

Epidemiology of insomnia: A review of the Global and Indian scenario

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Abstract

Insomnia is an extremely common disorder. The prevalence of insomnia in a study depends on the criteria's selected for determining the prevalence. It is well known that several factors like gender, age, psychiatric disorders among several others are risk factors for insomnia. The stress of modern urban life adds to the factors responsible for an increase in the prevalence. In addition several co-morbid factors can have a significant effect on the prevalence of insomnia. However, what is important is the effect insomnia has on the quality of life of the individual, its social implications like increased loss of work days, accidents, family disorders and the economic impact of this rather common disorder. This review summarizes the burden of this problem in the Indian context.

Keywords: Insomnia, prevalence, epidemiology, risk factors

Introduction

Insomnia literally means "lack of sleep at bedtime" (latin: insomnium)¹. However, in practice when used routinely it can have different meanings which may often result in a disparity in the prevalence rates in epidemiological studies.

Sleep is one of the essential and basic physiological processes seen in higher animals. A full night's refreshing sleep is essential for adequate daytime functioning. It is now well known that sleep is not a mere passive state but

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an active neurobehavioral state maintained by a highly organized interaction of neural networks and neurotransmitters of the central nervous system. Sleep has an important role in the regulation of central nervous system (CNS) and the body's physiological functions, regulating metabolism, catabolism, temperature, learning and memory consolidation². The patho-physiology of insomnia is highly complex involving multiple factors that provide inputs to the sleep system added to specific and cognitive behaviors which are individual specific that further influence the patho-physiologic inputs.

After pain, insomnia is probably the most common symptom reported by patients. Insomnia is both a symptom and a disorder. Chronic insomnia is more prevalent than heart disease, cancer, AIDS, diabetes and several other disorders³. Most of us usually sleep well, but modern life, especially urban life is filled with events which cause occasional insomnia in practically all of us. However, these occasional events take the shape of a

disorder only when despite adequate opportunity, sleep is lacking often repetitively (daily, weekly or over months) even years. Also, over the years the concept of insomnia has changed.

Epidemiology

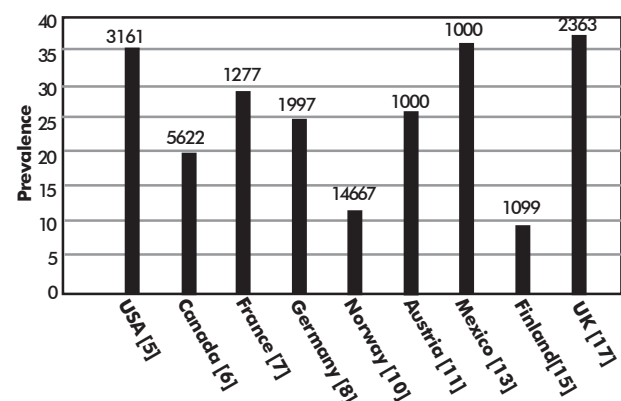
As stated earlier, the prevalence of insomnia is variable depending on the parameters selected. This was aptly documented in a study by Ohayon⁴ who determined the prevalence of insomnia based on four categories. Prevalence based on (a) symptoms of difficulty in initiating and maintaining sleep or unrestorative sleep was 30-48%. (b) This dropped to 12-16% when to the above parameters was included accompanying frequency modifiers. (c) When another parameter of accompanying daytime consequences was included this fell further to 9-15% and (d) when based on dissatisfaction of sleep quality and quantity this further fell to 8-18% (more in females). (e) Finally when insomnia was based on DSM IV classification the prevalence fell further to 4.4%- 6.4%.

