



ALCOHOL AND HEALTH

# ALCOHOL AND SLEEP



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# INTRODUCTION

Sleep is essential to quality of life, both personal and professional. Most adults need 7 to 9 hours of sleep a night in order to feel rested.<sup>1</sup> When they get less than that, their behaviour, productivity and health are affected.

Attentiveness, concentration and the ability to think clearly are the first to suffer from the lack of sleep.<sup>2</sup> Then come slowed reflexes, memory problems, muscle and mental fatigue, and mood swings, even aggressiveness. Thus, the amount of sleep we get has an impact on our ability to get along with people and build relationships. A lack of sleep also affects our capacity to situate ourselves in space and time. In extreme cases, it can lead to hallucinations, which clearly can be fatal if we are doing something that requires our full attention. In other words, not sleeping enough can have multiple consequences: aside from the impact on quality of life, the most significant ones involve focus, attentiveness, concentration and memory. Indeed, lack of sleep may well be the hidden cause behind most of the “human error” that causes accidents at work or on the road.

Taking a longer-term view, researchers have found a correlation between the amount and quality of sleep and various chronic health issues, such as obesity, diabetes and hypertension. Insufficient sleep can also disrupt the immune system and impair our capacity to fight disease.

Sleeping does much more than provide rest; it recharges both mind and body. Getting enough sleep is therefore critical to achieve and maintain good health.

Given the above, it is no surprise that researchers are studying the many factors that can interfere with sleep quality, particularly lifestyle and drinking habits.

The purpose of this publication is to review the relationship between alcohol and sleep. First, we explain the different stages of sleep and why alcohol is such a fickle friend of slumber. Then we provide a brief examination of the relationship between alcohol and certain sleep problems. In so doing, we once again highlight the fact that, even when it comes to the connection between drinking and sleeping, moderation is always in good taste.

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<sup>1</sup> Foster, J. (2013). Alcohol and Sleep in: Preedy, V. R., Patel, V. B., & Le, L. A. (Eds.). *Handbook of Nutrition, Diet and Sleep* (No. 3). Wageningen Academic Pub.

<sup>2</sup> [http://thebrain.mcgill.ca/flash/d/d\\_11/d\\_11\\_p/d\\_11\\_p\\_cyc/d\\_11\\_p\\_cyc.html](http://thebrain.mcgill.ca/flash/d/d_11/d_11_p/d_11_p_cyc/d_11_p_cyc.html)



## THE STAGES OF SLEEP

When people are ready to sleep, they become drowsy and nod off. This is the “falling asleep” stage. Once someone is actually sleeping, two distinct stages follow. The first is **non-REM** (Rapid Eye Movement) **sleep**, or slow-wave sleep, which itself can be broken down into light sleep and deep sleep, and the second is **REM sleep**, also called paradoxical sleep.

Non-REM sleep is characterized by initial slower brain activity during which sleep is lighter, followed by deep sleep in which we shut ourselves off completely from the outside world. This is a key restorative time when the body recovers from fatigue and repairs physical damage. During this sleep stage, skin is repaired, bones are renewed, toxins are eliminated from the respiratory, cardiovascular and glandular systems, and various hormones are secreted, which contribute to tissue repair and muscle building.

Alternating with non-REM sleep are stages of REM sleep and periods of dreaming during which we tend to stir. While REM sleep is deep sleep, it is also characterized by irregular breathing, rapid eye movements beneath closed eyelids and

brain activity similar to that observed when we are awake. Hence the term “paradoxical.” The most fascinating thing about this stage is that it is the time of night when we have our strangest and most detailed dreams.

We also process our daily emotional experiences during periods of REM sleep, which serve as a kind of overflow valve. Studies show that by allowing us to recover from daily stress, REM sleep makes us more effective when we are awake.<sup>3</sup> Other research has shown that REM sleep helps us consolidate memories and organize everything we have learned, especially intellectual learning and complex things that require new reflexes or strategies. This is why memory is so affected by a lack of REM sleep.

We spend about 75% to 80% of our total sleeping time – about 6 hours of an 8-hour night – in non-REM sleep. The remaining 20% is spent in REM sleep.

