EIGA Safety Transport Information

Prepared by WG-17 Transport Safety SI-TS 13/21

Managing Driver Fatigue

Introduction

Fatigue can affect all people in their working environment to varying levels. Driving is a complex mental and physical task requiring sustained levels of concentration and skill to maintain maximum performance. No driver can afford to be fatigued nor can anyone else. Driver fatigue causes thousands of road accidents each year. Research shows that driver fatigue maybe a contributing factor in 20% of these accidents and up to one quarter of serious and fatal accidents [1]. The management of such fatigue is critical to the safe operation of gas industry delivery vehicles and the drivers to return home safe at the end of every shift.

Further information on fatigue related to general working and shift patterns can be found in EIGA Info HF 09, *Fatigue from working patterns - Shiftwork and overtime* [2].

Scope

The purpose of this publication is to provide training topics and recommendations that can help to avoid situations that affect drivers in their daily lives and can make them fatigued. It gives guidance on what to consider when creating a fatigue management system.

Definitions

BMI: body mass index.

Circadian body clock: A circadian rhythm is a natural, internal process that regulates the sleep/wake cycle and repeats approximately every 24 hours.

CPAP: Continuous positive airway pressure.

DDDR: Driver distraction and drowsiness recognition - is an in-vehicle system designed to detect symptoms of fatigue and alert the driver, warning them to take a break.

Fatigue: the feeling of extreme physical and mental tiredness.

MVA: motor vehicle accident.

Sleep Apnoea: temporary cessation of breathing during sleep due to obstruction of the airway.

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Learning more about fatigue

1. Do your drivers recognise the signs of fatigue?
2. Do your drivers know what actions to take if they are fatigued?
3. Do you train your drivers in fatigue awareness and how to adapt their lifestyle to help prevent fatigued driving?
4. Does your company have a fatigue management policy and do you check if it is effective?
5. Are you collecting and analysing data to be sure that drivers are respecting the driving and working hours?
6. Are you using this information for creating a system which supports you to manage driver fatigue?
7. Do you have processes in place to manage sleep apnoea and medical treatments?

If the answer to any of the above questions is 'no', then you should consider taking action!

THIS TRANSPORT SAFETY INFORMATION GIVES GUIDANCE ON DRIVER FATIGUE AND MANAGEMENT WHICH WILL HELP TO IMPROVE SAFETY IN ROAD TRANSPORT.

Effects of fatigue

Fatigue is more than falling asleep at the wheel. Fatigue describes the feeling of being tired, drained or exhausted.

It causes poor judgment, poor hazard perception, impaired coordination with slower reactions and impacts on how well one can work. It builds up, leading to a progressive loss of alertness that ultimately ends in sleep and is a major contributing factor in many road incidents.

The effects of fatigue include the following:

Loss of alertness. This is when you respond more slowly to things as they arise. Loss of alertness is an early sign of fatigue and may result in less efficient vehicle control (for example finding it hard to drive inside the lanes or finding it hard to maintain a constant speed).

Poor judgment. Before drowsiness sets in, fatigue affects the ability to think clearly, which is vital when making safety related decisions and judgments.

Someone who is very fatigued may not realise how fatigued they really are. As a result, fatigued people are unaware that they are not functioning as safely as they would if they were not fatigued. Decision making is slowed, reaction times are increased and at times decisions are based on entirely incorrect assumptions or on flawed information perceived by the fatigued driver.

Drowsy driving. Drowsiness means feeling sleepy, but not actually being asleep. When drowsy, a driver may drift in and out of sleep occasionally without knowing it (micro sleep). Nodding of the head while driving is a symptom of micro-sleeps.

Falling asleep at the wheel. Falling asleep at the wheel happens in numerous incidents, typically very severe single vehicle incidents where there has been no attempt by the driver to control the vehicle. Often the driver is completely unaware of events before the incident.

Poor memory. Being fatigued also affects the memory. As the brain shuts down and prepares for sleep, it allows less and less information to be gathered and processed. For example, drivers may have travelled a significant distance without knowing it. This is directly related to loss of alertness.