Epidemiology of insomnia- International studies

One of the first surveys for insomnia prevalence was carried out by Mellinger et al in 1979. This survey which was conducted in the US took a sample of 3161 people from 18-79 years of age and found prevalence of 35% (5) of whom about half had severe symptoms⁵. Later in 1996 Ohayon found a prevalence of insomnia in 20.1% in Montreal, Canada amongst 5622 French subjects of 15 years or more (8-14)⁶. In 2000 a study by Lager and colleagues in France with a sample of 1277 persons found a prevalence of insomnia in 29%⁷. In another study in 1997 among German citizens of 13 yrs or more Simen et al found difficulty in falling asleep or staying asleep in 25% of subjects with seven percent of them having frequent symptoms⁸. Shigooka et al among 6277 Japanese outpatients attending 11 hospitals found a prevalence of 20.3%; in those where symptoms stretched for over a month the prevalence fell to 11.7%⁹. In a telephonic survey among 2001 Norwegian population of 18 years and more the one month point prevalence of insomnia was found to be 11.7% using the DSM IV criteria¹⁰. Among 1000 Austrian subjects the prevalence of insomnia was found to be 26% with 21% being severe & chronic (1 year or more)¹¹. Another study among 3719 South Korean individuals of 15 yrs or more the

prevalence of insomnia occurring at least three nights or more per week was found to be 17%¹². A study in Mexico by Lopez and group among 1000 subjects aged 18-84 found a prevalence of insomnia in 36% with 16% reporting severe symptoms¹³. In Singapore among 3418 subjects aged 15-55 years, the prevalence of insomnia was found to be 15.3% for symptoms of more than one year¹⁴. A study in 1099 subjects from Finland found prevalence between 9.6 to 12.8% of frequent and 57.6 to 62.7% of occasional insomnia¹⁵. In 1365 Chinese adolescents of 12-18 years age insomnia was found among 16.9% of the subjects in a study by Liu et al¹⁶. In another study among 2363 adults between 18 years or more from UK about 37% reported insomnia, 69% of whom had insomnia at 12 months follow up. Among those without insomnia at baseline, the incidence of insomnia at 12 months was 15%, and this was significantly associated with baseline anxiety, depression, and pain¹⁷. Lastly in a study from Pakistan Kidwai et al¹⁸ assessed the prevalence of insomnia, its associated factors and the use of sleep medicines in a cross-sectional survey of 1488 adults from five urban and semi urban communities of Karachi. Of the total 466 subjects included in the study 31.3% respondents reported insomnia, out of which 141 (30.2%) reported using sleep medicines most frequently prescribed by their family physician (80.8%). The prevalence of insomnia in the US, Canada & Europe is shown in Table 1.

Table 1: Country-wise Distribution of the Prevalence of Insomnia (USA, Canada & Europe)



Note: Figure following country name denotes reference number, figure above prevalence bar diagrams denotes number of patients included in study

Multinational studies

There are few studies that have studied the prevalence of insomnia in subjects from multiple countries. One such study in Europe, having a sample size of 1125

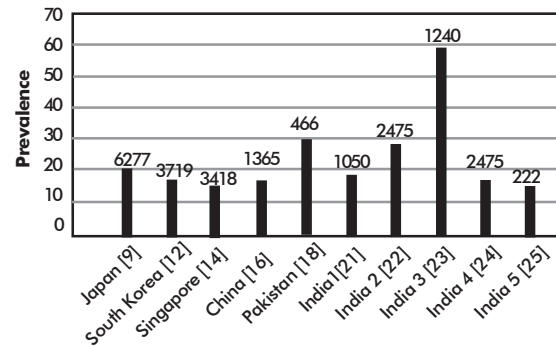
subjects from France, UK, Germany & Italy reported insomnia in about 25% and using the DSM IV classification in 4% of the subjects¹⁹. Another multinational study undertaken in among 40,202 European children aged 11-16 years frequent insomnia (at least twice a week) was present in 10-8 – 33.2% of the subjects²⁰.

Epidemiological studies from India

There are but few studies from India which looked at the prevalence of India among different segments of the population. Panda et al studied the prevalence of sleep related disorders among healthy population from South Indian states. Among 1050 apparently healthy attendants/relatives of patients attending a tertiary care hospital in a population of 35.1 ± 8.7 years age insomnia was reported in 18.6% of the patients with 18% for initiation of sleep, 18% for maintenance and 7.9% with early morning awakening. Hypertension was noted in 42.6% of the subjects²¹.

