The Bi-directional Association Between Insomnia and Anxiety

Alv A Dahl[1] and Bjørn Bjorvatn[2]

1. Department of Clinical Research, Norwegian Radium Hospital, Oslo University Hospital, and Faculty Division, The Norwegian Radium Hospital, University of Oslo; 2. Department of Public Health and Primary Health Care, University of Bergen, and Norwegian Competence Centre for Sleep Disorders, Haukeland University Hospital, Bergen

Abstract

Both insomnia and anxiety are common complaints, but while insomnia is a diagnostic criterion for several mental disorders, anxiety is not a criterion for primary insomnia. Numerous studies have shown a high rate of co-morbidity between anxiety disorders and insomnia. The relationship is bi-directional since insomnia contributes to the development of anxiety disorders and anxiety results in insomnia. Four relevant models of co-morbidity are discussed: one disorder represents a predisposition or vulnerability; a common cause exists for insomnia and anxiety disorders; although not casually related, the presence of one disorder influences the presentation, course or outcome of the other; and residual effects of a remitted disorder influence the presentation and the course of the other. Worry seems to be a common affective factor in both anxiety disorders and insomnia. We could not identify any naturalistic outcome and only a few treatment studies that covered both disorders. Treatment studies of post-traumatic stress disorder (PTSD), panic disorder and generalised anxiety disorder (GAD) with both anxiety and insomnia as outcome measures showed variable improvement of both pharmacotherapy and cognitive–behavioural therapy. In treatment programmes for hypnotic discontinuation, the level of anxiety was a key factor for success or not. Researchers on insomnia and anxiety disorders should have more contact, since they have much in common.

Keywords

Insomnia, anxiety, anxiety disorders, co-morbidity

Disclosure: The authors have no conflicts of interest to declare.
Received: 17 November 2008 **Accepted:** 9 February 2009
Correspondence: Alv A Dahl, Department of Clinical Cancer Research, The Norwegian Radium Hospital, Rikshospitalet University Hospital, Montebello, 0310 Oslo, Norway. E: alvd@ulrik.uio.no

Insomnia is a subjective complaint of difficulty falling or staying asleep or not being restored by sleep. Insomnia is both a symptom of sleep disorders, somatic diseases and mental disorders and a disorder in its own right. Anxiety is an abnormal or overwhelming sense of apprehension and fear often marked by physiological signs (such as sweating, tension and increased pulse), by doubt concerning the reality and the nature of the threat and by self-doubt about one's capacity to cope with it. Anxiety is also a symptom of mental disorders and somatic diseases, and various anxiety disorders are defined according to the type of anxiety symptoms. Several classifications of both insomnia and anxiety are used, but this review will mainly stick to the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV), where insomnia is divided into either primary or secondary to other disorders/diseases, and the sleep problems must have a duration of at least six months. In DSM-IV both post-traumatic stress disorder (PTSD) and generalised anxiety disorder (GAD) have sleep disturbance as a diagnostic criterion. By contrast, anxiety is not a diagnostic criterion of primary insomnia, but the reverse is true for some parasomnias.

Numerous studies have shown a high rate of co-morbidity between anxiety disorders and insomnia. The relationship is bi-directional since insomnia contributes to the development of anxiety disorders, and anxiety disorders result in insomnia. The character of this bi-directional relationship will be elucidated through a selective review of recent studies.

Epidemiology and Co-morbidity

DSM-IV-defined chronic insomnia has a 12-month prevalence of 6–12% in the population, while the prevalence of anxiety disorders is approximately 15–20%. In the National Comorbidity Survey Replication (NCS-R), insomnia was observed in 32.5% of those who had an anxiety disorder and the odds ratio was 4.0 compared with persons without these disorders.[1] A similar odds ratio was reported in a Swedish community-based study.[2]

Taylor et al.[3] reported from an American community sample that 19% of persons with insomnia showed clinically significant anxiety compared with persons without insomnia, and anxiety explained 36% of the variance in the severity of insomnia score. In a large cross-sectional study from four European countries, Ohayon et al.[4] found that insomnia was associated with panic disorder in 61% and with GAD in 44%. Insomnia was also significantly associated with GAD in a large epidemiological study from the UK.[5]

In a population-based study comparing persons with primary insomnia with good sleepers or those with some insomnia symptoms, LeBlanc et al.[6] observed higher scores on anxiety, depression, neuroticism, arousal predisposition, stress perception and emotion-orientated coping in persons with an insomnia diagnosis. A gradient concerning level of anxiety was observed from good sleepers to those with insomnia symptoms and finally to those with the insomnia diagnosis.

