Sleep: A lever for improved wellness and productivity

Summary

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levia™
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INTRODUCTION

Work environments are becoming increasingly competitive, so it is not surprising that companies are looking for ways to improve their efficiencies. Workplace health programs are among the strategies innovative organizations are implementing. As sleep can be problematical for employees, it is a good idea to learn more about the impacts of this issue, and to be aware of what other companies are doing to improve sleep and evaluate their results.

This initiative involved an international review of conclusive data, best practices and promising initiatives. The project focuses on the quality of sleep of the majority of employees. However, there are problems specific to night-shift workers that will not be addressed in this document.

The document features 4 sections:

1. The definition of sleep disorders: to provide a good description of the phenomenon and establish uniform definitions.
2. The epidemiology surrounding sleep disorders: to understand the extent of the problem and how prevalent it is among employees.
3. The determinants of sleep disorders: to fully understand the underlying factors.
4. The impacts of sleep disorders: to estimate the costs for society and organizations.
PART 1 –
Defining sleep disorders

In this section, we will describe the biological need for sleep and its role in human physiology, and then define what sleep disorders are.

Sleep is known to be just as vital for the body as eating and exercising. Sleep allows for physical, psychological and intellectual recuperation.

Some of the main roles of sleep include:

• Stimulating and strengthening the body’s immune system
• Regulating mood and stress
• Maintaining learning and memory functions
• Maintaining cognitive capacities
• Replenishing the energy reserves in muscle and nerve cells
• Regulating certain functions, such as blood sugar levels (difficulty metabolizing sugar can lead to weight gain and diabetes)
• Eliminating toxins

A night’s sleep is comprised of a succession of cycles (often four to six) of about 90 minutes each. Every cycle has several phases and each plays a distinct role.

Phase 1, slow-wave sleep, is characterized by slower brain activity and its function is physical repair. It is subdivided into four stages:

• Stage I (drowsiness): sleepiness and relaxation.
• Stage II (light sleep): represents between 45% and 55% of the sleep cycle and seems to be for consolidating memory.
• Stages III and IV (deep sleep): Stage III represents 3% to 8% of the sleep cycle and Stage IV represents 10% to 15%. The sleeper is isolated from the outside world and it is difficult to wake them up. At this point in the sleep cycle, the person recuperates from physical fatigue and the body repairs and regenerates tissues, builds bone and muscle and strengthens the immune system. This is a very important phase, as the entire body and the brain are at rest and recuperating.

Phase 2, REM sleep (rapid eye movement sleep): REM is the dream period, characterized by intense cerebral activity. Its function is psychological recovery and repair.
• REM sleep represents about 25% of a person’s total sleep time
• The person shows signs of very deep sleep and wakefulness (facial expressions, irregular breathing and elevated cardiac activity)
• Dreaming occurs in this phase

Several scientific sources recommend seven to eight hours of sleep a night. Less than that is considered insufficient.

The internal clock or “circadian rhythm”. In addition to the various sleep phases, we have to take our own “internal clock” into consideration, as it varies from person to person. The circadian rhythm spans 24 hours and acts as an internal mechanism that regulates the wake-sleep cycle. It modulates physical activity and the absorption of nutrients, and it regulates body temperature, muscle tone and the secretion of hormones throughout the day.

Three sleep disorders have a particular impact in the workplace.

1. Trouble sleeping
2. Diagnosed insomnia
3. Diagnosed obstructive sleep apnea (OSA)

We will examine their definitions and prevalence in the following section.
PART TWO –
The epidemiology of sleep disorders

In this section we will provide data on the prevalence of the three sleep disorders identified in the previous section. The rates of prevalence reveal the extent to which sleep disorders affect a large segment of the population.

A. Prevalence of sleep disorders

In Canada, the 2016 Canadian Sleep Review revealed that:

- 74% of Canadians say they get less than seven hours of sleep per night
- 67% would like to improve the quality of their sleep
- 59% state that they do not get as much sleep as they would like every night.

B. Prevalence of diagnosed insomnia

To be diagnosed with insomnia, the following three conditions must be met:

1. The person reports one or more of the following sleep problems: a) trouble falling asleep; b) trouble staying asleep; c) waking up early; d) unrestful sleep.

2. These issues occur at least three nights per week, for at least three months, despite good sleep habits and suitable sleeping conditions.

