



# Anxiety and depression mediate the relationship between insomnia symptoms and the personality traits of conscientiousness and emotional stability



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## ABSTRACT

This study examined the relationship between the Big Five personality traits and insomnia symptoms in the general population. Additionally, the mediating role of anxiety and depression was examined. Participants ( $N = 625$ ) completed online measures of the big five personality traits and insomnia severity. Insomnia symptoms were independently related to extroversion, agreeableness, conscientiousness, emotional stability, anxiety and depression in univariate analysis. Linear regression determined conscientiousness and emotional stability to be the only traits predicting insomnia symptoms. However, these relationships were at least partially mediated by anxiety and depression. Whilst reduced levels of conscientiousness and emotional stability has previously associated with poor sleep and insomnia, the current outcomes shed light on the mechanisms which serve to mediate this relationship.

## 1. Introduction

Symptoms of insomnia including difficulty initiating and maintaining sleep, early morning awakenings with an inability to return to sleep, and impaired daytime functioning are highly prevalent, affecting up to 10% of the general population at disorder level, and 30% at symptom level (Espie et al., 2012; Morin et al., 2006). It has been theorised that, an individual's personality may act as a predisposing, and potentially perpetuating, factor in relation to the disorder (Spielman et al., 1987). In support, research has evidenced that insomnia appears to be related to a greater degree of: maladaptive perfectionistic traits; neuroticism; negative affect; social inhibition; internalisation; and anxious concerns; and lower levels of conscientiousness and emotional stability (Akram et al., 2018; Akram et al., 2017; Dekker et al., 2017; Duggan et al., 2014; Van de Laar et al., 2010). However, the evidence base supporting the relationship between insomnia and personality remains mixed, with little consistency concerning the specific traits which are most predictive of insomnia (Dekker et al., 2017). Whilst this disparity may stem from methodological differences regarding the measure or population used,

research should examine whether these relationships may be influenced by mediating psychological factors. With that in mind, research has evidenced the relationship between particular personality traits (i.e. Perfectionism, emotional stability) and insomnia symptoms to be mediated by anxiety and depression (Ahn et al., 2019; Akram et al., 2017; Batterham et al., 2012; Jansson-Fröjmark and Linton, 2007).

One of the most prominent models of personality is the five-factor model (Goldberg, 1993), comprised of five traits: extroversion, agreeableness, conscientiousness, emotional stability (or neuroticism) and openness to new experiences (Gosling et al., 2003). Of these, research has reliably demonstrated poor-sleep and insomnia symptoms to be associated with reduced emotional stability (a tendency to be emotionally reactive and experience more negative emotions) and low levels of conscientiousness (a tendency to be reliable, well-organised and hard-working) (Dekker et al., 2017; Duggan et al., 2014; Hintsanen et al., 2014). Interestingly, the direction of these two traits are predictive of health outcomes, with those lacking in conscientious and emotional stability at greater risk of mortality (Kern and Friedman, 2008; Lahey, 2009) and mental health difficulty (Chien et al., 2007; Kotov et al., 2010;

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Lahey, 2009). Health promoting behaviours (i.e. exercise, healthy diet, lower risk taking, community integration and relationship stability prominent in conscientious individuals are linked to reduced mortality (Bogg and Roberts, 2004; Friedman and Martin, 2011; Kern and Friedman, 2008). In contrast, neurotic individuals experience greater negative emotions (e.g. anxiety, hostility, nervousness, depression), risk taking behaviour, somatic complaints, and endorse fewer health promoting behaviours (Booth-Kewley and Vickers, 1994; Watson and Pennebaker, 1989). Of particular note, symptoms of anxiety and depression appear to be commonly reported amongst individuals low in conscientious and emotional stability (Chien et al., 2007; Kotov et al., 2010).

Similarly, insomnia is generally associated with reduced immune functioning (Taylor et al., 2003), risk taking behaviour (Womack et al., 2013), mortality risk (Parthasarathy et al., 2015), and psychological disorders, of which anxiety and depression appear to be the most prominent.