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<sup>3</sup> Roehrs, T., & Roth, T. (2001). Sleep, sleepiness, and alcohol use. *Alcohol Research and Health*, 25 (No. 2), 101-109.

## ALCOHOL AND SLEEP

Acute alcohol consumption depresses the central nervous system and that affects sleep in a variety of ways.<sup>4</sup>

The first known research on alcohol and sleep dates back to 1883, when Mönninghoff and Piesbergen conducted an observational study on the depth of sleep in relation to physical exercise and alcohol consumption. Since 1960, English-language medical databases have listed more than 150 studies that assess the impact of drinking on the quantity and quality of

sleep in adults among the general population who are not alcohol dependent.<sup>5</sup>

Many drinkers believe that alcohol promotes sleep, but the research as a whole shows that, although alcohol is a sedative, it disturbs the sleep cycle, exacerbates certain sleep problems and consequently has repercussions during waking periods.

Let's look at how alcohol affects the physiology of sleep.



<sup>4</sup> [http://lecerveau.mcgill.ca/flash/capsules/articles\\_pdf/effets\\_alcool.pdf](http://lecerveau.mcgill.ca/flash/capsules/articles_pdf/effets_alcool.pdf)

<sup>5</sup> Ebrahim, I. O., Shapiro, C. M., Williams, A. J., & Fenwick, P. B. (2013). Alcohol and Sleep I: Effects on Normal Sleep. *Alcoholism: Clinical and Experimental Research*.

## ALCOHOL AND THE PHYSIOLOGY OF SLEEP

### Falling asleep

Every study since 1883 has reached the same conclusion: **after drinking alcohol, people fall asleep more quickly.**

This holds true whether people are given just a small amount of alcohol (between 0.15 and 0.49 mg/kg, or about 1 or 2 drinks), a moderate amount (between 0.5 and 0.74 mg/kg, or 2 to 4 drinks) or a large amount (more than 0.74 mg/kg, or more than 4 drinks). Generally speaking, researchers have also found that the sedative effect of the alcohol lasts through the first part of the night. In fact, **people who have consumed alcohol wake up less frequently and for shorter periods of time during the first hours** after falling asleep. This is true regardless of sex or age.

However, it must be noted that **drinkers tend to develop a tolerance for the “knock-out” effect of alcohol.** Research shows that people who consume alcohol on three to seven consecutive days feel its sedative effects less intensely.<sup>6</sup>

Another factor that affects the impact of alcohol on sleepiness has to do with when people do their drinking. According to Foster, while blood alcohol content is rising, alcohol actually acts as a stimulant, rather than a sedative.<sup>7</sup> Thus, **a small amount of alcohol consumed just before bedtime tends to delay the moment of falling asleep.**

Initially, it would seem that one or even several drinks could help people sleep. However, while alcohol generally helps people fall asleep and not wake up during the first hours of sleep, **it has a very disruptive effect on the rest of the night**, which is marked by more fragmented sleep and frequent waking. Sometimes, people wake too early in the morning and are unable to fall asleep again. These effects are primarily due to a kind of mini-withdrawal that occurs during the second part of the night.

This is why people often say that alcohol is a fickle friend of sleep.

### Non-REM sleep

Based on the last 50 years of research, it is safe to conclude that, during the first part of the night, alcohol increases the amount of non-REM sleep, regardless of sex, age or amount of alcohol consumed. Nonetheless, the greatest increase in non-REM sleep is observed in those who have drunk a considerable amount. Polysomnograms reveal that people who are given four alcoholic drinks before going to bed have 1% to 11% more non-REM sleep than after consuming no alcohol. Among people who drink small or moderate amounts, the increase varies between 0.5% and 7.5%. However, it is important to note that these effects disappear rapidly with tolerance, which develops with repeated alcohol consumption.

Taking the whole night into account, the impact of alcohol on the amount of non-REM sleep is directly related to the amount of alcohol consumed. According to Ebrahim and colleagues, no clear trend has been observed among those who drink lightly.<sup>8</sup>



<sup>6</sup> Roehrs, T., & Roth, T. (2001). Sleep, sleepiness, and alcohol use. *Alcohol Research and Health*, 25 (No. 2), 101-109.