Suri et al have undertaken several questionnaire based studies in Delhi among different age groups. In a study among 2475 adult subjects of 30-60 years, it was found that 28.1% of the subjects reported to have complaints suggestive of disorders of initiation and maintenance of sleep²². In another study by the same authors among 1240 elderly subjects the prevalence of insomnia was 59% again mainly of sleep initiation and maintenance²³. In yet another questionnaire based study among 2475 school children by the same group insomnia was reported among 17.3% of the children²⁴. Sharma et al followed 710 patients in two groups for 8 years to observe sleep complaints. In group I, 222 patients who presented in the period (2003 to 2006) with a mean age at presentation of 43.1 ± 17.6 years and a sex ratio of 2.48:1. They observed that 15.34% of patients presented with difficulty in falling asleep as the chief complaint and 22.73% with frequent awakenings after falling asleep. The 247 presenting in the later 4 years (2007-2010) formed group 2 with an age group of 41.7 ± 15.0 years and sex ratio of 2.1:1 respectively. In this group 13.6% had difficulty falling asleep as the chief complaint and 31.4% had frequent awakenings²⁵. The prevalence of insomnia in Asian countries is shown below in Table 2.

Table 2: Country-wise Distribution of the Prevalence of Insomnia (Asia)



Note: Figure following country name denotes reference number, figure above prevalence bar diagrams denotes number of patients included in study
India 3 [23] is a study amongst elderly subjects

Prevalence of insomnia in the presence of comorbidities

Patients with chronic medical conditions have a higher prevalence of insomnia. This was noted commonly by the primary care physicians²⁶. In a study from Italy Terrazano et al noted that among 3284 patients of insomnia the underlying cause were cardiovascular diseases among 35%, musculoskeletal disorders in 28% and GI conditions in 19% among other lesser common disorders producing the insomnia symptoms²⁷. In a study in 98 patients with chronic pain having an average age of 46 years, insomnia of moderate to severe intensity was seen in 53% of them compared to 3% in controls; suggesting an increase of 18 folds in the likelihood of having insomnia²⁸.

Psychiatric conditions are very commonly associated with insomnia²⁹. Overall it was noted that among psychiatry patients insomnia was very common (40% of psychiatry patients). Among them those with acute disorders have insomnia in 75% which persisted in 30% of them during remissions³⁰. In these groups anxiety disorders and depression were most commonly associated with insomnia. It was further noted in a study that problem of insomnia at the beginning increases the chances of a major depression disorder about 3.5 years later³¹. In a landmark study by Chang et al in 1997 on the relation of insomnia and subsequent development of depression it was found that among 1053 medical school graduates, those who had insomnia when followed up over the next 34 years, 12.2% of them developed depression and 13 of them committed suicide³². In another survey by Weissmann in 10,000 adults it was

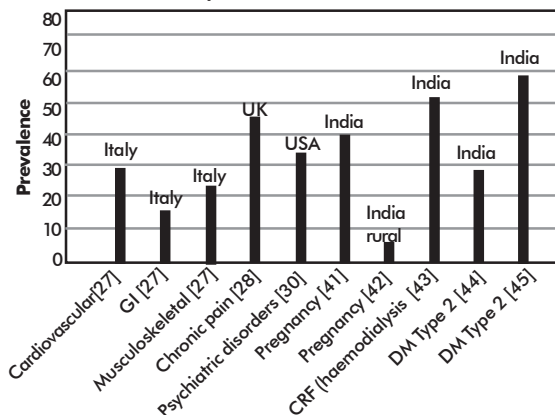
noted that 8% those with insomnia sought psychiatric help within one year whereas only 2.5% of normal controls had any psychiatric problems in that period³³. They also observed that insomnia was a suggested primary attributable factor for psychiatric disorders, being also associated with increased risk of depression, panic disorders and alcohol abuse. In individuals with psychiatric disorders several studies have conclusively shown that their relationship with insomnia is bi-directional^{30,32}. Psychiatric disorders like depression^{34,33} anxiety disorders^{33,35}, substance abuse³⁵ schizophrenia³³ also have a major impact on the prevalence of insomnia. A study by Taylor et al showed that patients with insomnia had a 9.82 and 17.85 times higher likelihood of depression and anxiety³⁶. Panda et al²¹ who looked at the prevalence of insomnia also found associated depression in 11.7% and anxiety in 2.5% of the study group.