Here, anxiety often acts as a precursor for insomnia due to growing worry and ruminative thinking through the pre-sleep period, and depression developing as a result, perhaps due to the encumbering nature of daytime impairments and poor quality of life associated with the disorder (Ford and Kamerow, 1989; Staner, 2010; Kyle et al., 2010). These findings suggest that if insomnia is associated with conscientious and emotional stability, this association may be mediated by symptoms of anxiety and depression.

Therefore, this exploratory study aimed to investigate the mediating role of anxiety and/or depression on the relationship between insomnia symptoms and the Big Five personality traits after controlling for the presence of other potentially co-occurring physiological sleep disorders (e.g. sleep apnoea, narcolepsy). Specifically, this study aimed to: i) determine the extent to which symptoms of insomnia were independently related to the traits of extroversion, agreeableness, conscientiousness, emotional stability and openness to new experiences; and ii) determine whether any confirmed relationships were mediated by symptoms of anxiety and/or depression.

## 2. Method

### 2.1. Sample and procedure

An online cross-sectional survey was conducted, involving questions examining the relationship between the big five personality traits and symptoms of insomnia, anxiety and depression. The procedure was approved by the Sheffield Hallam University Research Ethics Committee, and all participants provided informed consent, and were aware of their right to withdraw.

Members of the general population were targeted through social media websites. Additionally, students from a number of Northern Institutions in the UK were sought through respective course participation schemes. 732 participants began the online survey and 625 respondents provided complete data. Course credit was provided on completion where requested. Those who reported: conducting shift work, a central nervous system disorder, presently using sleep altering medication, a prior head injury or significant sleep disorder symptoms other than insomnia (e.g. apnoea, sleepwalking, narcolepsy, restless legs syndrome/periodic limb movement, circadian rhythm disorder) were omitted from analysis ( $n = 48$ ). Therefore, a final sample of 557 participants (mean age =  $24.40 \pm 11.46$ , range 18–81, 75% female; 74% student) were included into the analysis. This sample size was deemed sufficient for a 95% confidence level, exceeding our target of 500 complete responses leaving an acceptable 4.5% margin of error (Niles, 2006). Of note, to ensure the absence of a sleep/wake disorder other than insomnia the SLEEP-50 questionnaire (Spoormaker et al., 2005) was used (see 'Measures' for details).

### 2.2. Measures

#### 2.2.1. The Ten Item Personality Inventory

The Ten Item Personality Inventory (TIPI: Gosling et al., 2003) was used to assess the Big-Five personality dimensions. TIPI covers personality dimensions of Extroversion, Agreeableness, Conscientiousness, Emotional Stability and Openness to New Experiences using independent subscales. This instrument consists of 10 items with a common stem of 'I see myself as'. Each item consists of two descriptors that represent a pole of the Big-Five personality dimensions and is rated on a 7-point scale ranging from 1 (disagree strongly) to 7 (agree strongly). Many studies have supported the reliability and validity of the measure (c.f. Furnham, 2008; Gosling et al., 2003). The score for each subscale ranges from 2 to 14, with higher scores indicating a greater presence of the specific trait. Assessment of internal consistency yielded a Cronbach's alpha of .65.

#### 2.2.2. Insomnia severity index

The Insomnia Severity Index assessed the experience of insomnia symptoms (Bastien et al., 2001). Comprised of 7 items, the severity of insomnia symptoms over the past two weeks including difficulty initiating and maintaining sleep and awakening too early are examined. Items are scored on a 5-point likert scale, with total scores ranging from 0–28. Higher scores represent greater insomnia symptoms. Initial assessment of the ISI among patients evaluated for insomnia demonstrated the measure to demonstrate a high internal consistency and reliability (Cronbach's alpha .74: Bastien et al., 2001). Assessment of internal consistency in the current study yielded a Cronbach's alpha of .85.

#### 2.2.3. Hospital Anxiety and Depression Scale

Anxiety and depression were assessed using The Hospital Anxiety and Depression Scale (HADS: (Zigmond and Snaith, 1983). The scale consists of 14 fixed choice items (seven for both anxiety and depression) each scored between 0 and 3, and each with a maximum total score of 21. Higher scores on each subscale represent greater anxiety (HADS-A) and depression (HADS-D). In a review of 747 studies using the HADS, Bjelland and colleagues (2002) provided support for the measures factor structure, discriminant validity and internal consistency. Assessment of internal consistency in the present study yielded a Chronbach's alpha of .85 for the anxiety subscale, and .75 for the depression subscale.

