



# Professional drivers' fatigue as a problem of the modern era

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## ABSTRACT

**Objective:** All around the world numerous studies have been carried out and indicated that 20–50% of commercial vehicle accidents occur because of fatigue. Professional drivers represent an important category of drivers who are present in traffic on a daily basis transporting passengers or goods and their responsibility is at a very high level. These drivers are most exposed to the impact of fatigue. The review of the literature has provided three main factors which can influence the onset of fatigue: sleep factors, work factors, health factors. The main aim of this study was to determine the influence of the three main factors of fatigue between bus and truck drivers in the Republic of Serbia.

**Methods:** The survey has been conducted among bus and truck drivers who are employed in transportation companies across the Republic of Serbia. The research consists of collecting and analyzing bus and truck drivers' answers according to the above mentioned factors which influence the occurrence of fatigue.

**Results:** In this study we have found that circadian rhythm, sleep and work factors have an impact on drivers' fatigue. On the other side, time of going to sleep has no impact on the quality of sleep and on fatigue. The results show that if the drivers work over the legal limit, they are 3 times more likely to sleep less than 6 h in 24 h and if they sleep less than 6 h, it is likely that the poor quality of their sleep will be 8 times higher. The poor quality of sleep reduces driver performance, and therefore increases the risk of accidents.

**Conclusions:** 2 of 3 investigated factors have an impact on the occurrence of fatigue. The third factor, health factor, should be examined in more detail, and other elements should be analysed in order to determine their influence on the fatigue.

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## 1. Introduction

We live in the decade of action for road safety which indicates that the problem of road safety is serious and that the entire world is struggling to resolve the problem of traffic accidents. More than 1.2 million people die each year on the roads around the world, making road traffic injuries the leading cause of death globally. Most of these deaths are in low- and middle-income countries where rapid economic growth has been accompanied by increased motorization and road traffic injuries. In addition to deaths on the roads, up to 50 million people obtain nonfatal injuries each year as a result of road traffic crashes, while there are additional indirect health consequences that are associated with this growing epidemic (WHO, 2015). According to OECD/ITF (2015), the number of road fatalities declined by 42% overall between 2000 and 2013 in 32 countries in the International Road Traffic and Accident Database (IRTAD) for which the data are constantly available.

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Why are there traffic accidents? There are numerous influences that contribute to the occurrence of accidents. American scientist William Haddon ([Haddon, 1980](#)) tried to systematize them in a matrix, which is named after him. The basic Haddon matrix systematizes three factors of traffic safety to human, vehicle and environment – before, during and after accidents. However, there is a need to separate the road from the environment, so the road is a special factor. Thus, the enlarged Haddon matrix systematizes the four factors of traffic safety – human, vehicle, road and environment – before, during and after accidents.

The human factor appears as the most important factor, because it affects active and passive safety in various ways. Driving under the influence of fatigue is among the most important elements in addition to gender, age, abilities, skills-training, attitudes, experiences, behaviors.

Fatigue is a human factor who greatly affects mood and motivation, as well as sleepiness and cognitive functions and abilities of man, and therefore the driver. [Lal and Craig \(2001\)](#) showed that sleepiness can be regarded as a form of fatigue related to the stimulation of brain activities and parts of the central nervous system which regulate the onset of fatigue. While sleepiness is aroused by the need to sleep, fatigue is a broader concept and represents a signal which our body sends informing us to stop all activities (physical, mental) and to have rest, which does not necessarily include sleeping. Many studies worldwide have identified fatigue and/or sleepiness as the major causes of road accidents ([Akerstedt & Kecklund, 2001](#); [Chen & Wu, 2010](#); [Connor et al., 2002](#); [Dobbie, 2002](#); [Lyznicki, Doege, Davis, & Williams, 1998](#); [Perez-Chada et al., 2005](#)). This rate is particularly high among professional drivers where, depending on the country, it has been estimated that 20–50% of road accidents occur due to driver fatigue. [Torregroza-Vargas, Bocarejo, and Ramos-Bonilla \(2014\)](#) suggest that truck drivers are a highly exposed group because of the extended time they spend behind the wheel, and, as a result, are at high risk of being involved in road crashes. They show that the working conditions of truck drivers may increase the risk of a crash dramatically if the regulations do not include a road safety perspective.

