School of Professional Education and Executive Development
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SPEED

HONG KONG COMMUNITY COLLEGE
香港專上學院

*Working Paper Series No.9, Issue 6, 2018*

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|---|---|
| Title | Health impacts of insomnia and preventive strategies |
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| Issue Date | 2018 |
| Issue Number | 6 |
| Paper Number | 9 |
| Citation | Fong, B. & Lau, A. (2018). *Health impacts of insomnia and preventive strategies* (Working Paper Series No. 9, Issue 6, 2018). Hong Kong: The Hong Kong Polytechnic University, College of Professional and Continuing Education, School of Professional Education and Executive Development. Retrieved Aug 27, 2018 from http://weblib.cpce-polyu.edu.hk/apps/wps/assets/pdf/w20180609.pdf |
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# Health Impacts of Insomnia and Preventive Strategies

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## ABSTRACT

Sleep is a naturally recurring state that is significant and crucial factor for physical development and mental health. However, it is often neglected by many people, especially in developed countries. Many people, adults and children, are affected by sleeping disorder and the problem of sleeplessness has become a common complaint. The attributing factors of sleeplessness include environment, drugs, beverages and alcohol, smoking, stress, anxiety, biorhythm, chronic diseases and lifestyle behaviours. Insomnia affects both physical or mental health. Weight gain, depression, mood disorder, chronic diseases, injuries and even death are the consequences. Leaving treatment by cognitive behavioural therapy and medications aside, prevention is the preferred action. Stress management, attention and improvement to the environment, avoidance of alcohol, smoking and certain food and beverages like caffeine containing drinks, management of chronic conditions, and the appropriate and sensible use of electronic screen devices are key preventive measures, that helps to promote quality sleep and thus avoiding insomnia.

**KEYWORDS:** Insomnia, Sleep Duration, Sleep Deprivation, Sleep Disorder, Sleep Hygiene, Chronic Conditions, Stress, Primary Prevention

## 1 INTRODUCTION

Sleep is a naturally recurring state of the mind and body. In human beings, one-third of the lifetime is occupied by sleep (Johnson, 2005). Biologically, sleep is a significant and crucial factor for the physical conditions and physiological development as well as for mental wellness. Having a good quality sleep is essential to healthy lifestyles. However, it is often neglected by many people, especially in developed countries. Research around the world have found high percentages of people with sleeping disorder in every single day. As an international city, Hong Kong citizens are also affected by sleeping disorder. The consequence of insomnia will result by the prolongation of inadequate and disturbed sleep at a certain period (Centre for Health Protection, 2013).

Sleeplessness is a common complaint in Hong Kong. According to a population-based survey in 2007, nearly a half of the 5,000 adult participants claimed that the average sleep duration was less than 7 hours per night. The prevalence of insomnia was 39.4% in average (Centre for Health Protection, 2013). A more recent survey conducted in 2011 revealed 35.5% of respondents had slept less than 7 hours per night. The percentage of teenagers who have less than 8 hours of sleep is ridiculously high. Based on the survey in 2011/12, more than 90% of teenagers could not sleep more than the recommended sleeping hours a day (Centre for Health Protection, 2012). Insomnia is a common public health problem.

## 2 SLEEP CYCLES AND INSOMNIA

Sleep consists of non-rapid eye movement (n-REM) and rapid eye movement (REM). There are 3 stages in n-REM including light sleep, eye movement stop and deep sleep. REM usually occurs around 90 minutes after falling asleep. This phase is the main period for dreaming. Under normal conditions, the sleep cycles alternate between n-REM and REM sleep about every 90 minutes. There are 3 to 5 cycles per night for most people. The cycle typically begins with n-REM and then REM (Centre for Health Protection, 2013). Whether a person feels well does not only depend on the amount of sleeping hours but also the pattern of sleep cycles. Adequate amount of deep sleep is desirable and is associated with a good night sleep. Normal sleeping time varies for different age groups. 8 to 12 hours should be ideal for children and adolescents who need to spend time to sleep. 7 to 8 hours and 5 to 6 hours should be acceptable for adults and elderly respectively. In real life, if a person lives and works well, he or she is practically having good sleeping quality irrespective of the hours or timeslot of sleep.

