

Epidemiology of Insomnia: Prevalence and Risk Factors

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1. Introduction

Insomnia is among the most prevalent health complaints, with approximately 10 to 15% of the general population suffering regularly from it and about 25 to 35% presenting transient or occasional insomnia (Ancoli-Israel & Roth, 1999; Ohayon, 2002; Morin et al., 2006; Doghramji, 2006; LeBlanc et al., 2009). However, many questions remain unanswered with regard to our understanding of insomnia and prevalence estimates vary because of inconsistent definitions and diagnostic criteria. In addition, the use of baseline and follow-up assessments to establish incidence and remission rates can be problematic because of the wide spectrum of insomnia duration (e.g., a positive finding of insomnia at baseline and 1-year follow-up may reflect unremitting chronic insomnia or 2 episodes of transient insomnia) (Roth, 2001; Young, 2005).

The elderly in particular are affected by insomnia, and it has been shown that women are more likely to have sleep difficulties than men. Although insomnia can be a primary condition, and can coexist with other disorders or be considered secondary to these disorders, the mechanisms producing it are not clearly defined (Doghramji, 2006).

Insomnia can be brought on by psychosocial causes, co-morbid medical disorders, abuse of alcohol or other substances. The relationship between insomnia and psychosocial and medical conditions is believed to be reciprocal; each condition may cause, maintain, and even exacerbate the other.

2. Prevalence of insomnia

There is no consensus for classification used in defining insomnia in terms of its symptoms, frequency and severity. These variations of the definition and population studied determine the wide variation in the estimated prevalence (Ohayon, 2002; Mai & Buysse, 2008; Roth et al., 2011).

Various are the concepts used to define insomnia, which range from the concept of "unsatisfactory sleep" developed by the American Medicine Institute in 1979, to the International Classification of Sleep Disorders (ASDA, 1990) definition according to which

insomnia corresponds to the complaint of insufficient sleep almost every night or by being tired after the usual sleep time. The three main diagnostic manuals, International Classification of Sleep Disorders (ICSD-2) (American Academy of Sleep Medicine, 2005), Diagnostic and Statistic Manual (DSM IVTR) (American Psychiatric Association, 2000), and International Classification of Disease (ICD-10) (World Health Organization, 1992), vary in their approach to defining insomnia.

Another important source of variation streams from the need of hiring professional interviewers or laborious instruments for its measure according to the most commonly used criteria. Besides, the frequent association of insomnia and mental disorders, results in a wide variation between the concepts used and the means to measure primary insomnia.

As a result of these differences in insomnia case definitions, estimates of insomnia prevalence have varied widely, from 10–40% (Bixler et al., 1979; Ford & Kamerow, 1989; Kuppermann et al., 1995; Üstun et al., 1996; Simon & Von Korff, 1997; Ancoli-Israel & Roth, 1999; Léger et al., 2000; Ohayon e Roth, 2001; Ohayon, 2002; Li et al., 2002; Rocha et al., 2002; Pires et al., 2007; Roth et al., 2011). Given all the information available, the prevalence of insomnia symptoms may be estimated at 30% and specific insomnia disorders at 5-10% (Roth et al., 2007; Mai & Buysse, 2008).

A third of the Americans have reported one or more insomnia symptoms: difficulty in falling asleep, difficulty to maintain sleep, waking up very early, and in some cases, a non-restorative or a bad quality sleep, in a study by the National Sleep Foundation in conjunction with the Gallup Organization, which objective was, from telephone interviews examine the prevalence and nature of the difficulty in sleeping (Ancoli-Israel & Roth, 1999). More recently, the America Insomnia Survey conducted among 10,094 health care plan subscribers, assessed insomnia using the Brief Insomnia Questionnaire (BIQ). The questionnaire, developed for the study generated diagnoses of insomnia according to the definitions and criteria of the SDM-IV_TR, ICD-10 and RDC/ICSD-2 systems (Summers et al., 2006). This study found that insomnia prevalence estimates varied widely, from 22.1% for DSM-IV-TR to 3.9% for ICD-10 criteria; the RDC/ICSD-2 estimate was 14.7% (Roth et al., 2011).

Ohayon e Roth (2001) in a transversal study with a representative sample of 24,600 individuals of the populations of France, United Kingdom, Germany, Italy, Portugal and Spain, 15 years old or more, found a 10.1% prevalence for difficulty in going to sleep and 22.2% to mantaining sleep, with a frequency of three or more times a week. When using the DSM-IV criteria to diagnose insomnia (complaint of difficulty in falling asleep or to maintain sleep or of a non-restorative sleep, for at least one month, causing clinically significant distress or impairment in the individual) this prevalence is 11.1%. Also in France, Léger et al. (2000), in a sample of 12,778 people, reported a prevalence of 21% and 16%, in falling asleep and mantaining sleep, respectively, and 19% of insomnia, according to the DSM-IV criteria.