Mood change. Being fatigued can also make people irritable, agitated, aggressive and poor company. They can start to overreact to things including those that wouldn't normally upset them or under-react to things that you normally would address in a more rational manner**.**

Causes of fatigue

There are several main causes of fatigue in people driving vehicles:

Driver rest periods. A driver having adequate rest periods between shifts and during the shift is critical to ensure a driver does not become fatigued. In the EU, the regulation of driving hours and day and night rest, are established by regulation (Regulation (EC) No 561/2006 *on the harmonisation of certain social legislation relating to road transport*), while the weekly working hours are fixed by each local government both of which are controlled by the use of tachographs [3]. In regions where there is no legislation or

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agreed driving time, then rest periods should be agreed with local management ensuring the driver has adequate rest.

The quality of rest not just the quantity is important to prevent the driver becoming fatigued. Consideration should be given to where the driver is taking their rest periods for example in cab sleeping as opposed to hotels with facilities such as air conditioning, heating, quiet location etc.

There should be a monitoring process to ensure compliance but compliance along to these minimum requirements is not enough to guarantee a driver will not become fatigued.

Hours of work - circadian body clock. The biological clock tells you when it is lunch time, gives a lift at certain times of day, and affects the body temperature. Most people's clocks run on a daily rhythm of approximately 24 hours. In principle, human beings are day orientated.

There are two cycles per day when most people's biological clocks make them likely to feel sleepy. One is in the afternoon from 14:00 – 16:00. The other, is the early morning, 02:00 – 06:00.

A driver needs to be aware of their own body clock. This will help them take extra care and precautions during those times they are most likely to feel sleepy. Drivers shall comply with the hours of service or legislated regulations and accept their responsibility to get plenty of sleep during your off-duty time.

All drivers, managers and supervisors need to understand that driving whilst fatigued is not solely work related. The driver needs to consider the driving to and from work. This is particularly important at recruitment as it is important the driver is not travelling for long periods before they get to work. The driver needs to make their employers aware if they decide to change their home address.

If the employer asks the driver to work from another location, ensure the overall driving period is considered.

All drivers, contractor or employee, shall ensure they have the appropriate rest and sleep habits between shifts. Managers, supervisors and schedulers shall ensure that drivers do not have other duties that negatively impact their rest between shift and/or contribute to their fatigue.

Sleep Homeostasis. Sleep homeostasis is another factor that regulates our sleep / wake cycle. It is also known the need to recover lost sleep. It is wake dependent and it increases in proportion of the amount of time a person has been awake since their last sleep. If sleep is shorter than usual, a sleep debt is accrued. A proportion of this debt needs to be made up during the person's next sleep cycle.

Drivers need to be aware that additional sleep is required after short or interrupted rest periods.

Operational staff and fatigue. Although it is the driver's responsibility to ensure they have sufficient rest before driving, it is the responsibility of operational staff to ensure that they have scheduled adequate rest periods between shifts for drivers. These rest periods shall be in line with company standards that meet at least legislated requirements to ensure the driver is well rested at the commencement of their next scheduled shift. Companies should develop procedures to manage the movement of drivers between shift patterns.

Sleep apnoea. Obstructive sleep apnoea is a sleeping disorder that is considered a major contributor to fatigue in some individuals. It is a condition that when sleeping, partial or total obstruction of the airway occurs and breathing frequently stops, resulting with the individual being woken multiple times a night and only sleeping lightly and not getting the restorative deep sleep required. The individual quickly becomes fatigued during the day effecting their capabilities to perform even simple tasks well let alone a complex task like driving.

The correct treatment for sleep apnoea can be highly effect with a great improvement in the quality of life and significantly improves the safety of any driver by reducing the risk of fatigue.

For detailed information on symptoms, diagnosis and treatment of sleep apnoea see Appendix A.

Illness and medications / drugs

An unwell state, for example the onset of colds, flu, hay fever / sinus, headaches etc. can itself be a contributing factor to fatigue. Medical advice should be sought where necessary being aware that some medications may cause drowsiness. Both medically prescribed prescriptions and over-the-counter medications can impair driving ability. Always follow the label precautions. This responsibility rests solely with the driver.

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Illegal substances shall never be taken when driving. They can have major changes on perception as well as drowsiness.