Insomnia also understandably is extremely common among shift workers and patients with circadian rhythm sleep disorders because of disturbances in the normal sleep wake cycle due to work or social demands. Common among these are the delayed sleep phase syndrome (DSPS) (where the biological clock shifts forward, seen commonly amongst adolescents and the young adult population³⁰. This is related to the combined effects of their physiological predisposition and social factors. Among shift worker insomnia is demonstrated to be more frequent³⁷ increasing with the number of shifts under taken³⁸. Further the length of time that shift duties are undertaken has an important bearing on the prevalence³⁹. This was also shown to be common among BPO workers who have shift duty by Suri et al in their study⁴⁰.

There are few studies of the role of co-morbidities on the prevalence of insomnia from India. Suri et al in a questionnaire based study among 181 business process outsourcing (BPO) workers in the New Delhi area found that only 57.1% maintained regular sleep schedules compared to 71.2% among controls. They were sleepier than the control group through the total sleep time was nearly equal among both groups (60% of BPO workers exhausted compared to 29% of controls). Further this group were found to have a higher rate of depression 62.9% against 4.6% ($p < 0.001$), anxiety 33.9% against 1.4% ($p < 0.001$) and increase consumption of substances of abuse ($p < 0.001$) (alcohol, narcotics, cigarettes) and sleep disturbances. 37.8% against 9.6% ($p < 0.001$)⁴⁰. The same group in another study among 325 pregnant women

found that the prevalence of disorders of initiation and maintenance of sleep was 47.6%, being maximum in the third trimester ($p < 0.0005$). The study also showed an increased excessive daytime sleepiness (more among primi-gravidasp < 0.001), an increased prevalence of depression 11.4% ($p < 0.045$) and anxiety 18.1% which increased negatively with age ($p < 0.0571$) and increasing gestation period ($p < 0.099$)⁴¹. In another study by Banga et al carried out to estimate the incidence of maternal morbidity during labor and puerperium in rural homes in 772 women in villages in Maharashtra, India; it was seen that the incidence of maternal morbidity was 52.6% of which insomnia was seen in 7.4% of the cases⁴².

In another study among a group of patients from a Delhi Hospital on chronic haemodialysis for more than one year insomnia was found in 60.9% of patients and depression in 47.8%. Among the caregivers depression was seen in 31.4% patients⁴³. In another case control study from South India among 184 patients with diabetes mellitus it was noted that insomnia was the most common sleep disorder noted being seen in 33.7% against 8.2% of controls⁴⁴. In yet another study on the prevalence and correlates of disordered sleep with Type 2 Diabetes by Rejendran et al from South India among 120 subjects it was seen that there was a high prevalence (69%) of sleep dysfunction in patients with type 2 diabetes and showed a poor sleep quality using the Pittsburg sleep quality index (Score 7.08, cut off score 5.0). Among the individual components of PSQI, sleep latency was the most affected, followed by sleep quality and duration. Duration of diabetes was the greatest predictor of sleep disturbances in the study sample, while age, gender, BMI, insulin or OHA use or HbA1c did not correlate with sleep dysfunction⁴⁵. Diabetics with sleep disordered breathing show an improvement in the control of diabetes with the use of continuous positive airway pressure (CPAP) (46,47,48). However, no correlation of insomnia with the level of control of diabetes has been found. Lastly, in an interesting study of prospective analysis of adverse drug reactions in a south Indian hospital where among 1250 patients admitted during the study period, 250 adverse events were observed. Among these the category of drugs affecting the central nervous system it was noted that insomnia was seen with Chloroquine, trihexyphenidyl, and prednisolone⁴⁹. The prevalence of insomnia in the presence of co-morbidities is shown in Table 3.