In a study in the city of Hong Kong, where the definition used was the positive response (sometimes or always) at least three times a week in the last month, the prevalence found in 9,851 individuals between 18 and 65 years old was of 4.4% for difficulty in falling asleep, 6.9% mantaining sleep after being interrupted and 4% for early morning awakening. The prevalence of insomnia (considering a positive answer to any of these questions) was 11.9% (Li et al., 2002).

In Latin America, there are few studies on sleep disorders and its occurrence in the population. In Brazil, Rocha et al. (2002), in a population-study of 1,221 individuals in a city in Minas Gerais State (BambuÍ), found 35.4% prevalence of insomnia in the adult population (more than 18 years old). The most common complaint was of intermediate insomnia (27.3%); followed by initial insomnia (18.3%) and final insomnia (14.3%), with a frequency of three or more times a week, during the last month. In São Paulo State, Pires and collaborators (2007) performed a study to compare prevalence of insomnia complaints and sleep habits among women of more than 20 years old in a general population sample, between the years 1987 and 1995. The criterion used was frequency, where those who answered questions about insomnia "of three to six times a week" or "daily" were considered insomniacs. The results were: for difficulty in falling asleep 17.2% (in 1987) and 23.5% (in 1995) and for difficulty in maintaining sleep 18.6% and 29.8% (in 1987 and 1995, respectively). Marchi and collaborators (2004) in a study conducted with 833 women between 18 and 90 years old and that used DSM-IV criteria to diagnose insomnia, observed prevalence of 35.4% among women of a city in São Paulo State (São José do Rio Preto).

In order to understand the high prevalence of insomnia and to provide evidence for a better treatment or management of that in the health care, epidemiological studies in this area have focused on the complex pathways of the determination of insomnia. A new generation of studies has investigated which factors have been implicated in its development and persistence.

3. Risk factors for insomnia

3.1 Socio-demographic and economic factors

Factors most commonly associated to insomnia are: gender, age, marital status, income, educational level, and race/ethnicity. Sleep disorders affect women and men differently and may have different manifestations and prevalences (Philips et al., 2008).

A consistent finding in literature is the higher prevalence of insomnia among women than in men (Breslau et al., 1996; Léger et al., 2000; Sutton et al., 2002; Ohayon, 2002; Ohayon & Partinen, 2002; Ohayon & Hong, 2002), there being few studies that observed higher prevalence in men (Kim et al., 2000).

A meta-analysis of more than 29 studies and 1,265,015 individuals showed that women have a 41% higher risk (95% CI 1.28–1.55) of developing insomnia than men (Zhang & Wing, 2006). In another study, data from the *National Sleep Foundation* showed that 57% of women suffer one or more insomnia symptoms at least some nights a week (National Sleep Foundation, 2005). Women reported a larger number of insomnia symptoms, with daytime consequences, dissatisfaction with sleep and having a diagnosis of insomnia when compared to males. The woman/man ratio for insomnia symptoms is about 4:1, increasing with age (Ohayon, 2002).

Léger et al. (2000) demonstrated that the more restrictive the criteria for insomnia, the more important the difference between sexes. The prevalence, when the criteria evaluate only one complaint of insomnia is 78% among women and 68% among men. When using DSM-IV criteria, prevalence is 22% among women and 14% among men, and if criteria include more than one complaint of sleep disorders with daily consequences (criteria for severe insomnia), prevalence is 12% in women and 6.3% in men.

Another study identified some risk factors specific to gender. Low educational level and retirement were associated to a higher risk of insomnia in men, while being divorced or widow, housewife and sleep in a noisy atmosphere, were associated to a higher risk of insomnia in women (Li et al., 2002).

The reasons why women are more affected than men are not well known. Evidences suggest that insomnia may occur in association to hormone changes that are unique to women, such as those accompanying them during menopause. Although the relationship between hormone levels and sleep is complex, it seems that there is a correlation between the decrease in circulating estrogens and progesterone and an increase of insomnia prevalence (Krystal, 2003). The decrease of complaints during hormone therapy may be an indicator that its occurrence is in part due to the fall of female sexual hormones that occur at menopause (Polo-Kantola et al., 1998; Sarti et al., 2005).

Another possible explanation for this difference between sexes is given by the fact that women present a higher prevalence of mental disorders, especially depression and anxiety (Li et al., 2002), which would increase the risk of insomnia. Another hypothesis is that women would be more sensitive to the methods of measuring insomnia, because culturally women are allowed greater freedom to show their emotions while men tend to hide or not to admit them (Panda-Moreno et al., 2001).