Insomnia is the most common sleeping disorder affecting 85% of the population (Chiu, 2003). People, who have trouble in sleeping or difficulty in sleeping at a regular time, can be considered as suffering from insomnia. A clinical definition is "*The predominant complaint is difficulty initiating or maintaining sleep, or non-restorative sleep, for at least one month"* (Chiu, 2003). Insomnia can be distinguished into three types which are initial insomnia, interrupted insomnia and early insomnia (Johnson, 2005). Difficulty in falling asleep, waking up too early or during the night inadvertently are the common signs of insomnia (Roth, 2007). Symptoms of insomnia include daytime sleepiness, irritability, and even depressed mood (NHLBI, 2011).

## 3 CAUSES OF INSOMNIA

Insomnia can be transient or chronic. Transient insomnia lasts for less than two weeks and is commonly caused by (i) environmental factors such as heat, light and noises, (ii) adjustment sleep disorder related by stress, (iii) drug-induced sleep disorder, and (iv) circadian rhythm. Chronic insomnia continues for more than two weeks and is mostly due to

sleep disorders associated with medical or psychiatric disorders, and the sleep apnoea syndrome (Chiu, 2003).

### 3.1 Biorhythm

Insomnia affects all age groups of people. Insomnia can be determined by daily behaviour. Many people have a misconception about exercising at night and believe firmly that it is good for sleep and this is wrong. After vigorous exercising, the body temperature and heart rate will be raised and a hormone called adrenaline is released. The brain will be activated by adrenaline and the person then have difficulty in falling asleep (DiChiara, n.d.). On the other hand, insomnia is common among people who need to work night shifts or irregular hours.

All organisms on Earth have their particular biological clock, which controls the mechanisms of circadian rhythm. When the circadian rhythm is disrupted, life pattern of the organisms will be changed and such alteration of life pattern is not natural. In humans, the body is designed to work in the daytime but not in the night time (Wooten, 2007). Shift-workers often suffer from insomnia. Furthermore, human activities have been changed substantially in recent years from the sharp increase in the use of electronic devices such as the mobile phone and electronic screens (Pearl, 2016). Such technological evolution in the past decade has indirectly led to insomnia among many people. In the 2013 survey by the Government, 49% of respondents were found to have depleted sleeping time (Department of Health, 2014).

### 3.2 Stress

In general, stress, anxiety and depression are the most common causes of chronic insomnia. Other emotional and psychological causes include anger, worry, grief, bipolar disorder, and trauma. Stress is prevalent in city life, arising from work competition, financial wants, expensive properties, noisy environment, crowded workplace, busy streets, packed public transport, traffic jam, unhealthy lifestyle, inadequate rest, lack of entertainment and hobbies, etc. When people work under extreme pressure like large workload or night shifts, negative emotions such as anger, sadness or anxiety may develop easily (Epstein, 2008). The associated symptoms of agitation and arousal will make sleep difficult, resulting in break of the sleep continuity with awake and alert during sleeping. The situation with the younger generations can be very serious. Moreover, having difficulty in sleeps can aggravate anxiety, stress and depression.

### 3.3 Body Conditions

Sleeplessness is not only affected by psychological factors, but the physiological conditions of the body can also cause insomnia, including nasal allergies, gastric reflux, hyperthyroidism, pain arising from arthritis, asthma, Parkinson's diseases, low back pain, etc. Most of the people with chronic health problems have a higher chance to be affected by cardiopulmonary deficiency like heart disease, breathing problem, hypertension, chronic pain or urinary problems, resulting in disturbance of sleep at night (Taylor, 2007).

Sleep apnoea is a common sleep disorder leading to chronic insomnia. It is characterized by pauses in breathing or periods of shallow breathing during sleep. Each pause lasts for a few seconds to a few minutes and happens frequently during the whole night. There are two types of sleep apnoea: Obstructive Sleep Apnoea (OSA) and Central Sleep Apnoea (CSA). OSA is caused by a blockage of the airway, resulting in loud snoring. CSA is caused by the instability in the respiratory control centre and the brain fails to signal the muscles to breathe (Blahd, 2016). Local studies have revealed prevalence rates of 4 to 5% and 4.8% among adults and children respectively (Hui, 2007; Li, 2010; Ng et al., 2015). The inadequate

oxygen supply disrupts regular sleep and some individuals will wake up during the sleep. Sufferers of sleep apnoea experience sleepiness or excessive daytime fatigue.