Table 3: Table showing the prevalence of insomnia in the presence of co-morbidities

Note: Figure following country name denotes reference number, figure above prevalence bar diagrams denotes the country where study undertaken

Determinants of insomnia

Epidemiological studies indicate that there are a few social and demographic factors which have a definitive relationship with the prevalence of insomnia.

Gender & Age

Several studies show that women, especially post-menopausal women are more predisposed to insomnia. However the predilection of the female sex to insomnia has also been seen among younger children⁵⁰⁻⁵³. Further these results are seen uniformly in the most studies around the world⁵⁴⁻⁵⁹. Studies from India by Suri et al found insomnia to more common among females (23.6: 32.5% among male and females respectively in adult and 50.0: 63.5% among males & females respectively among the elderly). However, among children insomnia was found more among male children being 20.1 to 15.3% in boys and girls respectively^{22,23,24}. In the study by Panda et al²¹ also insomnia was seen to be higher in females (10.3 to 8.3%) as was seen in the study by Sharma et al²⁵.

Although age is believed to be a risk factor for the development of insomnia^{60, 10} this is not been shown in all studies^{34,61,62}. Ohayon in a study spread among three countries in Europe concluded that age per se could not be held responsible for the higher prevalence in older persons⁶³. It has rather believed to be attributable to the general inactivity, absence of active social life and

associated medical and psychiatric disorders among older persons. In the healthy elderly population prevalence of insomnia was similar to that among the younger population. In the studies by Suri et al insomnia increased progressively with age being 17.3%, 28.1% & 59.0% respectively in the child, adult & elderly population respectively^{22,23,24}. However a study by Kidwai et al¹⁸ found that gender or age were not associated with insomnia.

Role of other factors on insomnia

Other factors like occupations, socio economic status, marital status and mental & physical health have significant impact on the precipitation and perpetuation of insomnia. Psychosocial, physical and mental health are associated with higher prevalence of insomnia^{9,64,61,62}. Studies have found direct relationship to employment status^{50,60,55,65}, socio economic status⁵⁵, educational level⁵⁵ and the prevalence of insomnia. Marital status (married, divorced, widowed, single) also have a significant impact on the prevalence of insomnia^{50,9}. These factors were studied by Kidwai et al¹⁸ who assessed the prevalence of insomnia and found that the odds of having insomnia were three times more likely in someone with psychological distress (OR 3.09; CI 2.30 - 4.15) and two times as likely if he/she was troubled by health related issues (OR 2.40; CI 1.84-3.13) or had been exposed to adverse events (OR=2.02; CI 1.18-3.45). Those who experienced financial problems were 59% more likely to report sleep problems (OR=1.59; CI 1.20-2.12). Interestingly income or occupational status was not found to be associated with insomnia, but married persons tended to enjoy better sleep. Sara SarrafiZadeh and K Begum⁶⁵ in a questionnaire based study, from South India (Mysore) studied the relationship between the amount of sleep and the quality of life of 91 software engineers aged between 21 and 45 to determine the prevalence of insomnia among this group. The authors found that 56% of the participants had mild and 35% severe insomnia, compared to 23 percent in the general population. In terms of gender differences, more women suffered from mild insomnia than men while more men suffered from severe insomnia than women. Quality of life in general, and mental and physical health in particular, was significantly lower in subjects with insomnia than in other participants.

The metabolic effects of Insomnia

Lack of adequate sleep has several and often serious consequences on various metabolic functions and almost all body organs. This has been studied extensively but here only a brief outline of the various metabolic effects of insomnia is included.