Most epidemiologic studies report a higher prevalence of insomnia symptoms with age (Bixler et al., 1979; Vela-Bueno et al., 1999; Léger et al., 2000; Kim et al., 2000), but some authors associate this increase in prevalence to factors that would contribute to a worse quality sleep and not to age *per se* (Lamberg, 2003). With age, psychological and medical problems and medicines used in these treatments would cause a decline in sleep quality (Lee et al., 2008).

Sutton et al. (2002) in a study conducted in a representative sample of the Canadian population over 15 years old did not find a significant association between age and insomnia. For these and other authors, insomnia should not be considered as a component of the aging process and studies should consider the multifactorial aetiology. In this age group, individuals present a higher difficulty to adjust to new changes in life, e.g. retirement, change of address, loss of family members (Panda-Moreno et al., 2001). Another explanation is a growth in circulatory, digestive and respiratory diseases (Ohayon e Zulley, 2001), changes in circadian rhythms (Roth & Roehrs, 2003), allergies, migraines, rheumatic disorders (Ohayon e Zulley, 2001), etc. All these factors show a significant association to insomnia.

In some studies (Pallesen et al., 2001; Ohayon e Partinen, 2002), the prevalence of insomnia did not behave as expected. Prevalence of initial insomnia was higher in the younger groups, a result that is probably related to group lifestyle (e.g. staying up until late on weekends) or to circadian factors. Ohayon e Zulley (2001) report that among the youth, stress would have a more important role in prevalence of insomnia than in the elderly, when probably physical illnesses would be more significant.

Studies that examined the association between marital status and insomnia generally report a higher prevalence in separated/divorced individuals or widowed (Ohayon et al., 1997; Léger et al., 2000; Li et al., 2002) when compared to single or married.

In Brazil, results of investigations conducted by Rocha et al. (2002) confirm this association. Widowed (OR = 2.3; 95% CI 1.5-3.5) and separated/divorced (OR = 2.2; 95% CI 1.2-4.2) were more likely to suffer from insomnia when compared to married individuals.

Prevalence of insomnia is higher in individuals with low income and in those with low literacy (Bixler et al., 1979; Li et al., 2002). However, further studies using multivariate analysis did not identify low-income and low literacy as independent risk factors for insomnia (Ohayon et al., 1997). One hypothesis to explain these results is that, among individuals with low literacy and low income, these factors could reflect additional social disadvantage such as unemployment and poor living conditions in general (Pallesen et al., 2001), which could feed daily stress or lead to insomnia (Kim et al., 2000).

The high occurrence of physical and mental health problems could be a possible explanation, presented by Rocha and collaborators (2002), to a higher prevalence of insomnia among individuals with low socio-economic development.

Another SDE factor studied is race. Prevalence of insomnia is generally higher among blacks as compared to whites (Bixler et al., 2002). Folley et al. (1999), in a cohort study among elderly (65 years old or more), with a three year follow-up, found that the incidence of insomnia was higher in black women (19%), followed by white men and women with 14% and black males (12%). Among blacks, women had a higher risk of developing insomnia (OR = 1.58; 95% CI 1.03–2.41), when compared to men. Among whites, risk of developing insomnia did not differ between male and female (OR = 0.77; 95% CI 0.50–1.20).

In a Brazilian study conducted at Bambuí (Rocha et al., 2002) prevalence was higher in white individuals (52.8%), followed by mulattos/browns (44.3%) and blacks (2.9%), but the univariate analysis performed found no statistically significant association between insomnia and race, when comparing white with mulattos/browns (OR = 1.0; 95% CI 0.80–1.3) and blacks (OR = 1.4; 95% CI 0.6–3.0).

3.2 Physical and mental morbidity

Links between poor physical health and insomnia have repeatedly been demonstrated, (Moffitt et al., 1991; Sutton et al., 2001; Martikainen et al., 2003; Roth & Roehrs, 2003; Buysse, 2004; Ohayon & Bader, 2010) as many diseases involve pain and/or distress that can interfere with sleep. Using data from the 2002 Canadian Community Health Survey (CCHS): Mental Health and Well-being, Tjpkema (2005), reported that over 20% of people with asthma, arthritis/rheumatism, back problems or diabetes reported insomnia, compared with around 12% of people who did not have these conditions. After adjustment for demographic, socio-economic, lifestyle and several psychological factors, the conditions that remained independently related to insomnia were fibromyalgia, arthritis/rheumatism, back problems, migraine, heart disease, cancer, chronic bronchitis/emphysema/chronic obstructive pulmonary disease, stomach/intestinal ulcers, and bowel disorders. On the other hand, associations between insomnia and asthma, high blood pressure, diabetes and the effects of stroke disappeared.