© TOUCH BRIEFINGS 2009

Table 1: Temporal/Causal Models of the Relationship Between Insomnia and Anxiety Disorders*

Models**	Explanation
Independent	Insomnia and anxiety disorders are distinct, with completely independent causes. Any specific mixture results either from chance or from operation of general risk or help-seeking factors.
Predisposition or vulnerability	When insomnia or anxiety disorder occurs, it is a risk factor for development of the other.
Common cause	Insomnia and anxiety disorders have a shared aetiology arising from a 'common core liability'.
Spectrum or subclinical	Insomnia and anxiety disorders can be located on the same continuum or 'spectrum' of related disorders, in which one disorder is a prodromal, subclinical or attenuated manifestation of a common pathological process.
Pathoplasthy or exacerbation	Although insomnia and anxiety disorders are not causally related, the presence of one disorder influences the presentation, course or outcome of the other.
Complication or scar	Residual effects associated with either insomnia or anxiety disorders, which has remitted, influence the course or presentation of the other.

**After Klein et al.[7] **Relevant relationships in bold.*

In summary, the co-occurrence of insomnia and anxiety is well documented on both the symptom and the disorder levels based on studies with the main focus on anxiety and on insomnia.

Models of Co-morbid Relationships

In cases of co-morbidity, six models of relationship can be conceptualised (see *Table 1*).

The independent relationship model hardly gets support from research, and the same can be stated for the spectrum or subclinical model.

A predisposing relationship implies that one disorder has onset before the other, and this model has considerable research support. In a long-term study following children from three years of age to adults 26 years of age, Gregory et al.[8] observed that sleep problems before nine years of age were strongly predictive of later anxiety disorders, but not depression. That insomnia precedes anxiety disorders was also observed by Neckelmann et al.[9] in a long-term prospective population-based study of adults. The risk was highest for those who had insomnia at two time-points 11 years apart. This result suggests that chronic insomnia may be a trait marker for individuals at risk of, and may confer a risk related to accumulated exposure for the development of, anxiety disorders. These results are only partially in accordance with those of Ohayon et al.,[4] who reported that with no previous history of anxiety disorders, insomnia appeared before the current anxiety disorder in 18% of cases and appeared at about the same time in 39%, and anxiety appeared before insomnia in 43% of cases. In another large epidemiological study, Vahtera et al.[10] confirmed that anxiety predisposed to insomnia, particularly if a negative life event had happened recently. In a prospective community-based study, Jansson and Linton[2] showed that anxiety was strongly related to the development of insomnia one year later (odds ratio of 3.4). The most parsimonious interpretation of these findings is that insomnia can predispose for anxiety disorder and vice versa.

The common cause model implies that primary insomnia and anxiety disorders have a shared aetiology arising from a 'common core liability'. This model has much research support, although anxiety and sleep researchers use somewhat different terminology for quite similar concepts. This is an area ripe for better integration and a common ground.

An extensive list of aetiological and pathogenetic factors for anxiety disorders is given by Craske et al.[11] In neuroticism (negative affectivity), 50% of the variance is caused by additive genetic factors. There seems to be one genetic diathesis on which GAD and depression load most heavily and another on which panic disorder and phobias load most heavily. Biological correlates are shown in the balance between the sympathetic and the parasympathetic nervous systems, and lower cardiac vagal tone is observed in adults with high trait anxiety. Physiological arousal refers to a variety of processes incorporating sympathetic adrenal medullary and hypothalamic pituitary axis outputs, as well as startle reactivity, all of which are presumed to support the heightened vigilance and attention to threat that are characteristic of anxious individuals. Parental influence concerns the co-ordinated interaction of affective and behaviour displays between parents and infants. Parents of anxious children are more likely to be controlling and less granting of autonomy, and to suggest positive consequences than are parents of controls. Both interoceptive and external cognitive biases are common in anxious individuals, resulting in hypervigilance for threat cues and danger-laden judgements. Given enhanced processing of threat stimuli, a memory bias for threat cues might also be expected. Direct traumatic conditioning, observation of a model responding fearfully or being traumatised and transmission of threatening information represent life experiences of aetiological relevance.

