



FATIGUED DRIVING

WHAT IS...

What is the difference between fatigued driving and drowsy driving?

There are two types of sleep-related driving impairments that can affect driving ability:

- > Fatigue is a disinclination (or unwillingness) to continue performing the driving task at hand. This can occur as a result of repetitiveness of either the driving task or the driving environment, or can occur after driving for extended periods without a rest or break.
- > Drowsiness is a product of the human body's natural circadian rhythm or 'sleep-wake' cycle. Most people feel sleepy twice a day – in the afternoon and at night.¹ Teenagers need at least nine to nine and a half hours of sleep a night.² Without the proper amount, drowsiness occurs and once a person is tired there is no cure for drowsiness other than sleep itself.³ Thus, driving can be affected by this natural cycle.

The results of fatigue and drowsiness are the same and can be considered together. The driver is less alert and less attentive and can fall asleep. Both of these conditions reduce the ability to drive.⁴ Given that the consequences of fatigue and drowsiness on driving are the same, both terms are often used interchangeably.

How common is fatigued driving?

A public opinion poll conducted by the Traffic Injury Research Foundation in 2011 found that almost one-fifth (18.5%) of Canadians reported falling asleep at the wheel in the past 12 months. In the same poll, 14% of respondents admitted to driving often when they were fatigued.⁵

Crash data analysis shows that 26.4% of all fatal and injury crashes in Ontario (excluding property damage collisions) are fatigue-related.⁶ Similar to Canada, in the United States (U.S.) it is believed that up to 20% of serious crashes may be due to fatigue. Estimates place the number of fatigue-related

crashes between 79,000 and 103,000 per year with 1,500 fatalities annually in the U.S.

BEHAVIOURS

How does fatigue cause crashes?

There are two types of modes a driver can experience due to fatigue. The first is 'sleep mode'.⁷ This causes the driver to be under-aroused which typically leads to drowsiness. The driver begins to drive without awareness, no longer giving the proper amount of attention to the task of driving.⁸ Errors of neglect are made, meaning the driver fails to perform important driving tasks (e.g., braking in time, staying in their lane or staying on the road).

The second is 'overload mode'.⁹ This is characterized by the driver feeling over-aroused due to mental overload and irritability. This causes the driver to make dangerous errors, such as aggressive driving (e.g., road rage) or multi-tasking while driving.

Both of these modes increase the chances of crashing.

Who is most at risk to drive while fatigued?

Young drivers and specifically young males are most likely to be driving late at night and to be sleep deprived because of their lifestyle. Drivers that are younger than 25 years of age are one of the most at-risk groups with respect to fatigue-related crashes.¹⁰ Of drivers ages 20 to 24, 35% reported nodding off while driving and 28% of 16 to 19 year olds reported the same. This is the largest proportion of all the driver age groups that are at risk for fatigue.¹¹

Studies show that teens most at risk for fatigued driving are those who are considered 'overachievers'. These teens work long hours at part-time jobs, are involved in several extra-curricular activities and socialize often. They likely possess a vehicle to commute between their responsibilities and do not give sleep the priority it needs. This lifestyle puts them at risk for extreme fatigue behind the wheel.¹²

Males of all ages are also more likely to be fatigued while driving compared to female drivers. In a 2010 U.S. study, it was reported that 52% of men reported having ever fallen

1 Robertson et al. 2009
2 ECMT 2006
3 NHSTA 2006a
4 Vanlaar 2007
5 Marcoux et al. 2012
6 Elzohairy 2007

7 Moller et al. 2006
8 ECMT 2006
9 Moller et al. 2006
10 ECMT 2006
11 Beirness 2004
12 Carskadon 1989/1990

asleep while driving, compared to 30% of female drivers.¹³ Other drivers at risk are shift workers, who are more likely to be driving late at night, people with sleeping disorders, and those under the influence of alcohol or medication.¹⁴

Why are young drivers more likely to drive fatigued?

The lifestyle of teens plays a major role in their likelihood of driving fatigued but biological changes play a role as well. They often do not get enough sleep because they stay up late to study, work, or socialize¹⁵ but it is also their circadian clocks that make it difficult for them to fall asleep until later in the night.