Despite the importance of physical morbidity on the aetiology and maintenance of insomnia, emotional and mental disorders appear to play an even more important role on that (Breslau et al., 1996; Li et al., 2002). In fact, studies have reported that insomnia secondary to a psychiatric disorder is the most common diagnostic entity in 30%–50% of patients (Coleman et al., 1982).

As with physical morbidity, the relationship between insomnia and mental disorders is known to be bidirectional. Insomnia can be both a risk factor (Lustberg & Reynolds, 2000) and a consequence of depression (Lustberg & Reynolds, 2000; Roberts et al., 2000), of anxiety disorders and abuse of alcohol and other substances (LeBlanc et al., 2009).

The association between insomnia and major depressive episodes has been constantly reported: individuals with insomnia are more likely to have a major depressive illness. Longitudinal studies have shown that the persistence of insomnia is associated with the appearance of a new depressive episode.

The presence of insomnia symptoms was reported in 80% of individuals with a major depressive diagnosis, and levels close to 90% among patients with diagnosis of anxiety disorder (Ohayon, 2002). Research by Breslau et al. (1996) among young adults (21 to 30 years old) in Michigan, USA, found, after adjusting to gender, that individuals with history of insomnia in the last weeks presented four times higher chances to be diagnosed with depression (OR = 3.9; 95% CI 2.22-7.0) and twice higher for any kind of anxiety (OR = 1.97; 95% CI 1.08-3.6).

LeBlanc et al. (2009) in a population-based longitudinal study among adults participants from a larger epidemiologic study conducted in Quebec, Canada, found that, when compared to good sleepers, insomnia syndrome incident cases presented higher depressive and anxiety symptoms at baseline.

Individuals with sleep problems have significantly higher levels of common mental disorders. Research conducted by Üstün et al. (1996), in 15 cities in 14 different countries with outpatients between 15 and 65 years old, showed that, after deleting the item relating to sleep in the questionnaire ("the last two weeks, you have lost much sleep over worry?"), the General Health Questionnaire (GHQ-12) score – screening tool for these disorders – was twice greater for these patients with sleep problems when compared to those without sleep problems. In the same study, patients who reported positively for at least one question about insomnia complaints, the relative risk for depression was 9.0 (95% CI 7.7-10.5) and 3.9 for generalized anxiety (95% CI 3.3-4.6).

Research using data from the 2002 Canadian Community Health Survey (CCHS): Mental Health and Well-being showed mental and emotional health to be strongly associated with insomnia (Johnson & Breslau, 2001; Sutton et al., 2001; Ohayon, 2002; Martikainen et al., 2003; Ohayon & Roth, 2003). Around a third of people who reported having had an anxiety or mood disorder in the past year had insomnia, compared to 12% of those who did not have such disorders.

More recently, a population-based study conducted among 5,001 Chinese adults in Hong-Kong, showed that higher scores of depression and anxiety (Hospital Anxiety and Depression Scale – HADS) and poor mental health component of quality of life measures (QoL) were significantly associated with insomnia (Wong & Fielding, 2011).

3.3 Alcohol and other substances

Several studies have reported sleep problems associated with the use of several illicit drugs, and the vast majority of alcoholic patients entering treatment reported insomnia-related symptoms, such as difficulty falling and maintaining sleep (Mahfoud et al., 2009; Tjepkma,

2005). For example, the prevalence of insomnia ranged from 36 to 72 percent in patients admitted for alcoholism treatment, depending on sample characteristics and instruments used to measure insomnia (Foster et al., 2000; Brower et al., 2001).

Alcohol, which is a sedating agent, can aid the onset of sleep. However, it can also lead to increased arousal later in the sleep cycle, and with continued use, its benefits as a sleep aid is reduced (Quereshi & Lee-Chiong, 2004).

According to the results of the CCHS, 16% of frequent heavy drinkers reported insomnia, compared to 13% of those who were not frequent heavy drinkers, and this association persisted even after adjustment for other factors. In the same study, they found that about one in five (18%) people who used cannabis, but no other illicit drugs, reported insomnia at least once a week, significantly higher than the 13% reported by those who did not use illicit drugs or used them less frequently (Tjepkema, 2005).

In a Chinese population-based study, those consuming alcohol four to seven times a week had higher adjusted odds (OR = 4.7; 95% CI 1.6-13.4) of reporting insomnia than those who never consumed alcohol (Wong & Fielding, 2011).

Besides alcohol consumption, caffeine, drug withdrawal, and use of stimulants are also associated to sleep disruption (Ramakrishnan & Scheid, 2007).

Smoking was also positively related to difficulties in falling asleep and estimated sleep latency (Janson et al., 1995). Similar results were described by Philips and Danner (1995), who observed that cigarette smokers were significantly more likely than non-smokers to report difficulties in falling asleep, maintaining sleep as well as daytime sleepiness.