Alcohol

Laws relating to alcohol consumption and driving vary but alcohol is a potent cause of drowsiness. In addition, drivers should be reminded that alcohol is even more dangerous in combination with some or all of the following:

- the circadian low periods;
- a heavy meal; and / or
- some medications.

In most countries, the law prohibits driving under the influence of alcohol and drugs.

Highway hypnosis

Another fatigue factor is known as highway hypnosis. This usually occurs early in the morning or mid-afternoon and usually on long dull straight highways. Monotonous driving is a major issue which, at nights, is worsened by the sleep-inducing effect of the engine noise and rocking motion while there is little for the driver to do. A driver develops a fixed stare on the road ahead and becomes hypnotised into a brief sleep. Drivers who have been asleep for up to two seconds have no memory of having been asleep at all. These are called micro sleeps. A good way to combat this condition is to keep the eyes and head moving and focus on your surroundings every 5 to 10 seconds, thereby maintaining alertness and concentration.

Lifestyle factors

Several lifestyle factors that affect fatigue are under the control of the driver. It is the responsibility of the driver to ensure they are fit for work prior to starting their shift and advise the relevant person if not. Where a driver is requested to fulfil a duty / extra shift at short notice, they are more susceptible to fatigue.

The following lifestyle factors can contribute to fatigue:

- A driver's lifestyle influences their general tiredness at work. How well they sleep at home is normally related to specific issues that influence sleep, for example new-born babies, noisy neighbours etc.
- Behaviour prior to the start of work in terms of preparing to shift between day and night shift and the impact of permanent night drivers as they switch back to day activity during their rest periods. The first shift on nights is always difficult, even for permanent night drivers. Drivers should be aware that driving home after a night shift is a noted risk.
- Drivers returning to work immediately after a holiday are at serious risk of suffering from either 'jetlag' or tiredness. Drivers should plan to allow home rest before resuming duty.
- A heavy meal shortly before commencing a shift or during a shift is likely to induce drowsiness.
- An individual's fitness, health and obesity are known to affect an individual's propensity for sleepiness.
- Driving the day after having a lot to drink the night before can leave drivers fatigued due to poor quality of sleep and they could still be over their national drink driving limit by the start of their shift.

The driver’s attitude is important in recognising, accepting and mitigating these risks.

Warning signs of fatigue

Some of the warning signs of fatigue that the driver should be aware of are:

- loss of concentration;
- slower reaction times;
- not remembering driving the last few miles or drifting across the road;

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- nodding off at the wheel (micro sleeps), the body makes involuntary jerky movements as a defensive momentary warning, or the driver jerks the vehicle back into your lane;
- poor use of indicators;
- paying less attention to traffic;
- continuously yawning;
- eyes becoming sore or tired, starting to lose focus or dimmed vision; or
- painful limbs, stiffness and / or cramps.

When the driver has any of these warning signs – **stop, revive and survive!**

Reducing the risk of fatigue on the road

Ways the driver can minimise fatigue include:

- If tiredness is becoming an issue then pull over and have a short sleep (maximum of 15 minutes), use an alarm, and consider having a caffeinated drink before sleeping. However, drivers should be aware that the effect of caffeine decreases over time and can make the driver more at risk once the positive effects have worn off. Plan to have a break to avoid the peak tiredness zones. If the driver does need to stop for unplanned rest break, they should notify dispatch/scheduling personnel with new estimated time of arrival.
- Avoid the 'just one more junction syndrome' by planning ahead before judgment becomes impaired. Even if a stop is due soon drivers should not be afraid to stop earlier if tiredness is increasing.
- While schedule compliance is important, companies should encourage a culture where drivers feel empowered to take decision to combat fatigue. There are many shifts where time can be made up on a schedule, particularly on nights. This being the case there should be no reluctance to take a break. If driver fatigue is a scheduling issue, drivers should notify their supervisor if their schedule does not allow them to get enough rest.
- Personal preparation prior to the first shift back at work is very important, particularly for night drivers.
- Personal fitness is important and as weight increases, it is more difficult to keep fit.