3. The person reports having at least one of the following daily consequences related to their sleep problems:
   - Fatigue/discomfort
   - Attention, concentration and memory problems
   - Problems interacting socially or poor performance at work
   - Mood issues/irritability
   - Daytime drowsiness
   - Decreased motivation/energy/initiative
   - Tendency to make mistakes/have accidents at work or when driving

In Canada, 40% of the population suffers from trouble sleeping or insomnia that includes both condition 1 and condition 2.
• Tension headaches or general discomfort related to lack of sleep
• Worried or preoccupied about sleep

We should note that, while certain authors use the term insomnia, others talk of chronic insomnia.

In Canada, 13% to 19% of the population suffers from chronic insomnia.

C. Prevalence of OSA

Obstructive sleep apnea (OSA) is a sleep issue characterized by mild interruptions in breathing during sleep. These occur when the upper respiratory passages are blocked. The body realizes that breathing has stopped and the person wakes up to breathe. This cycle is repeated several times during the night, sometimes as many as 50 to 100 times per hour.

There are several degrees of OSA, depending on the number of respiratory arrests (apneas) or the number of shallow breaths per hour of sleep.

OSA is diagnosed by means of a test called polysomnography, which is conducted either at home or in a sleep clinic.

According to the literature we reviewed, 2% to 10% of the adult population seem to be affected by OSA

HOWEVER

according to a U.S. study, more than 80% of individuals who suffer from OSA will not be diagnosed.

That’s why it is so important to ensure that employees verify their condition – the consequences are serious.
PART THREE –
Determinants of sleep disorders

In this section we will identify the determinants of insomnia and OSA. That is, the factors that increase a person’s risk of suffering from insomnia or OSA, but which may not necessarily be the direct cause of sleep disorders.

The main factors influencing insomnia are:

- Age: risk increases with age
- Gender: women are more susceptible than men
- Depression: among those suffering from insomnia, 10.8% of cases are directly related to a depressive syndrome, and 33.1% are related to anxiety
- Physical illnesses: illnesses affecting the respiratory passages, rheumatism, chronic pain and cardiovascular disease increase the risk
- Having non-standard or staggered work schedules

Other factors may also cause problems, for example when an individual:

- Uses psychoactive substances (tobacco, alcohol): 3% to 7% of cases
- Is experiencing a stressful financial situation: 2.2 times higher risk for people in a difficult situation
- Is a victim of violence: 1.7 to 2 times higher for victims of violence
- Is in psychological distress: 5 times higher
- Is experiencing stress: 23% of people who indicated that most of their days were somewhat to extremely stressful suffered from insomnia; more than double compared to people who indicated that they did not feel stressed

Key factors influencing OSA are:

- Age: risk increases with age
- Gender: men are more susceptible than women
- Obesity: 60% to 90% of those suffering from OSA are obese
- Physical characteristics: receding chin, large neck
- Depression
- Physical illness: ear, nose and throat (ENT) irregularity
- Use of tobacco and alcohol
PART FOUR –
Defining the impacts

The various sleep disorders have a major impact on people’s health and on organizations.

Impacts on a person’s health

Sleep disorders have repercussions on various aspects of a person’s health: physical health, mental health and cognitive health. These impacts may be the consequence of sleep disorders or of an illness caused by sleep disorders.

- **Impacts on physical health:** Aside from the disorder itself, which could cause discomfort (daytime drowsiness) or a reduced quality of life, it could also cause certain illnesses and health conditions, particularly diabetes, obesity, hypertension and cardiovascular disease (CVD). The following table shows some of the data found in the research on the three sleep disorders analyzed.