3.4 Chronic pain

Disrupted sleep pattern or insomnia is one of the most prevalent complaints among persons with chronic pain conditions and is associated with pain discomfort. As the other factors evaluated, the relationship between chronic pain and insomnia is believed to be reciprocal (McCracken & Iverson, 2002; Wilson et al., 2002; Benca et al., 2004; Lautenbacher et al., 2006; Gupta et al., 2007; Gureje, 2007; Roth et al., 2007; Goral et al., 2010).

Using data from the Israel National Health Survey (INHS) conducted in 2003–2004 on a representative sample (N = 4,859) of the adult Israeli population, Goral et al., (2010) found that chronic pain was associated with both sleep problems and increased health care utilization even for individuals with no psychiatric comorbidity. Sleep difficulties but not health care utilization rates were more pronounced in the comorbid group compared to the chronic pain only group.

3.5 Menopause

Insomnia is the most frequent sleep disorder in postmenopause. Studies demonstrated that women in perimenopause and postmenopause present a higher sleep latency, difficulty in maintaining and are less satisfied with sleep when compared to those in premenopause (Landis & Moe, 2004).

Hormone changes, depressive states related to this period of life or to vasomotor symptoms (hot flashes and/or nocturia), besides chronic pain are some of the probable causes of

insomnia associated to menopause. Some studies refer to difficulty in determining if changes in sleep are due to aging or to menopausal status (Shaver & Zenk, 2000; Campos et al., 2005; Pérez et al., 2009).

Insomnia during menopause is frequently attributed to the heat waves. According to the majority of studies, it is more strongly associated with vasomotor symptoms, probably due to the cascade of symptoms: hot flashes and sweating at night generating insomnia, and, consequently, irritability and fatigue the following day (Pedro et al., 2003; Landis & Moe, 2004).

Prevalence of insomnia as a menopause symptom is relatively high, as shown in studies:

An Australian population-based follow-up study (Melbourne Women's Midlife Health Project) with 438 women (from 45 to 55 years old) followed for seven years analyzed changes in symptoms of menopause in terms of prevalence and severity. An increased prevalence of insomnia in time after menopause was observed. Thus, the reporting of sleep difficulties was observed in 38%, 43% and 45% of women with one, two and three years of post-menopause, respectively (Dennerstein et al., 2000).

In Spain, a sectional study, accomplished in 2006, with 10,514 women between 45 to 65 years old, observed a prevalence of insomnia of 45.7%. Prevalence of insomnia was of 37.5% among women in perimenopause and 49.4% in postmenopause (Pérez et al., 2009).

Another study that addresses insomnia in relation to the menopause transition was conducted in the Netherlands, with 2,450 women between 47 and 54 years old. Prevalence of insomnia in premenopause, perimenopause and postmenopause was of 37%, 47% and 60%, respectively. The crude odds ratios were: 0.99 (women in perimenopause compared to those in premenopause), 1.34 (women in postmenopause compared to those in perimenopause), and 2.06 (women in postmenopause compared to those in premenopause) (Maartens et al., 2001).

In a cohort study in Korea with 2,497 women between 40 and 60 years old, the prevalence of insomnia increases significantly in the transition from premenopause (7.3%) to perimenopause (15.9%) and to postmenopause (19.7%). The association between insomnia and the transition to menopause remained even after adjusting for age, education, income, marital status, physical illness, depression, and BMI, with ORs from 2.1 to 1.4 for perimenopause and postmenopause when compared to premenopausal women (Shin et al., 2005).

In Brazil, a household survey in Campinas (São Paulo State) in 1997, with 456 women, between 45-60 years old assessed the existence and frequency of symptoms - hot flashes, sweating, palpitations and dizziness (vasomotor symptoms) - in 4 weeks preceding the survey (replies: never, less than three times a day, from three to ten times a day and 11 times or more). The instrument also included psychological symptoms such as nervousness, irritability, headaches, depression and insomnia. Insomnia was one of the most prevailing among psychological symptoms. The percentage of insomniac women was 54.5%, prevalence which grew as the state of menopause, being 40.6% in premenopause, 55.9% in perimenopause and 61.1% in postmenopause (Pedro et al., 2003).

Still in Brazil, the evaluation of postmenopausal sleep quality (defined as "sleep badly" always or most times), with 271 women between 35 and 65 years old, treated at private

clinics or at school-hospitals in São Paulo city showed prevalence of 18.6% in premenopause, 37.5% in perimenopause, 28.9% in natural postmenopause and 38.9% in post-surgical menopause (Souza et al., 2005). In this study peri and surgical postmenopause were associated to "sleeping badly" (OR = 2.63; 95% CI 1.25-5.51 and OR = 2.78; 95% CI 1.18-6.60), respectively. Natural postmenopause and the use of HRT were not statistically significantly associated to "sleeping badly".