Ways schedulers and planners can minimise fatigue include:

- making sure that driver work duties make sense and avoid backward rotation, usually where the following work duties starts approximately 24 hours following the end of the previous one;
- choosing drivers for extra duties and call out in a way that minimises the changing of duties and takes into account the driver's readiness for duty;
- build in the correct allowances for daily and weekly rest periods to all vehicle/driver schedules;
- comply with standards or local legislation on driving hours, applying the most stringent;
- controlling overall scheduling so trip times are not excessively demanding;
- greater flexibility in working/driving hours where possible;
- taking into account all issues associated with loading and unloading when scheduling; and
- keep drivers focused and aware of the dangers of fatigue when driving.

Using technology to tackle fatigue

There are technologies (subject to local legislation) that can indicate fatigued driving to management or directly intervene to prevent/lessen the consequence of incidents due to fatigue, such as:

- GPS Systems – some systems can set geo-fences for certain routes and time of day limits. This can be used to geofence certain routes that are known high risk routes and susceptible to induced fatigued driving. Some advance systems you are able to do this by time of day therefore targeting the high-risk times when a driver's body clock might induce fatigued driving.

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- Automatic braking systems – these mitigate the consequence of a fatigued driver reacting late. Activations from the system can be help to identify high-risk areas and potentially fatigued driving.
- Lane departure systems – these intervene when a driver drifts out of his lane. Multiple activation might indicate a high-risk driver who might be susceptible to fatigue.
- Roll stability systems – analysis of activations can indicate high-risk areas and drivers.
- In-cab camera system – can mitigate risk by improving driver behaviour and assessing liability in collisions. Inward facing cameras can be directly used to identify fatigued driving but after the event.
- DDDR systems – these systems constantly monitor eye and wider head movement and optionally vehicle control inputs and send a warning to the driver when fatigued driving is detected.
- Fit for duty tests – these tests check the alertness of the driver before the commencement of the duty.
- Alcohol test system – these can check the driver is fit for duty and if connected to the vehicle will prevent it being driven.

Company culture and training about fatigue

It is important that fatigue is not just seen as a driver problem. The gas companies and their contractors need to set up a culture where fatigue is widely discussed and understood and has policies in place to identify, manage and act upon evidence of fatigued driving. Employees need to feel empowered to take timely actions to prevent fatigued driving. This should be reinforced by senior managers repeatedly make a clear point of safety being the highest priority and drivers are encouraged to take a break when sensing symptoms of fatigue.

Training should be given to all operational staff for example drivers, schedulers, dispatchers, supervisors and managers. This should include:

- what is fatigue and the risks;
- the causes and effects for fatigue;
- potential impact of illness, sleep apnoea, medications and alcohol;
- the importance of lifestyle and being fit for duty;
- the warning signs of fatigue and the importance of acting early;
- recognising sleep-related risk situations; and
- what practical steps can be taken to lessen the impact of fatigue.

Conclusion

Fatigue is a major root cause of many serious road incidents experienced by gas companies and their contractors. However, fatigue is a complex issue with multiple causes both within and outside the workplace. In order for a company to minimise the impact of fatigue they need to fully train their operational staff in understanding fatigue, the causes, effects and steps individuals can take to mitigate the risk. This should be supported by company policies and procedures to allow their staff overcoming fatigue issues and undertake analysis of data to identify potential fatigue issues.

References

Unless otherwise specified, the latest edition shall apply.

[1] The Role of Driver Fatigue in Commercial Road Transport Crashes, European Transport Safety Council, www.etsc.eu.

[2] EIGA Info HF 09, *Fatigue from working patterns - Shiftwork and overtime*, www.eiga.eu.

[3] Regulation (EC) No 561/2006 *on the harmonisation of certain social legislation relating to road transport*, www.ec.europa.eu.

[4] No airway obstruction during sleep by Drcamachoent/CC BY-SA 4.0, www.commons.wikimedia.org.

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[5] Airway obstruction during sleep by Drcamachoent/CC BY-SA 4.0, www.commons.wikimedia.org.

[6] McNicholas W, *Driving risk in obstructive sleep apnoea: Do new European regulations contribute to safer roads?*, Expert Review of Respiratory Medicine, 2016;10(5):473-475, www.tandfonline.com.