### Major impacts on physical health

<table>
<thead>
<tr>
<th>A – Lack of sleep</th>
<th>B – Insomnia</th>
<th>C – OSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVD: less than 5 hours of sleep, risk is 1.45 times higher for women and 1.18 times higher with less than 6 hours</td>
<td>CVD: risk is 1.33 times higher</td>
<td>CVD: risk is 2.2 times higher</td>
</tr>
<tr>
<td>Hypertension: increased risk with less than 6 hours of sleep</td>
<td>Myocardial infarction (type of CVD): risk is 1.41 times higher</td>
<td>Non-fatal CVDs: risk is 3.17 times higher for people with an apnea hypopnea index (AHI) of 30 or higher (people suffering from severe apnea)</td>
</tr>
<tr>
<td>Obesity: higher risk of obesity with less than 6 hours of sleep</td>
<td>Hypertension: risk is 1.8 times higher</td>
<td>Cardiac failure: 1.1% due to OSA</td>
</tr>
<tr>
<td>Diabetes: increased prevalence of type 2 diabetes and glucose intolerance reported in numerous studies conducted on groups of subjects who get less than 6 hours of sleep</td>
<td>Diabetes: 20% of diabetic Canadians suffer from insomnia compared to 12% of non-diabetics</td>
<td>Heart attacks: 5.3% due to OSA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypertension: risk is 1.8 times higher</td>
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<td></td>
<td></td>
<td>50% of people with OSA suffer from hypertension</td>
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<td></td>
<td></td>
<td>Diabetes: risk is 2.5 times higher</td>
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</tbody>
</table>
• **Impacts on mental health**: According to the Public Health Agency of Canada, mental health is defined as “the capacity for each of us to feel, think and act in ways that enhance our ability to enjoy life and deal with the challenges we face”. Here, we are talking about the impact of sleep disorders on depression and anxiety.

**Impacts on mental health**

**B – Insomnia**
- 1/3 of people suffering from insomnia report having mood disorders or anxiety (vs. 12% without insomnia)
- 2.9% of depressions are attributable to insomnia
- Strong correlation between insomnia and anxiety/depression (ratio = 2.42 for anxiety and 1.99 for depression)

**C – Obstructive sleep apnea**
- 6.2% of depressions are attributable to OSA
- Adult Canadians with OSA experience mood disorders (depression, bipolar issues, mania or dysthymia) 2.2 times more often

**Impacts on cognitive health**: According to the Quebec neuropsychologists’ association cognitive functions are our brain’s capacity to allow us to, in particular, communicate, perceive our environment, concentrate, remember an event or accumulate knowledge. The cognitive functions controlled by the brain are attentiveness, executive functions, intellectual functions, visuospatial functions, recognition, language, memory, the coordination of movements and the speed at which we process information.

We can see in the table below that the deterioration of cognitive functions – the functions that make it possible to be productive and alert at work – are affected by insomnia.

**Impacts on cognitive health**

**A and B – Insomnia/Lack of sleep**
- Attention
- Reaction time
- Errors in judgment
- Memory
- Concentration
- Etc.

**C – Obstructive sleep apnea**

Impacts on:
- time management
- performance of work duties
- workplace social interactions

**Deterioration of 20% to 50% with insomnia**
In fact,

- Decreased attentiveness and concentration affect our capacity to be results-oriented.
- Decreased creativity and reasoning affect our ability to solve problems.
- Decreased learning, memory and decision-making skills affect our capacity to be able to take a step back and see different perspectives.
- Decreased capacity for managing emotions and developing connections with colleagues or clients affects our capacity to work with colleagues and respond to clients’ needs.

**Impacts on the organization**

Sleep issues also impact organizations. Here are a few of the impacts documented in the literature we reviewed.

**Health expenses:** refers to the portion of health expenses linked to the impacts on employee physical health, some of which are the responsibility of the organization (consultations, medications, tests, hospitalization)

- Health expenses per individual are, on average, 75% higher for people suffering from severe or moderate insomnia, compared to those who do not suffer from insomnia: $1,323 versus $757 (a significant difference).
- An individual suffering from undiagnosed OSA costs between $2,700 and $3,300 more in health expenses than average.

**Driving accidents**

- Nearly 20% of fatal road accidents are associated with drowsiness or fatigue, not including cases where alcohol was consumed
- 4.3% of car accidents are attributable to OSA
- Individuals whose OSA is not treated are 2 to 3 times more likely to be in a car accident

**Accidents in the workplace**

- 3.9% of work-related accidents are attributable to insomnia
- People with insomnia syndrome are more likely to have accidents (not including driving accidents): 12.5% vs. 6.4% for good sleepers
- 0.6% of workplace accidents are attributable to OSA
**Presenteeism:** refers to employees who are present in the workplace but unable to carry out their tasks, or whose work pace or quality of work is reduced.

- 2.8 days per year for good sleepers, 6.2 for those with symptoms of insomnia and 27.6 for those with insomnia syndrome.

**Absenteeism:** refers to employees who are absent from work due to illness or fatigue

- 0.3 days per year for good sleepers, 1.6 days for those with symptoms of insomnia (without daytime consequences) and 4.4 days for those with insomnia syndrome.