Night time sleep declines over the teen years and teens are more likely to sleep in on the weekends to make up for their late week nights. Teens also experience a decrease in alertness when awake which begins in mid-puberty. These physical changes paired with the experimentation and limit-testing behaviours that are common to teens¹⁶ make them quite vulnerable to driving while fatigued.

What are the signs of fatigue?

- > yawning;
- > tired eyes;
- > feeling of heavy eyelids;
- > hard to keep still;
- > difficulty concentrating;
- > difficulty keeping thoughts together; and,
- > nodding off.¹⁷

What are the driving behaviours of a fatigued driver?

Fatigue causes a decrease in alertness, reaction time, memory, coordination, information processing and decision making; all skills needed to drive safely. This causes a withdrawal of attention from the changing demands of the road environment.¹⁸ Drivers are likely to speed or change their speed rate often, make frequent lane changes, ignore road signs and traffic control devices, and brake suddenly.¹⁹ The most dangerous effect of fatigue is the driver falling asleep, causing the driver to lose total control of the vehicle. For instance, at 100 km/h a driver travels 150 meters in only six seconds. If a driver's eyes are closed for only three or four seconds they could face disastrous consequences.²⁰

Although driving for long distances is commonly associated with the chances of falling asleep at the wheel, evidence shows that this is not always the case. In fact, 58.8% of people who admitted to falling asleep behind the wheel in the past 12 months did so after driving for less than an hour. Fewer than that (20.6%) reported falling asleep after 3 hours of driving.²¹

13 Tefft 2010

14 Robertson et al. 2009

15 Stutts et al. 1999

16 Carskadon 1989/1990

17 van den Berg and Landstrom 2006

18 Stutts et al. 2009

19 Robertson et al. 2009

20 Robertson et al. 2009

21 Tefft 2010

What are the common characteristics of a fatigued-related crash?

Fatigued-related crashes commonly:

- > involve only the driver who is young and male;
- > involve a single vehicle running off the roadway/ rear-end and head on collisions, often with no brake marks;
- > occur on higher speed highways; and,
- > result in serious injury.²²

When are fatigue-related crashes most likely to occur?

The most common time periods for fatigue-related crashes are mid-afternoon (3 pm-6 pm) and late at night/early morning (12 am-7 am). These time periods pose similar risk for a fatigue-related crash: a study conducted by Tefft (2010) found that approximately the same percentage of people report falling asleep during the time periods of 12 pm-5 pm and 12 am-6 am (26.1% and 24.7% respectively).²³ It is not surprising that these time periods are the most risky, our bodies have a circadian rhythm (common sleep pattern) that makes us sleepy in the afternoon and late at night.²⁴ These sleep-wake cycles cannot be avoided or ignored.

Besides our circadian rhythm, we are also subject to a natural homeostasis which is a biological need to sleep. The longer a person is kept awake, the more pressure that will build up for the need to sleep. This force would be the strongest late at night (12 am-7 am). For these reasons, fatigue-related crashes are most common around the times we biologically cannot deny our body of sleep.²⁵

ATTITUDES, CONCERNS AND PERCEPTIONS

What does the public think about fatigued driving?

Public opinion polls show Canadians believe the dangers of fatigued driving can be controlled easily because they think there are several options available for dealing with the effects of fatigue.²⁶ Studies show that the public underestimates the frequency of fatigued driving. In a survey conducted in Ontario, respondents estimated four out of ten drivers drive while fatigued when in reality six out of ten actually do so. Ontario drivers are less concerned with fatigued driving than most issues – they think that people are more likely to engage in other types of risky behaviour (such as drinking or speeding).

Drivers do not think they are likely to be caught driving while fatigued, nor do they think their chances of crashing are very high. This is especially true for males.²⁷ Respondents ranked getting to their destination on time as more important than taking breaks in order to rest.

22 Robertson et al. 2009

23 Tefft 2010

24 Beirness et al. 2004

25 NHTSA 2006a

26 Vanlaar et al. 2007

27 Fernandes et al. 2007

What do young drivers think of fatigued driving?