The metabolic profile that has received the major attention is the effect of insomnia on glucose metabolism. Though this was first observed decades back its significance is now better understood. Vgontas et al⁶⁶ showed that insomnia with short sleep duration is associated with increased odds of diabetes. Chronic sleep loss increases the risk of obesity and diabetes via multiple pathways, including adverse effects on the parameters of glucose regulation, including insulin resistance and dysregulation of the neuroendocrine control of appetite leading to excessive food intake and decreased energy expenditure⁶⁷. Sleep duration is shown to have a role in the regulation of leptin and ghrelin. The Wisconsin Sleep Cohort Study⁶⁸ has shown that a loss of 3 hours sleep from a baseline of 8 hours was associated with a 4-5% higher body weight. The sleep duration is shown to be independently associated with weight gain, more so in the young age groups⁶⁹. The Sleep Heart Health Study⁷⁰, the Massachusetts Male Ageing Study⁷¹, the US Nurse Health Study⁷², the National Health and Nutrition Examination Survey (NHANES)⁷³ and a Finnish study among 1336 men and 1434 women⁷⁴ have also found that decreased sleep duration was associated with glucose intolerance and increased diabetes.

Patients of insomnia have been found to have significantly higher metabolic rates than healthy controls with increased heart rate variability⁷⁵, higher plasma and urinary free cortisol levels suggestive of the association of the hypo-thalamic pituitary (HPA) axis with chronic insomnia⁷⁶. Positron Emission Tomography has shown that patients of insomnia exhibit greater cerebral glucose metabolism during wake and rapid eye movement sleep states⁷⁷. Sleep deprivation also leads to overall decrease in immunity⁷⁸ and a state of systemic inflammation with increased inflammatory markers⁷⁹. Insomnia has also been shown to be associated with high risk of developing dyslipidemia⁸⁰.

Morbidity and Mortality

Morbidity

Presence of chronic insomnia has been demonstrated to have a direct consequence on the quality of life. Patients of chronic insomnia tend to report a greater sense of daytime fatigue, poorer mood, higher anxiety and stress, less vigor, greater difficulty in coping up with daily social and familial needs and poor quality of life⁸¹⁻⁸³. Persistent and severe insomnia more importantly results in poorer perception of general health status affecting the health related quality of life (HRQOL). This decrease on HRQOL is equal or in some parameters more than that seen in chronic debilitating diseases like congestive heart failure (CHF) or psychiatric ailments like depression shown in a study by Katz et al⁸⁴. Studies have also shown a loss of semantic memory⁸⁵ and an increased risk of cognitive decline over a three year time span than an age matched control group without insomnia.

Insomnia has also been shown to have an effect on the cardiovascular system. Studies suggest that insomnia and/or short sleep duration are associated with an increased risk for hypertension in middle-aged individuals^{86,87} but not in older ones⁸⁸. The effect is probably more pronounced when insomnia is associated with objectively determined short sleep duration⁸⁹. Additionally, an altered 24 hour blood pressure profile with an increased nocturnal systolic blood pressure might be evident in insomnia patients. Longitudinal epidemiologic studies have found that insomnia increases the risk of developing hypertension and cardiovascular disease. For instance, in 4,794 male Japanese telecommunication workers followed for up to four years or until they developed hypertension, insomnia was associated with a significant increased risk of hypertension [OR 1.96:(1.42-2.70)]⁸⁵. Phillips and Mannino⁹⁰ in a longitudinal study in 8,757 participants without hypertension and 11,863 without cardiovascular disease followed for up to 6 yrs, insomnia predicted a slight increased risk of hypertension [OR 1.2:91.03-1.30] and cardiovascular disease [OR 1.5:(1.1-2.0)]. In a cohort analysis by Ayas and his group, 71,617 health care workers (age 45-65 years) without cardiovascular diseases at enrollment, were followed over 10 years to test for a link between sleep duration and the occurrence of cardiovascular events. After adjusting for associated cardiovascular risk factors, it was found that self-reported

under-sleeping and over-sleeping were both independently associated with a modestly increased risk of coronary events⁹¹. The same study population was re-evaluated in a prospective observational fashion to determine the optimal sleep duration associated with lower cardiovascular risk. The study group concluded that mortality risk in women is lowest among those sleeping 6 to 7 hours⁹².