#### 2.2.4. SLEEP-50

Subscales of the SLEEP-50 (Spoormaker et al., 2005) implied the absence of sleep disorders including: apnoea, sleepwalking, narcolepsy, restless legs syndrome/periodic limb movement, and circadian rhythm disorder. Whilst comprising of fifty items; items relating to insomnia (assessed by the ISI) or sleep hygiene (not a sleep disorder) were omitted in the current study. For each item, participants rated the extent that each statement (e.g. "I am told that I wake up gasping for air") was applicable in the past month (0 = not at all, 4 = very much). Total scores of:  $\geq 15$  indicate apnea;  $\geq 7$  sleepwalking;  $\geq 7$  narcolepsy;  $\geq 7$  restless legs syndrome/periodic limb movement; and  $\geq 8$  a circadian rhythm disorder.

### 2.3. Statistical analysis

Pearson's bivariate correlations examined associations between each of the big five personality traits with symptoms of insomnia, anxiety and depression. This was followed by a hierarchical linear regression analyses (using the enter method), with insomnia symptoms as the dependant variable, in order to determine whether any significant associations between the big five personality traits and insomnia symptoms were mediated by anxiety and depression after controlling for age and sex. Specifically, age and sex were entered as predictors in step-1; TIPI subscales in step-2; anxiety in step-3; and depression in step-4. Significance was considered at the  $p < .05$  level.

### 3. Results

#### 3.1. Univariate associations

Mean scores for the final sample were as follows: ISI,  $4.72 \pm 4.74$ ; HADS-A,  $8.03 \pm 4.36$ ; HADS-D,  $4.43 \pm 3.23$ ; extroversion,  $4.12 \pm 1.53$ ; agreeableness,  $4.84 \pm 1.14$ ; conscientiousness,  $4.93 \pm 1.32$ ; emotional stability,  $4.00 \pm 1.53$ ; and openness to new experiences,  $5.04 \pm 1.07$ . Symptoms of insomnia were negatively related to extroversion ( $r = -.17$ ,  $p = .001$ ), agreeableness ( $r = -.09$ ,  $p = .03$ ), conscientiousness ( $r = -.22$ ,  $p = .001$ ), and emotional stability ( $r = -.35$ ,  $p = .001$ ) but not openness to new experiences ( $r = .04$ ,  $p = .35$ ). Moreover, symptoms of insomnia were also related to anxiety ( $r = .45$ ,  $p = .001$ ) and depression ( $r = .43$ ,  $p = .001$ ). Correlation coefficients between traits did not indicate collinearity (all  $r$ 's  $> .70$ : See Table 1).

#### 3.2. Sex differences

Whilst, no sex differences in reported insomnia ( $t(554) = 0.28$ ,  $p = .78$ ) and depressive symptoms ( $t(554) = 0.18$ ,  $p = .86$ ) were observed, increased reports of anxiety demonstrated amongst females ( $M = 8.25 \pm 4.34$ ) relative to males ( $M = 7.28 \pm 4.31$ :  $t(554) = -2.31$ ,  $p = .02$ ). Moreover, females were more agreeable ( $M = 4.98 \pm 1.12$ :  $t(554) = -4.87$ ,  $p = .001$ ) conscientious ( $M = 5.03 \pm 1.26$ :  $t(554) = .01$ ,  $p = .99$ ) and less emotional stable ( $M = 3.86 \pm 4.31$ :  $t(554) = 3.86$ ,  $p = .001$ ) relative to males (agreeableness,  $M = 4.44 \pm 1.18$ ; conscientiousness,  $M = 4.67 \pm 1.46$ ; emotional stability,  $M = 4.32 \pm 1.62$ ). Extraversion ( $t(554) = 0.01$ ,  $p = .99$ ) and openness to new experiences ( $t(554) = 1.28$ ,  $p = .20$ ) did not differ in sex.