A study conducted in 2010 investigating why young drivers would drive while fatigued found that peer approval, perceived risk and optimism bias were all factors.²⁸ This means that young drivers are not afraid of getting caught or getting into a crash while driving fatigued, and they do not think it is likely they will experience the same fate as other fatigued drivers who did get caught or crashed (the 'it won't happen to me' attitude).

A focus group conducted in the U.S. with young drivers found that almost all male participants and all female participants reported driving while extremely sleepy. They reported falling asleep at red lights, being woken up by rumble strips and in some cases forgetting their trip home. Although they acknowledged the danger of fatigued driving, all respondents reported getting behind the wheel regardless of the amount of sleep they had the night before, and none of them were willing to give up driving when they knew they were fatigued.²⁹

Why is a fatigued driver dangerous?

People are not good at judging how likely it is they will fall asleep.³⁰ Many drivers do not feel drowsy or recognize drowsiness. Some drivers who were in a fatigue-related crash reported they did not feel tired before the crash. Drivers are also confident they can handle the situation if drowsiness occurs. Once a driver is drowsy it is much more difficult to overcome this feeling than if the driver had avoided becoming drowsy in the first place.

As well, fatigue has similar effects to alcohol intoxication. Studies show that a person who has not gotten proper rest in over 17 hours is equivalent to a person with a blood alcohol concentration (BAC) of 0.05, which would result in a roadside suspension from police. Sleep deprivation for a full day results in a BAC of 0.10, which is legally drunk.³¹

How does alcohol interact with fatigue?

Drinking alcohol, even small amounts, when fatigued is quite dangerous. Fatigue heightens the effects of alcohol, impairing the driver even more so than fatigue alone.³² The 'overachiever' teen, who is most at risk for fatigued driving, is also known to socialize and attend parties often, which creates more opportunities for them to consume alcohol, even if it is just one or two drinks.

A study in the United Kingdom found that low levels of sleep combined with low levels of alcohol (under the legal limit) worsened lane drifting in young male drivers (an error that is a common cause of sleep-related crashes). These low levels of alcohol increased the driving impairment already present due to lack of sleep – something that is not realized by drivers.³³

28 Fernandes et al. 2010

29 NHTSA 2006b

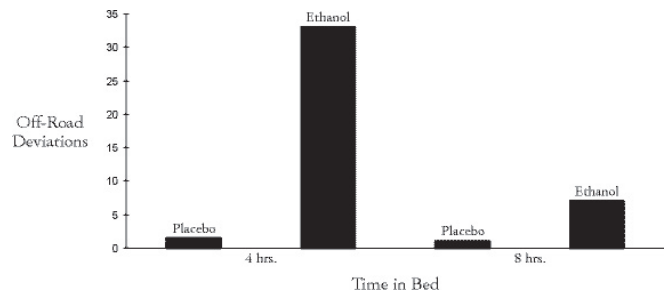
30 Vanlaar et al. 2007

31 Stutts et al. 1999

32 Stutts et al. 1999

33 Horne and Reyner 2003

The following figure shows how alcohol can affect fatigued driving.³⁴ With less sleep, alcohol has been shown to be associated with many more "off-road deviations" indicating that alcohol does compound the effects of fatigue.



LEGISLATION

Are there provincial/territorial fatigued driving laws?

No. There are no provincial/territorial laws that are specific to fatigued driving. However there are various driving infractions in the highway traffic act in each jurisdiction in Canada that are used by police to address this behaviour:

- > failure to drive in a marked lane;
- > failure to avoid collision;
- > unsafe lane change;
- > disobey sign;
- > failure to share half of roadway;
- > drive left of centre;
- > leave roadway not in safety.³⁵

How are fatigued drivers dealt with by the police?

Police officers have discretion to deal with fatigued drivers. According to the results of an Ontario study conducted in 2009, when asked how they would deal with a fatigued driver, police identified several actions they could take depending on circumstance. These include:

- > giving the driver a warning;
- > arranging for alternate transportation;
- > charging the (spacing) driver with a provincial offence;
- > charging the (spacing) driver with a criminal offence; and,
- > making an arrest.³⁶

SOLUTIONS

What needs to be done on our roads and what strategies are available to the public to decrease fatigued driving?

