



# The direction of the relationship between symptoms of insomnia and psychiatric disorders in adolescents

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## ABSTRACT

**Background:** This study assessed the direction of the relationship between symptoms of insomnia disorder, depression, various anxiety disorders and obsessive compulsive disorder (OCD) in adolescents after controlling for age, gender, chronotype, and outcome variable at baseline.

**Methods:** Data was collected in eight high schools in Adelaide, South Australia, at two time-points approximately 6 months apart. The study was completed by 318 and 255 high school students at baseline and follow-up, respectively, aged 12–18 ( $M=14.96$ ,  $SD=1.34$ ) in grades 7–11 at baseline. Hierarchical regression analyses were used to assess each relationship, the first model controlling for age, gender and chronotype, and the second controlling for outcome variable at baseline.

**Results:** Insomnia symptoms predicted and were predicted by symptoms of each psychiatric disorder in model 1. In model 2, insomnia symptoms predicted symptoms of depression, and vice-versa. Symptoms of insomnia also predicted symptoms of separation anxiety disorder (SAD), but not vice-versa, in model 2. Symptoms of obsessive compulsive disorder (OCD) and social phobia (SP) predicted symptoms of insomnia disorder in model 2, but not vice-versa. Insomnia symptoms were no longer related to symptoms of other anxiety disorders in model 2.

**Limitations:** The use of self-report measures, and potential predisposing, precipitating, perpetuating or preventative factors were not assessed.

**Conclusions:** Symptoms of insomnia disorder are bidirectionally related to depressive symptoms independent from baseline symptoms, and unidirectionally related to symptoms of OCD and SP where OCD and SP are independent risk-factors of the development of insomnia symptoms.

## 1. Introduction

Insomnia, anxiety and depressive disorders are amongst the most prevalent and debilitating sleep and psychiatric disorders in adolescents, with rates of approximately 11% (Johnson et al., 2006), 15% (Johnson et al., 2006), and 6% (Costello et al., 2006), respectively. Symptoms of insomnia (problems with sleep initiation, maintenance, duration, and non-restorative sleep) and psychiatric disorders predict reduced satisfaction with life (Roberts et al., 2008; Sawyer et al., 2002), poor academic achievement (Paavonen et al., 2000; Varley and Smith, 2003), suicidal ideation (Choquet et al., 1993; Glied and Pine, 2002), excessive tobacco, alcohol and drugs use (Johnson and Breslau, 2001), and various medical and psychiatric problems in adulthood (Bardone

et al., 1998; Franko et al., 2005). Comorbidity between insomnia and psychopathology can also exacerbate the consequences associated with each disorder, particularly tobacco, alcohol and illicit drug abuse (Johnson and Breslau, 2001).

Studies have found a strong association, and frequent comorbidity between symptoms and disorders of insomnia, anxiety and depression (Alvaro et al., 2014; Johnson et al., 2006). Such relationships are expected given that sleep disturbance is a criterion for major depressive disorder (MDD), generalised anxiety disorder (GAD) and separation anxiety disorder (SAD) (American Psychiatric Association, 2013). Furthermore, evidence suggests that such findings may be partially attributable to overlapping neurobiological, genetic, psychological, social and age related risk-factors following puberty (Beesdo et al.,

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2009; Casey et al., 2008; Johnson et al., 2006; Kaneita et al., 2009; Lipton et al., 2008; Nestler and Carlezon, 2006; Peroutka et al., 1998; Thapar et al., 2012; Tseng and O'Donnell, 2007; Waszczuk et al., 2015).

Insomnia symptoms that occurred in the context of psychiatric disorders were previously considered secondary symptoms of the psychiatric disorder. However, longitudinal studies have shown that insomnia in otherwise healthy adults leads to a two-fold increase in the risk of developing depression (Baglioni et al., 2011). Indeed, best available evidence in the adult literature suggests insomnia and psychiatric disorders are bidirectionally related (Alvaro et al., 2013), in that insomnia and psychopathology predict one another longitudinally. Adolescent studies in this area, however, are few and contain numerous methodological inconsistencies and issues.

Research has depicted two main contradictory findings. Some studies report a one-way relationship, where anxiety predicts insomnia and insomnia predicts depression (Johnson et al., 2006; Ohayon and Roth, 2003), but such studies are retrospective, and hence compromise memory accuracy (Golub et al., 2000). Longitudinal studies, however, report a bidirectional relationship, where insomnia or generic sleep problems predict and are predicted by depression, anxiety or overall mental health problems after controlling for confounders (Alvaro et al., 2013; Roberts and Duong, 2013; Shanahan et al., 2014). Kaneita et al. (2009) proposed three, not necessarily mutually exclusive mechanisms to explain the bidirectional relationship found in best available evidence. Firstly, common risk-factors such as genetic predispositions, biological factors, increased autonomy, and peer, familial and educational stressors that are common amongst adolescents independently contribute to the development and onset of insomnia, anxiety and depression. Secondly, sleep problems and psychopathology broadly derive from the same category of disorders, where only the order of symptom presentation differs. Thirdly, symptoms and disorders of insomnia and psychiatric disorders are independent but directly contribute to the development of one another.