#### 3.3. Linear regression analyses

Linear regression analyses determined that emotional stability and conscientiousness, but not extroversion and agreeableness, significantly predicted insomnia symptoms (step2: 15% total variance explained:  $F(6,550) = 16.22$ ,  $p = .001$ ) after controlling for age and sex (step1:  $>1\%$  variance explained:  $F(2,554) = 0.38$ ,  $p = .96$ ). After accounting for anxiety and depression, only age, conscientiousness, anxiety and depression remained significant predictors of insomnia symptoms in the subsequent steps (step3: 22% variance:  $F(7,549) = 26.70$ ,  $p = .001$ ; step4: 25% variance:  $F(8,548) = 22.77$ ,  $p = .001$ ; see Table 2). Therefore, whilst insomnia symptoms were associated with decreased emotional stability, this relationship appears to be mediated by anxiety and depression. Similarly, insomnia symptoms were associated with decreased conscientiousness, however this relationship appears to be partially mediated by anxiety and depression. Interestingly, age was not a significant predictor in the first step of the regression model but became significant in step two when personality traits were added to the model, suggesting that a suppression effect may be evident.

**Table 1**

Correlations between measures of insomnia symptoms, anxiety, depression and big five personality for all participants.

	1.	2.	3.	4.	5.	6.	7.
1. Insomnia severity							
2. Anxiety	.45**						
3. Depression	.43**	.63**					
4. Extroversion	-.17**	-.29**	-.33**				
5. Agreeableness	-.09*	-.11**	-.16**	.05			
6. Conscientiousness	-.22**	-.26**	-.26**	.09*	.14**		
7. Emotional Stability	-.35**	-.68**	-.51**	.37**	.18**	.26**	
8. Openness to new experiences	.04	-.10*	-.16**	.35**	.25**	.10*	.15**

Note: Anxiety, Depression: Hospital Anxiety and Depression Scale.

\*Sig at  $< .05$ , \*\*  $< .01$ .

**Table 2**

Linear regression analyses with insomnia symptoms as the dependent variable; age, sex, agreeableness, conscientiousness, extroversion, emotional Stability, anxiety and depression as predictors.

Predictors	R <sup>2</sup>	$\beta$	t	Sig.
Step 1	.00			
Age		-.01	-.25	.80
Sex		-.01	-.13	.90
Step 2	.15			
Age		.08	2.15	.03*
Sex		-.04	-.86	.39
Agreeableness		-.01	-.33	.74
Conscientiousness		-.14	-3.38	.001**
Extroversion		-.05	-1.06	.29
Emotional Stability		-.32	-6.91	.001*
Step 3	.22			
Age		.08	2.06	.04*
Sex		-.04	-.96	.34
Agreeableness		-.02	-.49	.63
Conscientiousness		-.11	-2.67	.008**
Extroversion		-.03	-.70	.49
Emotional Stability		-.08	-1.44	.15
Anxiety		.37	7.23	.001**
Step 4	.25			
Age		.08	2.03	.04*
Sex		-.03	-.74	.46
Agreeableness		-.01	-.15	.88
Conscientiousness		-.09	-2.29	.02*
Extroversion		-.00	.03	.98
Emotional Stability		-.10	-1.11	.27
Anxiety		.26	4.66	.001**
Depression		.21	4.30	.001**

Note: \* Sig at  $< .05$ , \*\*  $< .01$ .

### 4. Discussion

The present study examined the mediating role of anxiety and depression on the relationship between insomnia symptoms and the Big Five personality traits. Our results provide further evidence that specific aspects of the Big Five personality traits are associated with symptoms of insomnia. Here, extroversion, agreeableness, conscientiousness, and emotional stability were independently related to insomnia symptoms. However, in line with existing evidence (Dekker et al., 2017; Duggan et al., 2014; Hintsanen et al., 2014), when examined in a single regression model, only reduced conscientiousness and emotional stability were significantly predictive of insomnia symptoms. Furthermore, the relationship between emotional stability and insomnia symptoms was mediated by anxiety and depression, whereas conscientiousness was only partially mediated by these factors.