Public education combined with increased efforts by government to implement fatigue-reducing road infrastructure would help to decrease the frequency of fatigued driving. Drivers should take necessary measures to avoid fatigued driving before beginning trips and roads

34 Roehrs et al. 1994

35 Robertson 2009

36 Robertson 2009

should be equipped to help drivers achieve fatigue-free driving.

Highways can be modified in order to better prevent fatigued driving. For instance, rumble strips at both the centre and shoulder line have been found to reduce crash rates by 18-25%. Highway maintenance can make sure to clear away roadside obstacles and provide secure rest areas to encourage breaks.³⁷

If fatigued driving is put at the center of public concern, drivers can begin to learn how dangerous fatigue driving can actually be (comparable to drinking and driving). The message of personal responsibility of the driver should be stressed and drivers should be educated on the strategies available to deal with fatigued driving, such as getting adequate sleep before a road trip and scheduling break times for the journey.³⁸

Why isn't there more data available on fatigued driving?

It is very difficult to determine if fatigue is a factor in a crash, especially if the driver did not survive.³⁹ This makes it hard to collect accurate statistics on the magnitude of fatigued driving. There is no instrument to measure fatigue, unlike alcohol.⁴⁰ Once an officer is on site he or she cannot physically measure if a driver is fatigued. Because crashes commonly occur at night, it is less likely there will be any witnesses to the crash. The driver involved in the crash is not likely to admit that they dozed off or were drowsy at the time of the crash. Research is underway in countries such as Australia and Finland to develop tools to better detect driver fatigue. Once these tools are available, police can more accurately record fatigue-related crashes and these statistics can strengthen the growing research on fatigued driving.

What should a young driver do to prevent fatigued driving?

The top reason drivers report falling asleep at the wheel is because of lack of sleep the previous night.⁴¹ The lifestyle of young drivers facilitates the likelihood that they will also experience an extreme lack of sleep. Young drivers need to be conscious of this and compensate by either sleeping more or finding other modes of transportation when they are particularly tired.

Researchers suggest that the best strategy to deal with fatigue is to prevent it. Getting enough sleep before any long trip (and ideally, any driving in general) or a nap before driving will decrease the likelihood of crashing due to fatigue. Young drivers have a much higher risk of crashing at night than during the daytime, which is why graduated driver licensing programs developed night time restrictions. These restrictions have led to a 60% decrease in night time crashes of young drivers.⁴² Passengers can prevent fatigued driving by

asking the driver if they are tired. If they are, the passenger should discourage them from driving.

What should a driver do if they begin to feel fatigued while driving?

When experiencing fatigue, young drivers are more likely to turn on the radio, open a window/turn on the AC, talk to passengers, sing or use their cell phones to stay alert.⁴³ These strategies are actually more distracting than helpful and increase the risk that the driver could crash.

The only effective method for dealing with fatigue while driving is to prevent it. Drivers should take breaks at least every 2-3 hours so that fatigue does not become an issue. If this is not possible, and fatigue has already occurred, drinking caffeine and taking a nap have been found to temporarily help drivers deal with drowsiness.⁴⁴ A study found that both actions relieve fatigue, but only for a few hours.⁴⁵ Regardless of the ability to hold off sleepiness for a few extra hours with naps or caffeine, a driver should always plan to have the proper amount of rest before a trip and plan ahead for adequate break periods, because once a driver is fatigued, the impairment cannot be reversed.