Study results show an improvement in subjective sleep quality (Montplaisir et al., 2001; Saletu-Zyhlarz et al., 2003), improved psychological well-being (Purdie et al., 1995) and the diminishment of hot spells (Purdie et al., 1995; Montplaisir et al., 2001) with the use of hormone replacement. In contrast, a recent study accomplished by Kalleinen (2008) shows that although the hormone replacement restores hormone levels after menopause, it offers no advantages as regards sleep deprivation.

The lack of consistency among the results of the studies has been attributed mainly to differences in protocols used in studies based on use of hormone therapy, duration of treatment, age and symptoms of the subjects and type of menopause (natural or surgical) (Kalleinen, 2008).

3.6 Psychosocial factors

One of the most consistent findings in the literature is the association between psychosocial factors and incidence and persistence of insomnia. The huge changes in the demography and economy that occurred mainly in the last decades worldwide have a parallel in the people's lifestyle, the way people interact in their work, family disruption, lack of social support, among others. These changes have been implicated to the high levels of stress and sleep problems found in the studies in this area.

3.6.1 Stress and stressful life events

Stress is an important factor related to insomnia. Stressful situations increase the psychological and physiological activation in response to increased environmental demands. Such activation is incompatible with deactivation which is the main feature of sleep. Thus, the scientific literature confirms the common sense notion that stress *disrupts* sleep (Akerstedt, 2006). On the other hand, the relationship between stress and sleep has to be evaluated in the light of its bidirectionality. In fact, stress impairs sleep quality, and chronic sleep difficulty is likely to become a stressor in itself, thus promoting a vicious circle of stress and insomnia (Akerstedt, 2006).

The occurrence stressful life events (SLE) has been shown to be strongly associated to chronic insomnia (Healey et al., 1981; Kim et al., 2000; Ohayon & Zullely, 2001; Robaina et al., 2009) and is mediated by certain personality factors. Insomniacs tend to be unhappier in interpersonal relationships and have a relatively low self-esteem, having inadequate *coping* mechanisms to deal with stress (Ohayon & Hong, 2002; Basta et al., 2007). However, in the majority of cases, primary insomnia (aetiology that is not related to another mental disorder, medical condition or substance dependence) may be induced by a stress situation, such as: withdrawal of a family member, sadness, loss or stress at work, economic difficulty, surgical intervention, etc, that would occupy the individual's mind while trying to sleep (LeBlanc et al., 2009; Kim et al., 2011). According to Yaniv (2004), about 74% of individuals that have

sleep difficulties remember stressing life experiences associated to the beginning of their insomnia (e.g. personal losses, illnesses, marriage conflicts, etc). Once surpassed the critical period of occurrence of the triggering event, the subsequent insomnia could be another stress factor, since it affects activities related to everyday life (e.g. increasing the risk of losing one's job due to the impairment of efficiency in the work environment). Over time the effect of stress could be amplified resulting in a vicious circle, which would increase the levels of insomnia and stress.

Based on data from the 2002 Canadian Community Health Survey (CCHS), Tjepkema (2005) found that close to a quarter (23%) of people who described most of their days as being either "quite a bit" or "extremely" stressful reported insomnia and this was more than twice the percentage for people who reported little or no stress. According to the author, this difference persists even when physical and emotional/mental health along with socio-demographic, economic and lifestyle factors, were taken into account. Another finding reported is that the type of stress also made a difference; people whose main source of stress was a physical health problem, the death of a close relative, an emotional/mental health problem, personal/family responsibilities or problems in personal relationship had higher rates of insomnia compared with the overall rate.

Among Americans who suffered with occasional insomnia, the following events were described as the cause of difficulty to sleep: work stress (28% of individuals), family stress (20%) and death in the family (12%), according to research accomplished by the *National Sleep Foundation* together with the *Gallup Organization* (Ancoli-Israel & Roth, 1999).

A research conducted in Germany among the general population aged 15 years old or more, showed that individuals who reported having experienced some stressful event in the past year had more chance of being dissatisfied with their sleep, even after adjusting to age and sex (OR = 1.8; 95% CI 1.4-2.5). The chance of referring to dissatisfaction with sleep was greater among the people who perceived themselves suffering a high degree of stress (OR = 2.2; 95% CI 1.5-3.2), followed by those who presented a medium level of stress (OR = 1.5; 95% CI 1.0-2.1), when compared to individuals that did not report stress (Ohayon & Zulley, 2001).