## 4 EFFECTS OF INSOMNIA

Insomnia is associated with precipitating life events (Fernandez-Mendoza and Alexandros, 2013). There are serious health impacts associated with insomnia in both physical as well as psychosocial conditions. Most of the epidemiological studies have shown that short sleep duration or suboptimal quality of sleep are related to different physical and mental illnesses. On the other hand, some research have found that long sleep duration might increase the risks of chronic diseases and greater mortality in adults (Arora et al., 2011). In the population perspective, short sleep duration is a more salient issue than long sleep duration. The problem of insomnia may have enormous impacts on the health of the society.

### 4.1 Weight gain

"By sleeping less, patients are programming their body to eat more" ('The Active Times', 2016). Most studies have indicated that people who sleep less than five hours a day are found to be more likely to gain weight (UKHealthCentre, n.d.). In fact, short duration of sleep which are less than 5 hours and 10 hours were associated with 55% and 89 % increased risk of obesity in adults and children respectively (Cappuccio, Taggart & Kandala, 2008). According to a 2004 research, people who were sleepless were almost 30% more likely to become obese than those who slept more than seven hours (Peri, 2014). In Mainland China, the prevalence of short sleep duration was closely related to increased adiposity in early adolescents, especially among girls (Jiang et al., 2014). Appetite and hunger are increased by metabolism change. It is not difficult to imagine how many energy drinks or coffee consumed by someone who has insomnia but refusing to accept normal treatment. Eventually, the weight must be raised.

### 4.2 Risks of injuries

Insomnia also increases the risk of accidents or fatal injuries because of the deterioration of performance and intellectual capacity. A study endorsed by sleep experts states that sleep deprivation or sleepiness is the largest identifiable and preventable cause of road traffic accidents by as much as 15% to 20% (Injury Prevention, 2009). Another American research points out that patients with insomnia are over two times more likely to die from vehicle injuries (American Academy of Sleep Medicine, 2014). People who always have difficulty falling asleep cannot maintain concentration in their mind, and therefore they cannot handle sudden occurrences or events on the road due to the lack of, or even the loss of, instant judgment and reaction, resulting in a higher chance of death.

### 4.3 Depression and mood disorder

Poor sleep is associated with a high risk of mental illnesses. Negative emotions such as worries, and low mood are commonly arisen from too little sleep (Abbott, 2016). People suffering from depression tend to enter to rapid eyes movement sleep, i.e. dreaming time. This means the time of deep sleep becomes shorter. The brain and muscles are not given much time to relax and nightmares are frequent. Even the immune system cannot properly recover (UKHealthCentre, n.d.). Eventually, without resting over a long time will lead to extreme exhaustion and depression. The depressed patients who experience sleep disturbances are more likely to commit suicide. A meta-analysis has revealed that insomnia is significantly associated with an increased relative risk of 94%, 95% and 114% respectively for suicidal ideation, suicide attempt and suicide (Pigeon, Pinquart & Conner, 2012). Even with antidepressant therapy, these people will continue to experience insomnia and at a high risk for a relapse of depression later on (Harvard Health Publishing, 2009). People with insomnia are also likely to have clinically significant anxiety. The ratio is around 17 times when

compared with those not suffering from insomnia (Taylor, Lichstein & Durrence, 2005). Such anxiety will trigger many physical and psychological illnesses and disturb daily life.

Many studies have established that insomnia is highly comorbid with psychiatric disorders and is a risk factor for the development of depression, anxiety, and suicide because insomnia is associated with activation of the stress system, leading psychological conditions of depressed mood, fatigue, concerns about health and physical functioning, somatically focused anxiety, and poor coping resources. The patients also complain of difficulty in concentrating, memory problems, and difficulty in focusing attention Moreover, insomnia with objective short sleep duration may be a premorbid risk factor for mild cognitive impairment and dementia (Fernandez-Mendoza and Alexandros, 2013).