References

- Beirness, D.J., Simpson, H.M., Desmond, K. (2004). *The Road Safety Monitor 2004: Drowsy Driving*. Traffic Injury Research Foundation. Ottawa, Canada.
- Bohan, J.S. (2006). *Coffee or Nap?* Journal Watch Emergency Medicine. Massachusetts Medical Society.
- Cansfield, D. (February 2008). *Closing Remarks from Ontario's Minister of Transportation. Working Together to Understand Driver Fatigue: Report on Symposium Proceedings*. Highway Safety Roundtable. Toronto, Canada.
- Carskadon, M.A. (1989/1990). *Adolescent Sleepiness: Increased Risk in a High-Risk Population*. Alcohol, Drugs and Driving. 5(4)/6(1): 317-328.
- Elzohairy, Y. (2007) *Fatal and Injury Fatigue-Related Crashes on Ontario's Roads: A 5-Year Review*. Highway Safety Roundtable & Fatigue Impairment, Driver Fatigue Symposium, Toronto, May 16th 2007.
- European Conference of Ministers of Transport (ECMT). (2006). *Young Drivers: The Road to Safety*. Organisation for Economic Co-operation and Development. Paris, France.
- Fernandes, R., Soames Job, R.F., Hatfield, J. (2007) *A challenge to the assumed generalizability of prediction and countermeasure for risky driving: Different factors predict different risky driving behaviours*. Journal of Safety Research. 38(1): 59-70.
- Fernandes, R., Hatfield, J., Job Soames, R.F. (2010). *A systematic investigation of the differential predictors for speeding, drink-driving, driving while fatigued, and not wearing a seat-belt among Young Drivers*. Transportation Research Part F. 13(3): 179-196.
- Horne, J.A., Reyner, L.A. (2003). *Driving impairment due to sleepiness is exacerbated by low alcohol intake*. Occupational and Environmental Medicine. 60(9): 689-705.
- Marcoux, K. Vanlaar, W. Robertson, R. (2012). *The Road Safety Monitor 2011. Fatigued Driving*. Traffic Injury Research Foundation. Ottawa, Canada.

37 Smiley 2008

38 Cansfield 2008

39 Stutts et al. 1999

40 Cansfield 2008

41 Vanlaar 2007

42 ECMT 2006

43 Vanlaar et al. 2007

44 Stutts et al. 1999

45 Bohan 2006

Moller, M.J., Kayumov, L., Bulmash, E.L., Nhan, J., Shapiro, C.M. (2006). Simulator Performance, microsleep episodes, and subjective sleepiness: normative data using convergent methodologies to assess driver drowsiness. *Journal of Psychosomatic Research*. 61(3): 335-342.

National Highway Traffic Safety Administration (NHTSA). (March 2006a). Drowsy Driving and Automobile Crashes. NCSDR/NHTSA Expert Panel on Drive and Fatigue and Sleepiness.

National Highway Traffic Safety Administration. (September 2006b). Teen Unsafe Driving Behaviours: Focus Group Final Report. DOT HS 810 670. U.S Department of Transportation. Washington, DC.

Robertson, R., Holmes, E., Vanlaar, W. (2009). The Facts About Fatigued Driving in Ontario: A guidebook for police. Traffic Injury Research Foundation. Ottawa, Canada.

Roehrs, T., Beare, D., Zorick, F., Roth, T. (1994). Sleepiness and Ethanol Effects on Simulated Driving. *Alcoholism, Clinical and Experimental Research*: 18(1): 154-158.

Smiley, A. (February 2008). Strategies for Reducing Fatigue Related Crashes. Working Together to Understand Driver Fatigue: Report on Symposium Proceedings. Highway Safety Roundtable. Toronto, Canada.

Stutts, J.C., Wilkins, J.W., Vaughn, B.V. (1999). Why Do People Have Drowsy Driving Crashes? Input From Drivers Who Just Did. Washington DC: AAA Foundation for Traffic Safety.

Tefft, B. C. (2010). Asleep at the Wheel: The Prevalence and Impact of Drowsy Driving. Washington, D.C.: American Automobile Association Foundation for Traffic Safety.

van den Berg, J., Landstrom, U. (2006). Symptoms of Sleepiness while driving and their relationship to prior sleep, work and individual characteristics. *Transportation Research Part F: Traffic Psychology and Behaviour*. 9(3): 207-226.

Vanlaar, W., Simpson, H., Mayhew, D., Robertson, R. (2007). Fatigued and Drowsy Driving: Attitudes, Concerns and Practices of Ontario Drivers. Traffic Injury Research Foundation. Ottawa, Canada.