Insomnia research seems more preoccupied with pathogenetic models than with aetiology, but we may presume that most of the above-mentioned factors are relevant for insomnia also. The various models all see insomnia as a multidimensional condition in which psychological mechanisms are vital. The models presented by Espie et al.,[12] Harvey[13] and Morin[14] have quite a lot in common, although they vary as to taking insomnia (arousal) or normal sleep (de-arousal) as their point of departure. They all include the physiological factor of arousal and hyperarousal, where the same neural mechanisms are described in both insomnia and anxiety. The same can be said concerning cognitive factors that consist of cognitive biases (dysfunctional cognitions).

Selective attention to danger signals driven by negative beliefs stored in the long-term memory is common to both anxiety disorders and insomnia. Individuals with insomnia remain preoccupied with dangers of sleep initiation and maintenance, as well as negative consequences of sleep loss.

Worry seems to be the common affective factor in both insomnia and anxiety disorders, although it is frequently called anticipatory or apprehensive anxiety. Worry serves an alarm function directing attention towards issues demanding immediate solution, a prompt function, maintaining awareness of unresolved threatening situations, and a preparation function, anticipating threat and making the person ready for a threatening situation. Brosschot et al.[15] emphasised the pathogenetic effect of perseverative cognitions (worry, rumination and anticipatory stress) of long duration that may induce arousal. Sleep-related anxiety concerns fear of going to sleep,

returning to sleep after being awake, fear of the dark and other anxious thoughts at night.

Finally, behavioural factors such as maladaptive behaviours and safety behaviours are used to combat insomnia. In anxiety disorders various types of avoidance behaviour are common in order to preserve safety and avoid exposure to threatening stimuli. Various behavioural rituals are common in patients with insomnia, and some consider the bed as an enemy.

Empirical studies of the relative importance and time sequence of these factors have been performed. In a prospective population-based study, Jansson and Linton[16] examined the relative contributions of arousal, affective factors and dysfunctional beliefs. Compared with good sleepers, individuals with insomnia showed the strongest associations with dysfunctional beliefs, arousal came second and depression third, but all were highly significant; taken together they explained 72% of the variance in insomnia. When those with insomnia were compared with those with normal sleep, anxiety also made a significant contribution besides the other three factors, but again the strongest association was shown for dysfunctional beliefs. These three factors often co-occur in individuals with chronic insomnia, defining a cluster that contained 91% of the individuals with insomnia. According to Omvik et al.,[17] nocturnal worry was a consequence of insomnia in an experimental study, and the effect was independent of worry status at baseline.

As to the pathoplasty or exacerbation model and the complication or scar model, we could not identify any naturalistic outcome studies covering both anxiety disorders and insomnia. However, both of these models are of relevance for treatment choice in insomnia and anxiety disorders. If monotherapy for an anxiety disorder hardly affects insomnia or vice versa, dual treatment is indicated. If insomnia/disturbed sleep is a symptom of ongoing psychopathology, effective treatment of the anxiety disorder should normalise sleep patterns.

Treatment Studies Covering Both Insomnia and Anxiety Disorders

Although there are many treatment studies for both insomnia and anxiety disorders, only a few have both as outcome measures. In their review of 37 treatment studies of insomnia published between 1998 and 2004, Morin et al.[18] reported only four studies that also specified findings concerning co-morbid mental disorders, and none of them concerned anxiety disorders in particular.

Post-traumatic Stress Disorder

In a meta-analysis of 38 randomised controlled trials (RCTs) of trauma-focused cognitive behavioural therapy (CBT) and eye movement desensitisation for PTSD, only six reported effects on sleep.[19] In these studies improvements in PTSD symptoms were more pronounced than improvements in sleep disturbances; the latter effects were modest. Studies of pharmacotherapy of PTSD have rarely focused on sleep disturbances. The selective serotonin re-uptake inhibitors (SSRIs) that ameliorate the PTSD symptoms hardly have any positive effects on sleep, and some of them may indeed disturb sleep. The α_1-adrenergic receptor blocker prazosin seems promising in reducing both nightmares and PTSD symptoms in general, but is in need of further evaluation.[20] The study by Krakow et al.[21] using imagery rehearsal for nightmares in 67 crime victims found significant improvement of both sleep disturbance and other PTSD symptoms.