### 4.4 Chronic diseases

Sleep duration has been linked to mortality rate. Research has shown that sufferers of chronic diseases like type 2 diabetes, high blood pressure and heart disease would have the mortality rates elevated by insomnia. A study from Italy has found an unambiguous and inconsistent pattern of increased risk of developing type 2 diabetes in 28% of those people who have reported they sleep less than 5 to 6 hours each night, and 84% in those with difficulties in maintaining their sleep (Cappuccio, Delia, Strazzullo, & Miller, 2009). Moreover, a cohort study in Europe has noted that people who suffer from insomnia have a 45% and 15% increased risk of developing or, dying from cardiovascular diseases or stroke respectively, compared to those people sleeping 7 to 8 hours per night or do not suffer from sleep problems (Sofi, Cesari & Casini, 2012).

Chronic insomnia is also linked with significant medical morbidity, such as cardiovascular disease, hypertension, acute myocardial infarction, diabetes, metabolic syndrome and osteoporosis. Persistent difficulty initiating or maintaining sleep is associated with an increased risk of these chronic conditions, the severity of which is related to objective short sleep duration (Fernandez-Mendoza and Alexandros, 2013).

## 5 TREATMENT

Insomnia is a complicated disorder. Treatment is essential and should be applied as soon as possible. Cognitive behavioural therapy for insomnia (CBT-I) is a common technique for treating insomnia without the use of medications. This therapy is helpful to control or eliminate negative thoughts. There are different components including stimulus control and sleep hygiene. Stimulus control helps to remove factors that condition the patient's mind to resist sleep. Sleep hygiene aims to control the environment and change the basic lifestyle habits (Mayo clinic, 2016). In this type of treatment and as a rule, it always needs time to change people's behaviour, so it is effective for long-term treatment.

Most people with insomnia prefer sleeping pills and sedatives for "instantaneous" effects and convenience, but this usually offers short-term help only. Medicine can provide immediate relief during a period of stress. Whether or not these drugs have side effects, they are not recommended for prolonged use and are not considered as a long-term solution. Alternative medicines are also being considered as a treatment modality to alleviate insomnia and are getting more common and more acceptable by the public, particularly the young and more educated group. However, since the herbal supplements can react with certain medications and there is also not enough evidence to prove their effectiveness, it is necessary to inform the healthcare providers when engaging in alternative medicines.

## 6 PRIMARY PREVENTION

The goal of primary prevention in non-communicable disease is preventing the onset of a condition by eliminating or minimizing any risk factors. In insomnia, promotion of psychosocial and mental wellness, and enhancement of quality sleep by attention to the environment and biorhythm are key strategies in prevention. The negative health and psychosocial consequences of insomnia really call for close monitoring and effective preventive measures. Moreover, management of chronic body conditions can help to reduce the impacts of insomnia. Hence, restriction of behaviours and certain daily habits are essential. For example, avoiding stimulants such as caffeine is important because the mental condition will be in alert up to 7 hours and the chance of night time urination is also increased, leading to disturbance of sleep. Limiting the number of drinks with dinner is also useful to reduce fragmented sleep during the night (Prevention, 2015).

The habits of excessive alcoholic intake and strenuous exercise in the evening should not be continued. They will lead to poor sleep quality. In addition, avoiding using electronic screen devices, particularly before bedtime, is of importance in the prevention of insomnia. Unfortunately, these modern day gadgets are very common and they are everywhere, particularly in the cities. People should switch off all electronic devices that are being used extensively and at "extended" time period at home to allow for a resting lifestyle with silent and comfortable surroundings, that are conducive to quality sleep. As an excellent measure and habit, plenty of physical activities and daytime exercises can help people to fall asleep more easily.

### 6.1 Adults

Sleeping quality is an important concern to adults who are the main strength of the workforce in the society. Apart from the need to manage stress arising from work and family, this group should attend to their behaviours in social functions and adopt a "healthy" habit. Drinking and smoking at dinner parties or business meetings are common practices. However, nicotine in cigarette is a stimulant, which disturbs sleep. Intake of excessive alcohol or caffeine-containing drinks may compromise sleep. Therefore, working adults should limit food and beverages containing caffeine or alcohol to keep a good sleeping quality

Apart from the social habits, a 'sleep conducive' environment is beneficial to adults. Urban dwellers are susceptible to the surroundings like noise, temperature, and light pollution. A study has shown that exposure to night-time light would stop the release of melatonin which is a hormone produced by the pineal gland. Melatonin is secreted at night and is known for helping to regulate the body's biological clock (Chepesiuk, 2009). Decreasing melatonin production levels disturbs sleep and thus leading to insomnia and excessive daytime sleepiness, or even developing cancer. Moreover, the negative impacts of LED billboards, mobile phones, televisions and computers should not be trifled. People should turn off all the electronic devices and avoid using devices for a long time before sleep. This will be helpful to prepare well for a good night of sleep and rest. Keeping the room well-ventilated and at the appropriate temperature and choosing a comfortable mattress and pillows are the best tips for sleeping well.