In Brazil, a study conducted by Robaina and cols (2009) showed an important association between SLE and insomnia complaints of auxiliary nurses at a university hospital. The SLE associated to complaints of frequent insomnia were: "disrupter of relationship" (OR = 3.32; 95% CI 1.90-5.78), "serious health problems" (OR = 2.82; 95% CI 1.73-4.58); "serious financial difficulties" (OR = 2.38; 95% CI 1.46-3.88), and "forced change of residence" (OR = 1.97; 95% CI 1.02-3.79).

3.6.2 Job stress and other work characteristics

Occupational risk factors, such as shift work, job strain and number of work hours can also be linked to insomnia (Härmä et al., 1998; Nakata et al., 2001).

An essential aspect to be considered in this context is the stress originated by the work environment. There is widespread evidence that job stress can act as a risk factor for insomnia, as shown by several epidemiological studies on psychosocial job characteristics (Schnall et al., 2000; Akersted, 2006).

An important theoretical model for evaluating psychosocial conditions at the workplace is the demand-control model, designed by Karasek (1979). It considers the interrelationship between two components in the work process: (i) psychological demands: work overload, difficulties and little time available for the completion of work amongst others, and (ii) control: autonomy over one's own tasks, the possibility of using, developing, and acquiring new abilities (Karasek & Theorell, 1990). The perception of social support (from supervisor and from colleagues) was later included in this model by Johnson and Hall (1988). This dimension refers to the emotional integration, trust and assistance in performing, and was supposed to act as a moderator in the relationship between stress at work and health. The complete model is commonly referred to as the Demand-Control-Support model (Hausser et al., 2010).

A strong link between stressful working conditions – as measured by the demand-control model – and sleep was described by Kalimo and cols (2000) in a sample of 3,079 middle-aged working men in Finland. According to this study, the combination of high demands and low control (usually called *job strain*) was associated to a 30% prevalence of sleep disturbances, whereas a 5% prevalence of sleep disturbances was observed in the low demand-high control group. The study by Ota et al. (2005) also showed high job strain to be related to insomnia in 1,081 middle-aged workers in Japan.

The risk of insomnia increased with a higher degree of job strain, and decreased with a higher degree of job control in a sample of office workers. The combination of high strain with low degree of control or social support had an approximately three times higher risk of insomnia, as compared to that of low job strain with high degree of control or support (Nomura et al., 2009).

The analysis of the demand and control scores separately showed that only the demand was significantly related to disturbed sleep in a sample of healthy employed men and women in Sweden (Akerstedt et al., 2002a). Interestingly, the inclusion of an item corresponding to the inability to stop thinking about work during free time yield the highest OR, and forced work demands out of the regression.

In addition, an important connection between social support and sleep was also observed by Akerstedt et al. (2002b), as the lack of social support at the workplace was a risk indicator for disturbed sleep, not feeling rested and difficulties awakening.

Another theory-based conceptual job stress model for evaluating the relationship between job stress and sleep disturbances is the so-called effort-reward imbalance (ERI) model (Siegrist, 1996). According to this model, the imbalance perceived between these two dimensions (excess effort put in to fulfil work tasks and gaining insufficient recognition for this) generates stressful situations (Siegrist, 1996; Peter & Siegrist, 2000). The reward component corresponds to the returns that a worker expects to gain financially (adequate salary), self-esteem (respect and support), and occupational status (perspectives of promotion, work stability and social status). Effort takes into account the demands and obligations perceived by the worker (Peter & Siegrist, 2000). A third dimension was incorporated in the ERI model, called “over-commitment with work”. This is defined as a set of attitudes, behaviour, and emotions that reflect excessive effort in conjunction with a strong need for recognition and esteem (Peter & Siegrist, 2000). The imbalance between exerted effort and expected reward, mediated by over-commitment with work, would potentially be the highest risk factor for falling ill.

There is increasing evidence for the relevance of the ERI in relation to sleep disturbances. Peter and collaborators (1998) found that ERI was associated with sleep disturbances in a group of female transport workers. According to Fahlén et al. (2006), higher levels of exposure for the ERI components are associated with increased prevalence of sleep disturbances in a subset of the WOLF (WOrk, Lipids, Fibrinogen) cohort study. For women, the strongest association was seen between high effort/reward ratio and sleep disturbances (PR = 4.13, 95% CI 1.62-10.5), and between high effort and sleep disturbances (PR = 4.04, 95% CI 1.53-10.7). For men, the high over-commitment and fatigue (not sleep disturbances) yielded the most obvious association.

Actually, the relevance of over-commitment was described by Kudielka et al. (2004) in a longitudinal cohort study on employers from two German companies. The authors observed that workers were 1.7 times more likely to report disturbed sleep per standard deviation increase in over-commitment. Gender-stratified analyses revealed that higher over-commitment was associated with unfavourable sleep in men, while in women poor sleep was related to lower reward.

