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Daytime intrusive thoughts and subjective insomnia symptoms

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ABSTRACT

Insomnia is increasingly recognised as a 24 h complaint that is associated with an increased risk of mood and anxiety disorders. However, the effects of insomnia symptoms on maladaptive daytime patterns of thinking are poorly understood. We examined the relationship between subjective insomnia symptoms, attentional control and negative thought intrusions during daytime in a large sample of undergraduates experiencing poor sleep. A total of 109 participants completed self-report measures of sleep quality, current sleepiness, anxiety and attentional control. A behavioural measure of intrusive thought required participants to control their attention during two focus periods separated by a 5 min period of self-referential worry. Thought intrusions were sampled throughout the pre- and post-worry periods. Perceived insomnia severity was associated with the reduced ability to focus attention and uniquely associated with increased negative thought intrusions in the pre-worry period. These results support suggestions that acute episodes of poor sleep can dysregulate key networks involved in attentional control and emotion regulation, and that promote negative cognitive activity.

1. Introduction

Historically, insomnia has been characterised as "the result of an inability to turn off intrusive, affectively-laden thoughts and images at bedtime" (Borkovec et al., 1983, p. 9). Whilst this definition captures the important nocturnal aspect of insomnia, the evidence base for parallel daytime processes is increasing, and supports the reconceptualisation of insomnia as a '24 h disorder' (American Academy of Sleep Medicine, 2005; American Psychiatric Association, 1994). Worrisome thought is a central feature of several models of insomnia maintenance (e.g. Espie, 2002; Harvey, 2002; Lundh and Broman, 2000; Morin, 1993) and involves persistent intrusive thought; "spontaneous, unwanted, unbidden, uncontrollable and discrete thoughts attributed to an internal origin" (Rachman, 1981; Wells and Morrison, 1994 cited in Harvey et al. (2005), p. 599). The characteristics and consequences of nocturnal negative cognitive hyperactivity are well known (Harvey, 2002); however the relationship between insomnia symptoms and daytime cognitive hyperactivity (specifically thought intrusions and worry) has not been examined.

It is important to determine whether acute episodes of sleep disturbance are associated with daytime cognitive dysfunction because clarifying the processes involved in the transition from poor sleep to chronic insomnia has been highlighted as a priority in order to improve treatment for the condition (Ellis et al., 2012). Sleep-related worry has been investigated as a process variable within cognitive behavioural therapy for insomnia (CBT-I) which may improve key symptoms (self-reported insomnia severity, total sleep time and wake after sleep onset) (Sunnhed and Jansson-Fröjmark, 2014). However, it is unclear whether more general, intrusive negative cognition is also a feature of insomnia symptoms (which includes sub-clinical levels of poor sleep and concern about daytime function) that should be targeted early on in the complaint. Consistent with evidence that distractibility ('mindwandering') is a dominant predictor of negative affect (Killingsworth and Gilbert, 2010), the experience of poor cognitive control and thought intrusions in poor sleepers might confer risk for comorbid mood and anxiety disorder. Accordingly we investigated the frequency and valence of thought intrusions in a sample of young adults who naturally and markedly vary in their sleep quality.

Young adults are a comparatively neglected population in sleep research yet it has been reliably demonstrated that insomnia symptoms are important in this population and more complex than patterns of (voluntary) sleep restriction associated with lifestyle factors. In Taylor et al. (2013), 33.4% of 1039 students reported insomnia symptoms and a further 9.5% reported chronic insomnia (according to DSM-5 criteria, sleep diaries and self-report measures). Lund et al. (2010) found 60% of 1125 university students were 'poor sleepers' according to the Pittsburgh Sleep Quality Index (PSQI), with academic stress and emotional upheaval the most common causes of sleep trouble (39% and 25% respectively). Stress and tension accounted

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for the most variance in PSQI scores (24%), e.g. 'stress about college' 'racing thoughts' and 'worry about the future', suggesting the importance of thought intrusions and repetitive thought in this population.