Emotionally unstable individuals tend to experience adverse cognitive-emotional processes (John and Gross, 2004; i.e. worry, rumination, poor coping, and diminished emotion regulation). Whereas, those low in conscientiousness show deficits in responsibility, motivation, and self-control (Duggan et al., 2014). Together, the direction and combination of these two traits may contribute to disturbed sleep due to these

underlying difficulties with regulating emotion and behaviour (Duggan et al., 2014). Indeed, a key maintaining feature of insomnia from a cognitive perspective is the presence of negatively toned cognitive activity, manifesting primarily in relation to sleep-related worry and rumination (Harvey, 2002). Whilst these two factors differ in directional focus, with worry pertaining to the future (e.g. “my thoughts are racing, due to this I won't be able to fall asleep tonight”) and rumination (e.g. “I barely slept at all last night and now I can't focus on work”) the past (Carney et al., 2013; Hiller et al., 2015), both encompass recurrent negative thoughts relating to sleep. In turn, these cognitions fuel dysfunctional sleep-related behaviours (e.g. excess caffeine, daytime napping), and this may be more prevalent amongst those low in conscientiousness due to a lack of motivation and self-control. Consequently, the relationship between insomnia symptoms and the traits of conscientiousness and emotional stability may be explained by cognitive-emotional and behavioural deficits (Duggan et al., 2014) which serve to propagate negatively toned cognitive activity, ultimately resulting in poor sleep (Harvey, 2002). That said, these relationships were at least partially mediated by anxiety and depression. Here, it is likely that anxiety exacerbates pre-existing worry and negative ruminative thinking which leads to a negative thought cycle which transitions through the day and into to the pre-sleep period. In contrast, depressive symptoms may emerge considering the encumbering nature of the daytime consequences associated with insomnia (e.g. ability to cope with social and interpersonal difficulties, and the stressors of daily life) alongside the trait predisposition (i.e. conscientiousness and emotional stability) decreased to cope with these difficulties poorly (Staner, 2010).

Johann and colleagues (2018) recently highlight personality as a risk factor for dropout and treatment resistance from cognitive behavioural therapy for insomnia (CBTi). Whilst the authors focused on perfectionism, emotionally unstable individuals have also been linked to resistance with cognitive behaviour therapy (CBT) interventions (Gurtman et al., 2013). Given this, it may be beneficial a modified CBTi for those resistant to the traditional form by considering personality (Johann et al., 2018). Specifically, an emphasis on cognitive restructuring and alleviating sleep-related worry and anxiety may serve to normalise sleep-related cognitions in low conscientiousness and emotionally unstable individuals (Gurtman et al., 2013). Alternatively, CBT for anxiety and/or depression may hold therapeutic potential for insomnia. Here, physicians may allocate time to sleep-related cognitions and dysfunctional behaviours which perpetuate insomnia. In turn, the possibility emerges to prevent insomnia in its acute phase from transitioning further. As recently evidenced, this is possible with a single session of CBTi alongside a self-help booklet (Ellis et al., 2015).

Several limitations of the current study should be noted. The present sample was mostly female, and therefore the outcomes may not be entirely generalisable. That said, it has been demonstrated that women are more likely to experience disturbed-sleep compared to men (Zhang and Wing, 2006). Moreover, whilst a comprehensive assessment to address insomnia symptoms from the perspective of diagnostic criteria was used, the current outcomes cannot be extrapolated to individuals meeting diagnostic criteria for insomnia. Further, given the cross-sectional design, the causality of the relationships identified cannot be conclusively defined. However, this study did account for the often-overlooked presence of other potentially co-occurring physiological sleep disorders.

To summarise, the present outcomes add to the limited literature concerning the relationship between aspects of personality and insomnia. Whilst reduced levels of conscientiousness and emotional stability has previously associated with poor sleep and insomnia, the current outcomes shed light on the mechanisms which serve to mediate this relationship. Research should examine the possibility for modified CBTi approaches for treatment resistant individuals based on their personality.

## Declarations

### Author contribution statement

U. Akram, M. Gardani, A. Akram, S. Allen: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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### Competing interest statement

The authors declare no conflict of interest.

### Additional information

No additional information is available for this paper.

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