[7] Rodenstein D, *Driving in Europe: the need of a common policy for drivers with obstructive sleep apnoea syndrome,* Journal of Sleep Research, 2008;17(3):281–284, www.onlinelibrary.wiley.com.

[8] Tippin J, *Driving impairment in patients with obstructive sleep apnea syndrome*, American Journal of Electroneurodiagnostic Technology 2007;47(2):114–126, www.tandfonline.com.

[9] Tregear S et al, *Obstructive sleep apnea and risk of motor vehicle crash: systematic review and meta-analysis*, Journal of Clinical Sleep Medicine, 2009;5(6):573–581, www.jcsm.aasm.org.

Further information

EIGA SI-TS 01, *Transport Safety Information, an Overview*, www.eiga.eu.

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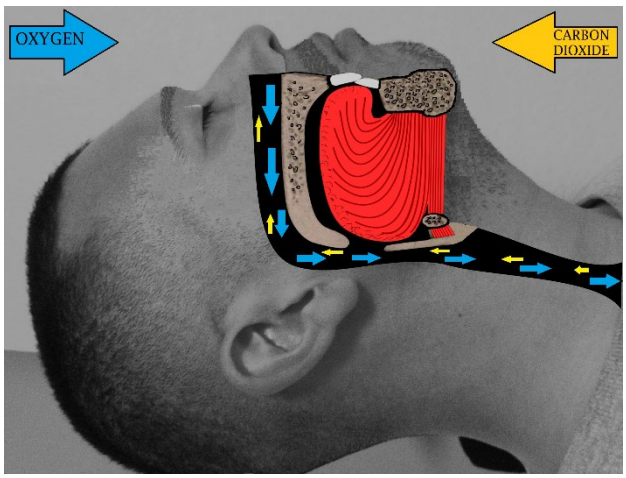
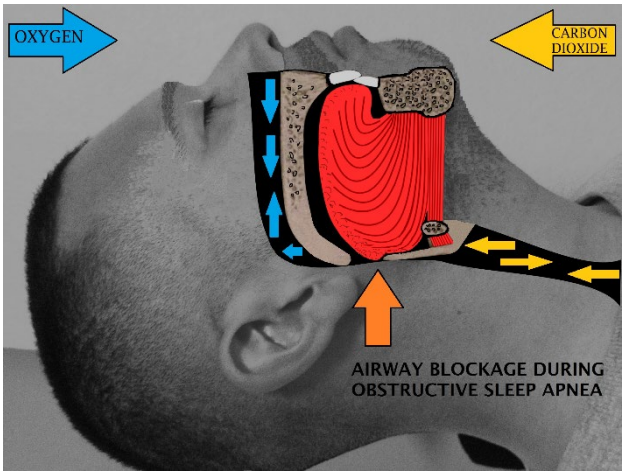
Appendix A

Obstructive Sleep Apnoea Syndrome (OSAS) is a condition that when sleeping, partial or total obstruction of the airway occurs and breathing frequently stops, resulting with the individual being woken multiple times a night and only sleeping lightly and not getting the restorative deep sleep required.



No Obstruction [4]



Airway Obstructed [5]

Risks of sleep apnoea

There is strong evidence that untreated OSAS is associated with a substantial increase in the rate of motor vehicle accidents (MVA), which varies between 2 and 7 times the general population risk in different reports and the driving impairment in OSAS patients has been reported as equivalent to driving whilst drunk [6, 7, 8]. An analysis of published reports indicated that the overall increased risk of MVA is 2.4 times that of the general population which exceeds the increased risk of MVA in many other clinical disorders already identified as associated with increased accident risk [9].

Risk factors sleep apnoea

The major factors that would lead to greater likelihood to suffer from sleep apnoea are:

- Excess weight –The risk for sleep apnoea is higher if the person is overweight with a body mass index (BMI) of 25 or more or obese with a BMI of 30 or higher.
- Large neck size – The risk of sleep apnoea is higher for neck sizes of 43 cm (17 inches) or more for men, or 40.5 cm (16 inches) or more for women. A large neck has more soft tissue that can block the airway during sleep.
- Middle age – Sleep apnoea can occur at any age. However, it is more common between young adulthood and middle age.
- Male gender – Sleep apnoea is more common in men than in women. For women the risk of sleep apnoea increases with the menopause.
- Hypertension – High blood pressure is extremely common in people who have sleep apnoea.
- Family history – Sleep apnoea is a heritable condition. This means that there is a higher risk of sleep apnoea if a family member also has it. Inherited traits that increase the risk for sleep apnoea include obesity and physical features such as a recessed jaw. Other common family factors, such as physical activity and eating habits, may also play a role.