We measured the frequency and valence of thought intrusions using an established measure of thought intrusions developed by Ruscio and Borkovec (2004) and adapted by Hirsch et al. (2009). This task has been widely used to examine thought intrusions and worry in non-clinical groups (Krebs et al., 2010), individuals with elevated worry, and generalised anxiety disorder (Hayes et al., 2010; Hirsch et al., 2009). The thought intrusions task measures the occurrence of resting level, spontaneously occurring thoughts which distract from the current task. It further measures the pervasiveness of thought intrusions following a period of active worry on a topic chosen by the participant. This paradigm overcomes limitations associated with self-report questionnaires that ask participants to retrospectively report the frequency with which they worry about a pre-determined set of topics chosen by researchers, and that might be confounded by recall bias.

Our study is the first to test the hypothesis that insomnia symptoms in young adults are associated with greater daytime thought intrusions, in particular negative thought intrusions, at baseline and following a period of self-referent worry. These predictions are consistent with previous evidence that cognitive control of attention is fundamentally affected following disturbed sleep and that worry is a central component of insomnia maintenance. We assessed the uniqueness of this relationship beyond the effects of anxiety and self-report deficits in cognitive control, both of which have been suggested to be elevated in insomnia, and associated with negative thought intrusions.

2. Method

2.1. Participants

Participants were 109 (82% *F*) university students with a mean age of 20.70 years (S.D.=4.56) who received course credits for participation. Participants responded to an online advertisement for 'a study investigating sleep and daytime function' – all respondents were invited to participate. Written informed consent was taken prior to participation. All study procedures were reviewed and approved by the University of Southampton Ethics Committee and the Research Governance Office.

2.2. Design and procedure

A cross-sectional research design examined associations between thought intrusions measured by the thought intrusions task and widely used self-report measures of insomnia severity (Insomnia Severity Index – ISI) and poor sleep quality (Pittsburgh Sleep Quality Index – PSQI), details below. Secondary self-report measures of attentional control (Attention Control Scale – ACS), trait anxiety (trait version of the Spielberger Anxiety Inventory, STAI) and current sleepiness (Stanford Sleepiness Scale - SSS) were also included.

2.3. Measures of subjective insomnia symptoms and sleep quality

1) Insomnia Severity Questionnaire (Bastien et al., 2001). The ISI measures perceived severity of insomnia, which corresponds with DSM-IV criteria for insomnia. It measures degree of satisfaction with sleep, interference with daytime function, noticeability of impairment and distress associated with the complaint. Responses are made on a 0–4 scale with higher scores reflecting a greater problem over the past two weeks. According to previously published guidelines for non-clinical populations a cut-off score of 10 identifies clinically important insomnia (Morin et al., 2011) with 86% sensitivity and 87.7% specificity. The scale has good internal consistency and test–retest reliability (Bastien et al., 2001), with a Cronbach's α of 0.84 in the current study.
2) Pittsburgh Sleep Quality Index (Buysse et al., 1989). The PSQI measures sleep quality over the past month measuring several key aspects of a poor sleep complaint; sleep quality, latency, disturbance, duration, habitual sleep efficiency, medication use and related daytime dysfunction. Responses are made on a 0–3 subscale to reflect the majority of days and nights. Scores range from 0 to 21 where a cut-off score of 5 achieves maximum specificity and sensitivity for detecting insomnia. The measure has strong internal validity (α=0.83) and temporal stability (α=0.85 for an average of 28.2 days) (Buysse et al., 1989) with a Cronbach's α of 0.75 in this study.
3) Spielberger Stait-Trait Anxiety Inventory (Spielberger et al., 1983). The STAI-T is a self-report measure of anxiety as a general disposition. It comprises 20 items which participants rate on 0–4 point scale with a possible range from 20 to 80 where higher scores reflect higher anxiety. The scale has high test–retest reliability and internal reliability α=0.86 (Barnes et al., 2002), with a Cronbach's α of 0.93 in this study.
4) Stanford Sleepiness Scale (Hoddes et al., 1973). The SSS measures moment-to-moment sleepiness which is affected by a whole range of contextual factors including propensity for sleep, sensory stimulation, motivation, hunger/thirst and posture (Dement and Carskadon, 1982). The measure has a 7-point scale where 1 is "Feeling active, vital, alert or wide awake" and 7 is "No longer fighting sleep, sleep onset soon; having dream-like thoughts". A score greater than 3 indicates significant sleepiness. We included a measure of sleepiness because daytime sleepiness (reflecting sleep debt) is considered to be a key marker of acute sleep loss (and associated acute rather than chronic insomnia symptoms) in this population.
5) Attentional Control Scale (Derryberry and Reed, 2002). The ACS is a trait measure of attention control, specifically the ability to 'focus', or maintain attention on a given task, and the ability to 'shift', or redirect attention to a new stimulus or between multiple competing tasks. There are 20 items rated on a 4-point scale where higher scores indicate better attentional control and the range is 20–80. Cronbach's α of 0.75 in this sample.