Among the adult population surveyed by Suri et al²² 10.7% had a history of having met with road traffic accidents that correlated with rising socioeconomic strata ($p < 0.004$), male gender ($p < 0.05$) and consumption of sleeping pills ($p < 0.002$).

Mortality

There are very few studies that have shown the effects of insomnia and the role of its treatment on mortality. A study by Janson et al⁶⁴ showed that presence of severe insomnia at the initial interview showed increased risk of mortality when followed up over 10 years. Another study⁹³ showed that severe insomnia among male population was related to increased risk of mortality during a three and a half year follow up period.

Many studies have looked into the association of insomnia with mortality risk with inconsistent findings^{94,95}. Recently, however, insomnia with objective short sleep duration in men has been found to be associated with increased mortality⁹⁶. The mortality rate was 21% for men and 5% for women. In men, mortality risk was significantly increased in insomniacs who slept less than 6 hours compared to the "normal sleep duration, no insomnia" group, (OR=4.00, CI 1.14-13.99) after adjusting for diabetes, hypertension, and other confounders. There was a marginally significant trend ($P = 0.15$) towards higher mortality risk from insomnia and short sleep in patients with diabetes or hypertension (OR=7.17, 95% CI 1.41-36.62) than in those without these co-morbid conditions (OR=1.45, 95% CI 0.13-16.14).

Two longitudinal studies of population-based samples revealed an association between subjective sleep complaints and cardiovascular mortality, at least in men^{97,98}. Data from the newer epidemiological studies yield inconsistent results. While Nilsson and colleagues⁹⁷ and Mallon and colleagues⁹⁸ found an association between insomnia and mortality, Kripke et al who followed 1.14 million subjects for 6 yrs no association between insomnia and mortality was established⁹⁴.

However, other studies^{99,100} using similar statistical models did not show a significant relationship between the presence/absence or frequency of insomnia with subsequent mortality over the next 4-6 years follow up period. Though, one of these¹⁰⁰ did suggest that mortality risk during follow up period was significantly related to incident insomnia.

However, recently several epidemiological studies have demonstrated a link between shorter duration of sleep and increased mortality¹⁰¹⁻¹⁰³. A very serious epidemiological observation made by several authors is that deviation from what are considered "normal" sleeping hours is associated with increased all-cause mortality¹⁰⁴⁻¹⁰⁶. Cardiovascular events and all-cause mortality were also found to be significantly associated with chronic insomnia among a group of ethnic Chinese in Taiwan in a recent report¹⁰⁵. It is important to note that this is not a direct causal relationship between sleep duration and increased mortality, as multiple behavioral and co-morbid factors (age, gender, obesity, diabetes mellitus, hypertension and smoking) interact, with possible cumulative effects leading to the observed increases in mortality.

Conclusion

Therefore it may be summarized based on evidence that insomnia is a universal complaint being present in about 25-30% of the population in general. Among patients with co-morbid conditions this may increase further to more than 50% varying with the disease condition and their severity.

Thus insomnia is a major health issue with a bearing in the morbidity, health related quality of life (HRQOL), probably on the mortality¹⁰⁷⁻¹⁰⁹, road traffic accidents being a major fall out of the disorder^{110,111}.

Lastly there are several reports from the western nations of the economic implications of insomnia^{99,100,112}. Studies have shown that most patients of insomnia are treated by general physicians¹¹³ and among them the prevalence was shown to be 69%²⁶. Though only one third reported the problem and only 5% of them seek medical treatment¹¹⁴. Therefore in a country like India with its huge population and work force it is practically impossible to have an accurate quantitative assessment of the socio economic impact of insomnia and the cost to the GDP.

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