<sup>7</sup> Foster, J. (2013). "Alcohol and sleep," in Preedy, V. R., Patel, V. B., and Le, L. A. (Eds.), *Handbook of Nutrition, Diet and Sleep*, No. 3, Wageningen Academic Publishers.

<sup>8</sup> Ebrahim, I. O., Shapiro, C. M., Williams, A. J., & Fenwick, P. B. (2013). Alcohol and Sleep I: Effects on Normal Sleep. *Alcoholism: Clinical and Experimental Research*.

## 5

**But among those given a moderate amount of alcohol, researchers observe a trend towards increased non-REM sleep. Larger amounts of alcohol significantly increase the amount of deep non-REM sleep.**

Thus, no matter how much alcohol is involved, people who participate in laboratory studies and are given one drink before going to bed experience more non-REM sleep during the first part of the night. When it comes to the night as a whole, only those who drink heavily (at least 4 drinks) experience more non-REM sleep. Note that outside the laboratory, sleepers are not always aware of these changes.

It has also been observed that, in general, compared to people who go to bed sober, those who drink before sleep wake up significantly more often during the night, regardless of how much they drink. Researchers therefore believe that alcohol reduces the quality of sleep, particularly in the second half of the night.



### REM sleep

There is a well-established link between alcohol and reduced REM sleep. Starting in 1960, researchers began noting that, in the presence of alcohol, REM sleep seemed to be “replaced” by non-REM sleep. That conclusion still holds today. However, advancements in science have made further refinements possible, and when the impact of alcohol is examined in terms of the number of drinks consumed, the results are more nuanced.

When people drink lightly or moderately, studies show no change in the amount of REM sleep during the first part of the night. By contrast, people who drink heavily experience a significant reduction in REM sleep during the same period.

When the whole night is considered, i.e. not just the first few hours of sleep, it appears that both moderate and heavy drinking reduce the total percentage of REM sleep. This effect is not observed among people who drink lightly (fewer than two drinks), so the conclusion is that reduced REM sleep is not related to alcohol per se, but to the amount consumed.

It is clear that drinking alcohol promotes sleepiness and disrupts the natural sleep cycle, keeping REM sleep from alternating normally with non-REM sleep. The latest update on the subject shows that changes in the sleep cycle are related to the amount of alcohol consumed.

More specifically, while it is true that any amount of alcohol increases the amount of non-REM sleep during the first hours of the night, only people who drink heavily experience an increase in the total amount of non-REM sleep during the course of the night. Furthermore, only those who drink heavily experience a decline in the percentage of REM sleep during the night. Finally, when people drink alcohol before bed – no matter how little or how much – they wake up more frequently during the night than when they don’t drink alcohol. In other words, alcohol affects quality of sleep.

## Alcohol and sleep disorders

**Drinking alcohol can exacerbate certain sleep disorders, notably insomnia, apnea and snoring.**

Data on alcohol use in Quebec shows that 4% of the general population and 10% of people who suffer from insomnia turn to alcohol to treat their sleep disorders.<sup>9</sup> Unfortunately, doing so even occasionally is a very bad idea.



### Insomnia

Insomnia is characterized by the following symptoms: difficulty falling asleep, waking frequently during the night, difficult falling asleep again after waking, waking too early in the morning and feeling tired upon getting up.

There are a host of factors associated with insomnia, but alcohol is definitely a possible cause. Several drinks can actually result in frequent waking, numerous changes in sleep stages and a reduction in the amount of REM sleep. Given that insomniacs have difficulty falling asleep again after waking during the night, it is clear that drinking alcohol before bedtime, which causes increased waking, is very likely to exacerbate insomnia.

In addition, since the sleep following several alcoholic drinks is light and fragmented, people tend to stay in bed longer in an attempt to feel more rested. Unfortunately, this just disturbs the sleep-wake cycle, which, in turn can cause greater sleepiness during the day and poor sleep the following night.

Among people who have a serious alcohol problem, switching from excessive to moderate drinking, or quitting drinking altogether, generally helps reduce insomnia, although a minority find that the problem can persist.<sup>10</sup>

<sup>9</sup> Morin, C. M., LeBlanc, M., Daley, M., Gregoire, J. P., & Merette, C. (2006). Epidemiology of insomnia: prevalence, self-help treatments, consultations, and determinants of help-seeking behaviors. *Sleep medicine*, 7 (No. 2), 123-130.