While these factors increase the likelihood of suffering from sleep apnoea it is entirely possible to suffer from the condition without any of these characteristics.

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Common symptoms of sleep apnoea

The most common symptom of sleep apnoea is snoring. However, not everyone who snores has sleep apnoea. Snoring is likely to be a sign of sleep apnoea when it is followed by silent breathing pauses and choking or gasping sounds. Other common symptoms of sleep apnoea include:

- loud or frequent snoring;
- silent pauses in breathing;
- choking or gasping sounds;
- daytime sleepiness or fatigue;
- unrefreshing sleep;
- insomnia;
- morning headaches;
- nocturia (waking during the night to go to the bathroom);
- difficulty concentrating;
- memory loss;
- decreased sexual desire; or
- irritability.

Diagnosis and treatment of sleep apnoea

Initial screening can be undertaken with a simple questionnaire that covers the risk factors and symptoms. If a driver is flagged up as potentially suffering from sleep apnoea, then they should be referred to a doctor or a specialist sleep physician. This is also required for acquiring the driver's initial license according to EU Directive 2014/85/EU *on driving licenses*, however when applying for a driver's license this directive may not have been in place. The symptoms may have either been overlooked or the condition may not have been present at the time, having developed in the time span between acquiring the driver's license and applying for the driving role in the industrial gases industry. Therefore, it is best practise for industrial gas companies to also assess new and existing drivers in this regard.

Drivers that are flagged require tests conducted to confirm diagnosis. A home sleep test is conducted in the comfort of their own home where they sleep while a small monitor collects data on the breathing and blood oxygen level while sleeping. For more complex cases an in-lab overnight sleep study may be required where sensors are place on various parts of the body to record brainwaves, heartbeat, breathing and movement.

If treatment if required there are several options:

- **CPAP.** Continuous positive airway pressure is a machine that uses a steady stream of air to gently keep the airway open throughout the night, so the patient can breathe. They sleep with a mask with a hose that is attached to a machine kept at the bedside. Masks and machines may vary depending on the treatment and comfort needs. CPAP is the most common treatment for obstructive sleep apnoea and is recommended for nearly all cases.
- **Oral appliance therapy.** An oral appliance is a device that fits in the mouth over the teeth while the patient sleeps. It may resemble a sports mouth guard or an orthodontic retainer. The device prevents the airway from collapsing by holding the tongue in position or by sliding the jaw forward so that they can breathe whilst asleep.
- **Surgery.** Surgical therapies are not as effective in treating sleep apnoea as CPAP and oral appliances. There are a variety of surgical options that can be selected if CPAP or oral appliance therapy does not work. The most common options reduce or eliminate the extra tissue in the patient's throat that collapses and blocks the airway during sleep. More complex procedures can adjust bone structures.
- **Weight management.** In some cases, weight loss can help improve or eliminate sleep apnoea symptoms if they are overweight or obese. Overweight people often have thick necks with extra tissue in the throat that may block the airway. There is no guarantee that losing weight will eliminate sleep apnoea, though it

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may help. This approach is unlikely to make a difference in patients with a narrow nasal passage or airway.

- **Positional therapy.** Positional therapy is a behavioural strategy to treat positional sleep apnoea. Some people have sleep apnoea primarily when sleeping on their back. Their breathing returns to normal when they sleep on their side. Positional therapy may involve wearing a special device around the waist or back to keeps the patient sleeping in the side position. Positional therapy can be used alone or together with another sleep apnoea treatment.
- **Lifestyle changes.** There are a variety of lifestyle changes that can be made to help reduce snoring and improve sleep apnoea symptoms. Behavioural changes such as quitting smoking or not drinking alcohol may improve sleep apnoea symptoms. Alcohol relaxes the throat muscles which can cause snoring or for the airway to collapse.

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