However, longitudinal studies that have reported bidirectional relationships often use variables that combine various sleep disturbances or psychiatric disorders into a single overall measure (Kaneita et al., 2009; Shanahan et al., 2014; Tochigi et al., 2016), potentially masking differences in directionality across specific sleep and psychiatric variables (Willis and Gregory, 2015). Insomnia is likely to be bidirectionally related to depression and GAD, as sleep initiation problems present ample opportunity for rumination and worry about future issues (e.g., such as academic examination or adverse events at school), and daytime ruminations and worry about future issues can extend to bedtime, increasing psychological and physiological arousal, and in turn causing insomnia (Taylor et al., 2005). Two longitudinal studies have assessed symptoms of insomnia disorder and depression in adolescence (i.e., as individual constructs), the first reported a bidirectional relationship (Roberts and Duong, 2013), and the second reported inconsistent results across a 10-year period where either difficulties initiating sleep were unidirectionally predicted by or bidirectionally related to depressive symptoms (Hayley et al., 2015) after controlling for covariates. Furthermore, Shanahan et al. (2014) reported that overall sleep problems in adolescents are bidirectionally related to GAD after controlling for covariates. Symptoms of insomnia are unlikely to be directly related to SAD, panic disorder (PD), and social anxiety disorder/social phobia (SP), as SAD, PD and SP are triggered by specific stimuli that are unlikely to consistently present near or extend to sleep time. Indeed, Shanahan et al. (2014) also found that overall sleep problems are not related to SAD after controlling for covariates. To date, adolescent studies have not assessed the direction of the relationship between sleep problems or other psychiatric disorders, but adolescent cross-sectional studies have reported no clinically significant relationships between insomnia or sleep problems and, PD or SP after controlling for covariates (Alfano et al., 2007, 2009; Alvaro et al., 2014). Previous adolescent and young adult research is

more contradictory and have reported either a relationship or no relationship after controlling for confounding variables (Alvaro et al., 2014; Ivarsson and Skarphedinsson, 2015; Timpano et al., 2014).

Furthermore, research has usually used categorical variables to assess directionality that assume the presence or absence of symptoms and disorders rather than continuous variables that assume a continuum of symptom severity. Patients can report fewer symptoms but more daytime dysfunction, or may find mild symptoms very distressing with high functioning impact. Moreover, a meta-analytic study reported the reliability and validity of psychopathological variables increases by 15% and 37% respectively when continuous rather than categorical measures were used (Markon et al., 2011).

Finally, previous studies have not accounted for chronotype, an important common risk-factor for sleep problems and psychopathology in adolescent populations, and therefore a potential confounding variable for the relationship between symptoms of insomnia and psychiatric disorders. Chronotype is the behavioural manifestation of the circadian rhythm and reflects the propensity for sleep onset and rise time relative to the 24 h day. Adolescents become more evening orientated (i.e., later sleep and wake times) following puberty (Crowley et al., 2007). Extreme evening tendencies are a criterion for delayed sleep phase disorder (DSPD) (American Academy of Sleep Medicine, 2014), which affects approximately 8% of adolescents (Saxvig et al., 2012). DSPD and eveningness have been associated with symptoms and disorders of insomnia, anxiety and depression in adolescent cross-sectional and longitudinal studies (Ferber, 1990; Giannotti et al., 2002; Mooney et al., 2016; Randler et al., 2009; Reid et al., 2012; Russo et al., 2007; Saxvig et al., 2012), and adult longitudinal studies (Antypa et al., 2016). Specifically, they may result in sleep initiation problems (attempts to fall asleep before their circadian propensity for sleep), longer pre-sleep wake episodes in bed and in turn increased opportunity for bedtime rumination or sleep anxiety, or sleep deprivation (sleep late and wake up early for school). Chronotype is therefore important to control for when examining the longitudinal relationship between insomnia and psychopathology.

This study is the first attempt to assess the direction of the relationship between symptoms of insomnia and different psychiatric disorders using continuous variables, and after controlling chronotype (and other confounding variables) in adolescents. The first hypothesis is that symptoms of insomnia disorder will be bidirectionally related to symptoms of depression and GAD after age, gender, chronotype and outcome variable at baseline are controlled. The second hypothesis is that symptoms of insomnia disorder will not be related to symptoms of PD, SAD or SP after age, gender, chronotype and outcome variable at baseline are controlled. The study will also examine the direction of the relationship between symptoms of insomnia and OCD.

## 2. Methods

### 2.1. Participants

Three-hundred and eighteen South Australian secondary school students aged 12–18 ( $M=14.96$ ,  $SD=1.34$ ) from eight high schools volunteered to participate in the study at baseline. Of these, 255 completed the study by returning the questionnaire at follow up (approximately 20% attrition rate;  $M\text{ age}=15.49$ ,  $SD=1.32$ ). One-hundred and forty (54.90%) were male and 115 (45.10%) were female. At follow up, 68 students were in grade 8, 39 in grade 9, 76 in grade 10, 29 in grade 11 and 42 in grade 12. Participants were eligible if their parents consented; they completed the questionnaires at baseline and follow-up, were in grades 7–11 at baseline, and fluent in English.

### 2.2. Measures

The demographic questionnaire contained items about personal history of psychiatric and sleep problems, medical history, treatment

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