<sup>10</sup> Brower, K. J., Krentzman, A., & Robinson, E. A. (2011). Persistent insomnia, abstinence, and moderate drinking in alcohol-dependent individuals. *The American journal on addictions*, 20(5), 435-440.

### Sleep apnea

Sleep apnea is a serious condition characterized by frequent pauses in breathing during sleep. These pauses, or apneas, usually last 10 to 30 seconds. They may occur several times during the night and result when the upper airway becomes blocked during sleep. Often, the nighttime obstruction occurs when the soft tissue at the back of the throat collapses and closes the airway. Relaxed throat muscles, a narrow respiratory tract, a large tongue or excess fatty tissue in the throat can also block the airway.

People who suffer from sleep apnea should cut back considerably on their drinking, and even avoid alcohol altogether. Alcohol can cause the throat muscles to relax abnormally, which can lead to a blocked airway.<sup>11</sup> Alcohol-related respiratory complications are even more pronounced among people already suffering from sleep apnea.<sup>12</sup> Alcohol can also reduce the brain's ability to wake up and detect a lack of oxygen in the body. This can lead to longer and more dangerous breathing pauses.<sup>13</sup>



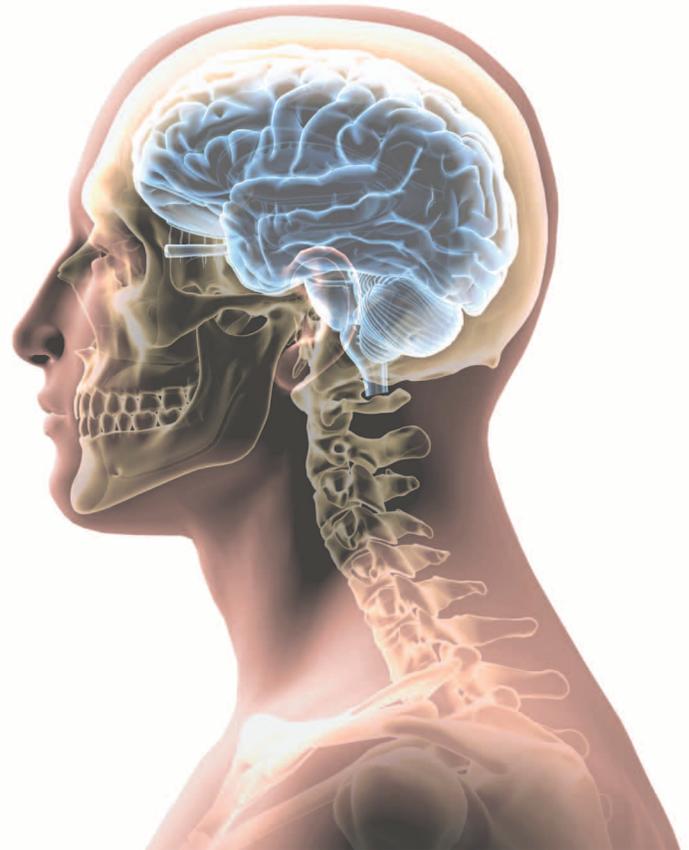
<sup>11</sup> <http://pubs.niaaa.nih.gov/publications/aa41.htm>. Page viewed November 5, 2013.

<sup>12</sup> Kolla, B. P., Foroughi, M., Saaidifard, F., Chakravorty, S., Wang, Z., & Mansukhani, M. P. (2018). The impact of alcohol on breathing parameters during sleep: a systematic review and meta-analysis. *Sleep medicine reviews*, 42, 59-67.

<sup>13</sup> <http://www.phac-aspc.gc.ca/cd-mc/sleepapnea-apneesommeil/index-eng.php>. Page viewed November 5, 2013.

## Snoring

In a much less serious way, relaxed muscles along the airway also explain why people who have drunk alcohol before going to bed are more likely to snore. Air has a harder time making its way to the lungs, making it a little more difficult to inhale and causing an increase in snoring. People who tend to snore are also more at risk for respiratory complications when they fall asleep after drinking. While snoring itself is not dangerous, it is associated with a higher risk of hypertension, and it is definitely annoying – especially for bed partners, who are usually the first to suffer its impact.