Panic Disorder

A small study of panic disorder patients treated with CBT in a group showed significant improvement of panic but not of sleep problems immediately post-treatment; presence of nocturnal panic attacks was not given.[22] However, clinical experience tells us that such attacks do not appear to hamper response to CBT in panic disorder patients.

Generalised Anxiety Disorder

Bélanger et al.[23] treated 44 GAD patients with CBT, among whom 34 reported at least one type of sleep disturbance. The sleep problems improved after treatment even though they were not specific targets of the treatment.

Pollack et al.[24] carried out an RCT of GAD patients who received escitalopram 10mg/day for 10 weeks and were randomised to receive eszopiclone or placebo for eight of these weeks, but for the last two weeks eszopiclone was replaced by single-blind placebo. Treatment with escitalopram plus eszopiclone showed greater improvement in anxiety, sleep and daytime functioning from week one versus escitalopram plus placebo. After eszopiclone discontinuation there was no evidence of rebound insomnia, but the difference in sleep outcome did not persist.

Summing Up

The results of treatment studies of PTSD, panic disorder and GAD with both anxiety and insomnia as outcome measures show variable results as to improvement in both measures. The most convincing study is that of Pollack et al., which clearly demonstrated the superiority of the dual treatment approach focusing on both anxiety and insomnia.

Special Problems

Nightmares

The National Comorbidity Survey suggested that patients with co-morbid panic disorder and PTSD experienced especially high rates of sleep and nightmare disturbance.[25] Nightmare complaints were significantly more elevated when PTSD was compounded by panic disorder than with other mental disorders, including GAD. Panic disorder with co-morbid PTSD was associated with a reduction of large-scale movements during sleep, which was strongly associated with nightmare complaints and with more frequent arousals, but not with significant worsening of objective sleep. More details concerning nightmares and PTSD are given by Lamarcke et al.[26]

Discontinuation of Hypnotic Drugs

Between 5 and 12% of the general population use some hypnotic medication to obtain relief from their sleep problems. However, long-term use of benzodiazepine (BZD), and also the new BZD agonists (e.g. zopiclone, zolpidem), has been associated with cognitive and psychomotor impairment and increased risk of tolerance and dependence. Thus, treatment programmes for hypnotic discontinuation combining tapering with psychological interventions have been developed. A recent study by Belleville and Morin[27] showed that the level of anxiety after eight weeks of treatment was a major determinant of success or not with

such a programme. Those who were unsuccessful were characterised by a higher level of anxiety. High levels of anxiety during discontinuation seem to be a predictor of continued use of hypnotic medication.

Conclusion

This article has confirmed the bi-directional and close relationship between insomnia and anxiety. It has also documented that anxiety and sleep researchers lack awareness of this relationship, although they use quite similar explanatory models. More attention to this bi-directionality should be given for three reasons:

- insomnia is a risk factor for anxiety disorders and vice versa, and thus early intervention might have a preventative effect;
- recognition of co-morbid anxiety disorders and insomnia may lead to changes of treatment strategy; and
- rather than prescribing monotherapy focused on either insomnia or anxiety disorders, dual therapy attacking both disorders seems to be more efficient in recent studies. ■

In memory of Dag Neckelmann, MD, PhD (1963–2008), a colleague and friend.

Alv A Dahl is a Research Co-ordinator for Psychosocial Oncology at the Norwegian Radium Hospital at Oslo University Hospital. He was previously a Professor of Psychiatry at the University of Oslo with a focus on psycho-oncological research. His other research areas include anxiety disorders, personality disorders and psychotherapy.