To Akerstedt (2006), it is possible that work demands in themselves are not the most important elements in terms of insomnia, but the concern or the anticipation of the work demands, which, in this author's view was corroborated by the results of studies with techniques of polysomnography.

In a series of cross-sectional and prospective studies on a representative sample of Danish employers, Rugulies and collaborators (2009) observed that ERI was a risk factor for the development of sleep disturbances among men, whereas among women, the association between ERI and sleep was restricted to the cross-sectional sample.

In this context, a new approach was described by Ota et al. (2005). The authors showed that the simultaneous use of two stress models (demand-control and effort-reward imbalance) is more useful in the identification of workers at risk of insomnia than the use of each model separately. In a recent prospective study, Ota et al. (2009) observed that reward from work effort and sufficient support at work assist recovery from insomnia (at baseline), while over-commitment and high job strain cause future onset of insomnia.

Another prospective longitudinal study (five-year follow-up) on work and sleep showed that "having to hurry" was the main psychosocial occupational factor associated to sleep disturbances in a random sample of employed men and women. In this study, the authors also identified other risk factors for the changes in sleep, after controlling gender and age, namely shift work, long weekly hours and vibration in the work environment (Ribet & Derriennic, 1999).

Other relevant aspects of work environment have been associated to sleep disturbances. In a study with a representative sample of the Swedish population, Akerstedt (2002) observed the following work features as significant predictors of disturbed sleep: hectic work, physically strenuous work, and shift work. Amongst these aspects, shift work is the most investigated given its striking effects the quality of sleep (Akerstedt, 2003).

In fact, shift work is a well-known occupational risk factor for insomnia. The term *shift work* refers to hours of employment outside the typical day schedule from 8 a.m. to 5 p.m. on Monday to Friday, thus referring to work during non-standard hours, including night work and/or work on weekends (Presser, 2003).

There is emerging evidence from studies on insomnia that individuals with shift work are at a higher risk for lack of sleep (Ohayon, 2002). Such evidence is added to those observed in the field of occupational health. In fact, of all of the occupational factors, shift work is the most investigated given its striking consequences to quality of sleep (Akerstedt, 2003).

The consequences of work hours are clearly related to the design of the shift system. Comparisons of work schedules performed by Härmä et al. (1998) showed that insomnia complaints were more common in rotating shift work, and in irregular shift work than in day work. Also, the effects of physical activity and alcohol consumption differed for different shift schedules. Considering the diversity of shift schemes, the most important in terms of effects over sleep is the nightshift. Night work has repeatedly been associated with sleep problems, when compared to other types of shift (Ingre & Akerstedt, 2004). Complaints on sleep difficulties refer both to the duration of sleep, and to its quality (Knauth and Costa, 1996).

Differences in sleep patterns related to work systems were studied by Pilcher et al. (2000) by means of meta-analysis. The authors concluded that permanent night workers (those who always worked at night) were the ones with shorter sleep. Those results remit to the clinical evaluation of sleep performed by Walia et al. (2011), who observed that shift workers, particularly fixed shift workers, had greater difficulties with sleep onset. These data reveal the importance of considering shift work history when analyzing sleep symptom severity.

In a classical study comparing day workers, shift workers with rotating morning and afternoon shifts, and shift workers including night work, the more frequent complaints on sleep were related to shift systems that included night work, and also in the group of shift workers who later changed to day work (Knauth & Costa, 1996).

A debate in the relevant literature refers to possible long-term effects of night work on sleep, which would be reported after quitting night work. For some authors, there is no evidence that early experience with shift work results in later sleep difficulties (Webb, 1983; Niedhammer et al., 1994). Other authors show that transfer to day work does not guarantee a reduction in sleep-related disturbances (Dumont et al., 1987; 1997). In a recent study on this matter, Rotenberg et al. (2011) showed that difficulty maintaining sleep was more likely to be reported by former night workers regardless of the time devoted to night work in the past, and of how recently they had left night work.

4. Final remarks

This chapter has offered a description of prevalence and risk factors associated to insomnia. In fact, insomnia is related to socioeconomic and demographic characteristics, psychosocial causes, occupational factors, co-morbid medical disorders, abuse of alcohol and other aspects of lifestyle. The diversity of factors here described reveals the multifactorial nature of insomnia in terms of its etiology (Summers et al., 2006). The reciprocity between some factors contributes to the complexity of insomnia, as can be seen by the relationship between stress and sleep. In fact, stress impairs sleep quality, and disturbed sleep is likely to become a stressor in itself, thus promoting a vicious circle of stress and insomnia (Akerstedt, 2006). A better understanding of insomnia prevalence and incidence demands validated and consistent definitions and diagnostic criteria. Clearly, this will lead to a better data interpretation, thus enhancing our understanding of this important disorder.

5. References

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