### 6.2 Children and teenagers

Sleep deprivation and disturbance are not uncommon among adolescents and children. Some studies have shown that sleeplessness is highly associated with using computers or video games before bedtime (WedMD, 2003). Parents should limit the using time and should not allow their children to fall asleep while watching television or videos.

The overuse of electronic devices is not the only reason causing insomnia in children, mental problems caused by stress are also of significant concern. Many children and

teenagers are living under stress. In the past decades, the cases of suicide among school-age children have been increasing. The reasons are inevitably linked to excessive pressure from parents' unrealistic expectation, academic stress, out-of-school activities and competition among the peers. School children usually cannot develop their interest because of too much homework and study. They have no or little time to play and to relax. Meanwhile, they have no pathway to relieve their stress. Lack of resting time causes insomnia more easily and the resulting negative impacts will be detonated as "an alarming bomb". Parents and teachers should identify the sources of stressors and help students to establish a balanced time schedule that allows time for joy and relaxation.

## 7 SECONDARY PREVENTION

Secondary prevention aims to reduce the impact of a disease or injury that has already occurred, commonly by screening (Institute for Work & Health, 2015). Choosing the correct instrument is a critical component in the assessment of sleep disturbances for researchers, clinicians and patients. However, these screening tools are not widely adopted in clinical practice or in community health or family practice.

The Pittsburgh Sleep Quality Index (PSQI) is an effective instrument used to measure the quality of sleep and evaluate the multiple dimensions of the participants' sleeping pattern. It is a self-rated questionnaire developed by researchers at the University of Pittsburgh to assess sleep quality and disturbances over a 1-month time interval. There are 19 individual items covering 7 areas: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). Each item is weighted on a 0-3 interval scale. In general, the lower the overall score, the healthier the sleep quality. If the PSQI global score is greater than a certain value, insomnia can be discovered in the early stage. A research has shown high correlations between PSQI and sleep log data, and a PSQI global score larger than 5 resulted in a sensitivity of 98.7% (Backhaus, Junghanns, Broocks, Riemann, & Hohagen, 2002). The PSQI has high test–retest reliability and good validity for patients with primary insomnia.

Another tool, Insomnia Severity Index (ISI), is widely used in the insomnia field. It is a brief screening assessment tool which contains 7 items. The dimensions evaluated are: severity of sleep onset, sleep maintenance, early morning awakening problems, sleep dissatisfaction, interference of sleep difficulties with daytime functioning, noticeability of sleep problems by others, and distress caused by the sleep difficulties (Morin, Belleville, Bélanger, & Ivers, 2011). Since some of the studies have shown that ISI was positively correlated with subjective sleep estimates and with PSQI, it indicates good convergent validity and high consistency. Therefore, ISI is a reliable and valid instrument to measure the level of insomnia.

In addition, the Sleep Condition Indicator (SCI) can be used to evaluate insomnia disorder in clinical practices. The development phase informs it for DSM-5 insomnia disorder and concerns about getting to sleep, remaining asleep, sleep quality, daytime personal functioning, daytime performance, duration of sleep problem, nights per week having a sleep problem and extent troubled by poor sleep (Espie et al., 2014). Referring to the research results, it indicated that the SCI is internally consistent, sensitive to change and correlates strongly with established screening instruments, known to be precise as PSQI and ISI.

## 8 CONCLUDING REMARKS

People spend so much time in sleep which is essential for the body to rest and prepare the work and activity demand for the next day. Lack of sleep or insomnia can cause harm and health problems. It is important to understand the factors leading to insomnia and the consequences of the sleep disorder so that actions can be taken to modify the daily work and life pattern and to avoid certain foods and drinks. To the local community, having a good night of sleep amounts to a big fortune. Thus, it is a very important public health issue to promote quality sleep and to prevent insomnia in the community. "Prevention is better than cure".

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