1. Roth T, Jaeger S, Jin R, et al., Sleep problems, comorbid mental disorders, and role functioning in the National Comorbidity Survey Replication, *Biol Psychiatry*, 2006;60:1364–71.
2. Jansson M, Linton SJ, The role of anxiety and depression in the development of insomnia: cross-sectional and prospective analyses, *Psychol Health*, 2006;21:383–97.
3. Taylor DJ, Lichstein KL, Durrence HH, et al., Epidemiology of insomnia, depression and anxiety, *Sleep*, 2005;28: 1457–64.
4. Ohayon MM, Roth T, Place of chronic insomnia in the course of the depressive and anxiety disorders, *J Psychiatr Res*, 2003;37:9–15.
5. Stewart R, Besset A, Bebbington P, et al., Insomnia comorbidity and impact and hypnotic use by age groups in a national survey population aged 16 to 74 years, *Sleep*, 2006;29:1391–7.
6. LeBlanc M, Beaulieu-Bonneau S, Mérettte C, et al., Psychological and health-related quality of life factors associated with insomnia in a population-based sample, *J Psychosom Res*, 2007;63:157–66.
7. Klein MH, Wonderlich S, Shea MT, Models of relationships between personality and depression: Toward a framework for theory and research. In: Klein MH, Kupfer DJ, Shea MT (eds), *Personality and Depression: A Current View*, New York, NY: Guilford, 1993;1–76.
8. Gregory AM, Caspi A, Eley TC, et al., Prospective longitudinal associations between persistent sleep problems in childhood and anxiety and depression disorders in adulthood, *J Abnorm Child Psychol*, 2005;33:157–63.
9. Neckelmann D, Mykletun A, Dahl AA, Chronic insomnia as a risk factor for developing anxiety and depression, *Sleep*, 2007;30:873–80.
10. Vahtera J, Kivimäki M, Hublin C, et al., Liability to anxiety and severe life events as predictors of new-onset sleep disturbances, *Sleep*, 2007;30:1537–46.
11. Craske MG, Waters AM, Panic disorder, phobias, and generalized anxiety disorder, *Annu Rev Clin Psychol*, 2005;1:197–225.
12. Espie CA, Broomfiled NM, MacMahon KMA, et al., The attention–intention–effort pathway in the development of psychophysiologic insomnia: a theoretical review, *Sleep Med Rev*, 2006;10:215–45.
13. Harvey AG, A cognitive theory and therapy of chronic insomnia, *J Cogn Psychother*, 2005;19:41–59.
14. Morin CM, Cognitive-behavioral approaches to the treatment of insomnia, *J Clin Psychiatry*, 2004;65(Suppl. 16): 33–40.
15. Brosschot JF, Gerin W, Thayer JF, The perseverative cognition hypothesis: a review of worry, prolonged stress-related physiological activation, and health, *J Psychosom Res*, 2006;60:113–24.
16. Jansson M, Linton SJ, Psychological mechanisms in the maintenance of insomnia: arousal, distress, and sleep-related beliefs, *Behav Res Ther*, 2007;45:511–21.
17. Omvik S, Pallesen S, Bjorvatn B, et al., Night-time thoughts in high and low worriers: reaction to caffeine-induced sleeplessness, *Behav Res Ther*, 2007;45:715–27.
18. Morin CM, Bootzin RR, Buysse DJ, et al., Psychological and behavioral treatment of insomnia: update of the recent evidence (1998–2004), *Sleep*, 2006;29:1398–1414.
19. Bisson JI, Ehlers A, Matthews R, et al., Psychological treatment for chronic post-traumatic stress disorder, *Br J Psychiatry*, 2007;190:97–104.
20. Miller LJ, Prazosin for the treatment of posttraumatic stress disorder sleep disturbances, *Pharmacother*, 2008;28:656–66.
21. Krakow B, Johnston L, Melendrez D, et al., An open-label trial of evidence-based cognitive behavior therapy for nightmares and insomnia in crime victims with PTSD, *Am J Psychiatry*, 2001;158:2043–7.
22. Cervena K, Matousek M, Prasko J, et al., Sleep disturbances in patients treated for panic disorder, *Sleep Med*, 2005;6:149–53.
23. Bélanger L, Morin CM, Langlois F, et al., Insomnia and generalised anxiety disorder: effects of cognitive behavioural therapy for gad on insomnia symptoms, *J Anxiety Dis*, 2004;18:561–71.
24. Pollack M, Kinrys G, Krystal A, et al., Eszopiclone coadministered with escitalopram in patients with insomnia and comorbid generalized anxiety disorder, *Arch Gen Psychiatry*, 2008;65:551–62.
25. Leskin GA, Woodward SH, Young HE, et al., Effects of comorbid diagnoses on sleep disturbances in PTSD, *J Psychiatr Res*, 2002;36:449–52.
26. Lamarche LJ, De Koninck J, Sleep disturbance in adults with posttraumatic stress disorder: a review, *J Clin Psychiatry*, 2007;68:1257–70.
27. Belleville G, Morin CM, Hypnotic discontinuation in chronic insomnia: impact of psychological distress, readiness to change, and self-efficacy, *Health Psychol*, 2008;27:239–48.