarios, or whether this is restricted to situations involving poor sleep in particular. Thus, the secondary aim of the current study was to determine if any pattern of biased expectations for negative outcomes represents a general tendency versus a specific sleep-related pattern of cognition held by individuals with clinically significant insomnia symptoms.

In order to achieve these key aims, we created a task capable of indexing expectancy bias for sleep specific and general information. This task used multiple trials depicting situations where the future probability of a negative or benign outcome is initially indeterminate, before then assessing the relative ease with which individuals can resolve scenarios depicting benign over negative outcomes. To achieve this, we employed an adapted version of Mathews and Mackintosh's (2000) interpretive bias assessment task. In this task, participants are presented with an initial sentence, which is concluded with a word fragment that when resolved renders the scenario negative or positive. For the current study we created scenarios that focus on the potential consequences of poor sleep, in addition to a number of more general scenarios, which could either be resolved in a benign or negative manner. For example the scenario: "If I don't get enough sleep tonight, tomorrow my mind will be …", could be followed by the word fragment 'fu_zy' (fuzzy—negative resolution) or 'f_nct_onal' (functional—benign resolution). Individuals with a more negative expectancy bias would be