**Errors:** medical errors, errors in judgment, etc.

- A study measured the impacts on a police force and identified that, generally, members with sleep disorders are 1.39 times more likely to make administrative errors, 1.58 times more likely to fall asleep at the wheel, and 1.76 times more likely to make errors or commit safety violations.

**Work environment:** relations with colleagues and clients. In the context of sleep, this aspect of the issue has not yet been the subject of scientific study so we cannot quantify the impact.

Depending on your industry or the type of work performed in your organization, these numbers can be used to convince decision makers that it is important to implement solutions to reduce the impact of sleep disorders.

By tracking the total cost of sleep disorders to society (health care systems and employers) we found two types of costs: direct costs and indirect costs.

**Direct costs** include healthcare costs associated with disorders, such as consultations for insomnia; or with health conditions resulting from sleep disorders such as obesity. Sleep disorders are a source of discomfort (daytime drowsiness) or reduced quality of life that could induce a person to consult doctors in order to resolve or better understand their disorder. As a result of these medical consultations, physicians could prescribe medications, diagnostic tests or treatments. In addition, the illnesses arising from these disorders (diabetes, cardiovascular disease) could themselves result in consultations, use of medications and treatments. Direct costs are generally costs related to medical consultations (family doctors and specialists), medications, medical devices, diagnostic tests and hospitalization.
Indirect costs include, primarily, losses in productivity and the financial consequences of accidents. Productivity losses are measured in terms of absenteeism and presenteeism, and are represented in numbers of days. The cost of these two indicators is equal to the number of days multiplied by the average salary. The cost of road accidents is the amounts claimed in insurance for damages. Costs related to accidents in the workplace could include property damage, the administrative cost of insurance, compensation, loss of revenue and reduced quality of life. The costs of premature death and unpaid care (e.g., provided by a relative) can also be considered indirect costs.

Several studies conducted in Canada, Australia, and the U.S. measured the direct and indirect costs, but the most relevant study is one that estimated the costs of insomnia at several different levels of severity (symptoms of insomnia and insomnia) and compared them to the costs related to people who slept well.

A person with symptoms of insomnia costs 3.3 times more in direct and indirect costs, and a person with insomnia syndrome costs 12.3 times more than a good sleeper.

More than 95% of these costs are absorbed by the organization, since they are related to presenteeism and absenteeism.

Impacts of initiatives implemented in the workplace

We have identified two studies of interest that looked at programs designed to address sleep disorders in the workplace and analyze their impact on employee absenteeism and/or presenteeism. They indicate that employees who participated in the program set up by their organization displayed fewer symptoms of presenteeism and were less likely to be absent from work.

There are also workplace programs designed to detect, diagnose and treat OSA. These programs usually include a questionnaire to identify employees at risk of OSA. These employees are then referred to specialists or sleep clinics for a polysomnography diagnostic test (on-site or at home) and, if needed, ongoing positive-pressure ventilation treatment.

Several companies have evaluated the impacts of this program on their health and accident-related expenses. Among these, an insurance company evaluated savings of as much as $200 per month per individual treated for OSA. The long-term savings could be even more if the reduction in associated comorbidities, such as diabetes or hypertension, were included in the analysis.
**Impacts of programs on presenteeism and injuries**

<table>
<thead>
<tr>
<th>Key results</th>
<th>Program (comparative)</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Decreased perceived presenteeism</strong> (from 1 to 10, how would you rate the impact of your sleep on your productivity?): 15.4% for the group with the program and 2.4% for the group without the program (DS)</td>
<td>Online cognitive behavioural therapy</td>
<td>A Fortune 500 Company</td>
</tr>
<tr>
<td>Slight, but not significant decrease in absenteeism</td>
<td></td>
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<tr>
<td><strong>Decreased perceived presenteeism</strong>: % of employees indicating 3 days and + (out of 7) wherein their productivity is affected by poor sleep quality (from 11.2% to 7%)</td>
<td><em>Healthy Sleep for Healthy Living</em></td>
<td>American Express</td>
</tr>
<tr>
<td>Firefighters who attended the educational sessions had 24% less chance of completing an injury report (as compared to those who did not attend the training session).</td>
<td><em>Sleep Health Education</em></td>
<td>Firefighters</td>
</tr>
</tbody>
</table>

A complete bibliography of all sources used in the preparation of Levia’s full report is included in the following pages.
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