## Alcohol and normal nighttime hormonal function

The pineal gland, located in the middle of the brain, secretes a number of hormones (including melatonin, commonly called the sleep hormone) in accordance with a circadian rhythm. In general, hormonal secretions are at their maximum during sleep. This is particularly true for human growth hormone, which is secreted by the pituitary gland and reaches a peak during non-REM sleep. However, studies show that when people drink alcohol before sleeping, growth hormone secretions decrease, despite the fact that drinking causes an increase in non-REM sleep. In fact, researchers have observed that the more someone drinks, the less growth hormone is secreted. One study even showed that the phenomenon persists after three nights, i.e. even after the person has developed a tolerance for the sleep-inducing effects of alcohol.<sup>12</sup>

<sup>12</sup> Roehrs, T., & Roth, T. (2001). Sleep, sleepiness, and alcohol use. *Alcohol Research and Health*, 25 (No. 2), 101-109.



## Alcohol's indirect impact on daytime attentiveness and functioning

This would be a good time to recall that a hangover, which results from excessive drinking, affects sleep by reducing both REM sleep and total sleep time, while increasing non-REM sleep. Studies show that one of the reasons people feel so bad the day after a drinking binge is the lack of sleep caused by the heavy drinking (Prat, Adan, Pérez-Pámiés and Sánchez-Turet, 2008 ; Verster and Roehrs, 2007). This explains why you can feel so tired and not in full possession of your cognitive faculties the day after tying one on. Nobody sleeps well after getting drunk.

Other research has examined performance and attentiveness in healthy people who drink alcohol before going to bed. In these studies, the day after an episode of heavy drinking, participants' ability to accomplish divided-attention tasks was impaired and they scored lower on performance tests.<sup>13</sup> Researchers therefore tend to agree that excessive drinking can indirectly affect attentiveness or functioning the next day, due to alcohol's disruptive impact on the sleep cycle. While the impairments observed in these studies are generally minor, the impact can nonetheless be significant when the tasks involved are complex or dangerous.

Given the ever-concerning number of motor vehicle accidents in Quebec, particularly those involving young people, it is important to note that many studies have also documented the potentiating effect of alcohol and the lack of sleep on attentiveness, judgement and motor function – and therefore on the risk of falling asleep and/or having an accident.<sup>14</sup> One study showed that staying up for 21 consecutive hours affected a person's ability to drive, producing changes equivalent to those caused by a blood alcohol content of .08.<sup>15</sup> It's dangerous enough to drive if you have drunk alcohol or if you are tired: combining the two can be twice as risky for everyone on the road.

## CONCLUSION

As is often true whenever alcohol is involved, the dose makes the poison, and the impact of alcohol on sleep is a perfect case in point.

When people drink alcohol before going to bed, the data show that a small amount generally has little or no effect on the sleep cycle, while a larger amount seems to have a more noticeable overall effect on sleep in general and on specific sleep disorders, as well as on a person's ability to function the next day.

At the same time, alcohol is a poor substitute for sleeping pills. This is particularly true for anyone who is susceptible to sleep disorders. Such people should definitely drink moderately or avoid alcohol completely before going to bed.

Once again, we come face to face with the simple fact that, no matter how you look at it, moderation is always in good taste.

Éduc'alcool would like to thank Charles M. Morin, Ph.D., professor of clinical psychology at the School of Psychology at Université Laval and renowned sleep expert, for his invaluable help in revising this publication.

<sup>13</sup> MSLT Multiple Sleep Latency Test.

<sup>14</sup> Taylor, D. J., & Bramoweth, A. D. (2010). Patterns and consequences of inadequate sleep in college students: substance use and motor vehicle accidents. *Journal of Adolescent Health, 46* (No. 6), 610-612.

<sup>15</sup> Arnedt, J. T., Wilde, G. J., Munt, P. W., & MacLean, A. W. (2001). How do prolonged wakefulness and alcohol compare in the decrements they produce on a simulated driving task?. *Accident Analysis & Prevention, 33* (No. 3), 337-344.

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Moderation is always in good taste.

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