The review of the literature has provided three main factors which can influence the onset of fatigue:

- sleep factors (circadian rhythm – working when you would normally be asleep and sleeping when you would normally be awake, amount of sleep)
- work factors (working very long or extended hours and having no time to recover from work),
- health factors (medical sleep problems and general health and lifestyle issues).

One of sleep factors – circadian rhythm plays an important role in the drivers' fatigue area. Truck drivers often work when they would normally be asleep and sleep when they would normally be awake. [Mohamed et al. \(2012\)](#) found that the greatest number of fatal accidents in Malaysia happened in the early morning hours and they caused heavy casualties. The cause of these accidents is at least partly attributed to fatigue and sleepiness.

[Bills \(1934\)](#) emphasizes that fatigue does not represent a unique phenomenon and distinguishes three aspects of fatigue: physiological fatigue (the reduction of physical capacity), objective fatigue (decrease of work) and subjective fatigue (the feeling of fatigue and weariness). [Grandjean \(1979\)](#) separates muscular and mental fatigue, the latter being a diffuse sensation which is accompanied by feelings of indolence and disinclination for any kind of activity. [McDonald \(1989\)](#) has illustrated that fatigue is one of those concepts which appear quite clear and unambiguous in everyday life but become notoriously elusive when one tries to pin them down in scientific discourse. Also [Brown \(1994\)](#) defines fatigue as a subjectively experienced disinclination to continue performing the task at hand. [Hancock and Verwey \(1997\)](#) defined fatigue as an individual's multidimensional physiological-cognitive state associated with stimulus repetition which results in prolonged residence beyond a zone of performance comfort. While [Philip et al. \(2005\)](#) agree that fatigue is eliminated by a sufficient period of rest.

Sleepiness, on the other hand, has a more precise meaning and definition. Sleepiness refers to the pressure to fall asleep or the probability of falling asleep at a particular time due to circadian and exogenous influences ([Johns, 2000](#); [Shen, Barbera, & Shapiro, 2006](#)). It disappears after sleep, but not after rest ([Philip et al., 2005](#)). Sleepiness is a physiological need, such as hunger and thirst. If the state of alertness is longer, the need of the body to sleep is higher. This need is measured by sleepiness ([Roehrs, Carskadon, Dement, & Roth, 2010](#)). Sleepiness can be regarded as a form of fatigue related to the stimulation of brain activities and parts of the central nervous system which regulate the onset of fatigue. While sleepiness is aroused by the need to sleep, fatigue is a broader concept and represents a signal which our body sends informing us to stop all activities (physical, mental) and to have rest, which does not necessarily include sleeping ([Lal & Craig, 2001](#)).

Our circadian body clock is thus programmed that individuals can be sleepy twice a day: first during the usual period of sleeping, in the middle of the night (01:00 – 06:00), the critical period being around 6 a.m. The next period is 12 h later, 12:00 p.m. – 04:00 p.m. A lot of studies have shown that the risk of accidents is 10 times bigger at night than during the day.

Getting less than the normal amount of sleep and getting poor sleep are sleep factors. Research findings indicate that critical incidents occur more frequently when drivers have had, at most, 4–6 h of sleep in the 24-h period prior to the incident ([Hanowski, Wierwille, Garness, & Dingus, 2000](#)). Most sleep experts suggest that six-hour sleep a night is the minimum but closer to eight is desirable. Keeping this in mind, in addition to the quantity of sleep it is necessary to observe the quality of sleep.

In many countries the law prescribes working hours, but many drivers work very long or extended hours causing a significant increase in the risk of sleeping at the steering wheel. In situations when drivers do not have time to recover from work and when they feel sleepy, they can choose to rest and be safe or to continue and risk to be involved in an accident.

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