2.4. The thought intrusions task

Consistent with Hirsch et al. (2009) the thought intrusions task contained three stages: an initial 5 min breathing focus, a 5 min worry period and a 5 min post-worry breathing focus. During pre-worry and post-worry periods participants were instructed to focus attention on their breathing. If thoughts wandered away from their breath, participants were instructed to redirect attention back to their breathing. Within pre- and post-worry periods 12 beeps were presented (between 20 and 30 s apart). On hearing a beep participants were asked to state one of four response options; if focussing on their breath as instructed, then participants reported "breathing". However, if when probed their attention had wandered from their breath, then they briefly described the content of the thought and whether it was positive, negative or neutral (e.g. "Looking forward to seeing my friends; positive", "Worried I won't meet my deadline; negative"). The experimenter logged all thought intrusions as they occurred and confirmed the reported valence with the participant at the end of the study.

In between breathing-focus periods participants were asked to identify a current worry. This was briefly discussed with the experimenter to ensure that the worry was characterised by concern about a future event (rather than a retrospective depressive concern). Over 50% of our sample identified a current worry related to workload, deadlines or exam pressure. Other worries included finance, relationships and change of residence. No sleep-related worries were chosen by participants. Participants rated (0–100) their worry with respect to: i) how likely is this to happen? (Extremely unlikely to extremely likely), ii) how catastrophic would it be? (Not at all catastrophic to extremely catastrophic), and iii) How well do you think you would cope? (Not at all well to extremely well). Across the sample VAS ratings confirmed that the self-referential worry topics chosen by participants involved high levels of uncertainty as to likelihood of outcome (M=50.83, S.D.=21.00), would be moderately catastrophic (M=54.74, S.D.=25.09), and difficult to cope with (M=43.66, S.D.=22.49). Participants focused on the worry for 5 min. The key dependent measures from this task were mutually exclusive: number of breathing focuses (assessing maintenance of attention on task goal) and number and valence of thought intrusions (assessing distractibility and worrisome thought).

Participants completed the ISI, PSQI, ACS and STAI two days prior to attending a test session in which they completed the sleepiness measure (SSS) and the thought intrusions task. Following standardised instructions (see Hirsch et al. (2010)) participants completed a practice breathing focus trial that lasted 45 s and contained three thought sampling beeps, and the thought intrusions task in full. As part of the debrief participants read some amusing news stories to reduce any residual negative effects of the worry induction.

3. Results

Descriptive statistics for all self-report measures are presented in Table 1. 36.8% of the sample experienced clinically important insomnia symptoms over the past two weeks. According to the PSQI, 72.1% of the sample was classified as "poor-sleepers." Average bedtime was 12.39 a.m. (S.D.=1.19), average sleep onset latency was 33 min (S.D.=26.5) where the most commonly reported reason was