

Prevalence of Sleepiness as a Risk Factor for Road Traffic Accidents: Sample of Hospitalized Saudi Drivers

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Abstract. Sleepiness in drivers is an important factor contributing to road traffic accidents. This study aimed to determine the prevalence of sleepiness among car drivers involved in road traffic accidents in Saudi Arabia, and its impact on the accidents. From January to June 2008, all drivers admitted to King Abdulaziz Medical City in Jeddah following their involvement in road traffic accidents, were interviewed within 24 hrs from admission using a questionnaire. Sleepiness was estimated using the Epworth Sleepiness Scale and Stanford Sleepiness Scale. Of all the drivers interviewed, 10.3% reported sleepiness as the main cause of accident; 27.9% reported snoring at night; 47% usually went to sleep after midnight; and 72.1% slept 6 hrs or less per night. Of the drivers with a Stanford Sleepiness Scale of 4-7, 41.1% attributed their accidents to sleepiness, and among drivers with an Epworth Sleepiness Scale of ≥ 10 , 70% attributed their accidents to factors other than sleepiness. Most drivers in the study sample had poor sleeping habits, and sleepiness as a risk factor for road traffic accidents was more prevalent when quantified using subjective validated measures.

Keywords: Sleepiness, Road traffic accidents, Drivers.

Introduction

Driving a car is a complex task that requires full alertness and concentration. To ensure full safety, a driver needs to be aware of the ever-changing surrounding environment, with continuous surveillance of the road. Cognitive, perceptual, motor, and decision-making skills are all

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involved in the process and hence, human error has been labeled the major underlying cause in up to 40% of car accidents^[1, 2]. This kind of error may be attributed to carelessness, inexperience, lack of knowledge or attention, over-exhaustion or fatigue. Indeed, excessive daytime sleepiness (EDS) may impair attention and thus, lead to an increased risk of an accident^[1,3,4]. In a laboratory study of neurobehavioral functions, sleep restriction combined with fatigue from long hours of driving was shown to significantly affect reaction time^[5]. The causality relationship between sleepiness at the time of driving and road traffic accidents (RTAs) has been investigated. Untreated obstructive sleep apnoea (OSA), as a major cause of EDS, has been linked to a significantly increased risk of RTAs as compared to normal individuals^[1,3,6,7], with a significant reduction in such risk with proper treatment^[6]. The risk of accidents is also associated with driver-reported sleepiness at the wheel and near-miss accidents^[8,9]. A recent study from Canada reports that 14.5% of study participants admitted to ‘nodding-off’ or falling asleep while driving during the past year^[10]. The estimated number of RTAs caused by sleepiness ranged from 1-3% in the US, 10% in France and over 30% in Australia^[11,12]. However, such data is not available in Saudi Arabia and studies on the underlying causes of road traffic accidents are limited. One local study analyzing around 13,000 police records over a three and a half-year period identified driver errors, including lack of attention, over-exhaustion, and fatigue as the main contributing factors in about two thirds of crashes^[13]. Another study, on a random sample of about 2500 drivers from the Eastern Region of Saudi Arabia, inquires about the use of seat-belts and mobile phones while driving, but no inquiry into sleepiness was reported^[14].

The magnitude of morbidity and mortality resulting from RTAs in Saudi Arabia is remarkable; however, there is limited local information on the prevalence and impact of sleepiness on drivers as a risk factor for RTA. The aim of this study is to determine the prevalence of sleepiness in a sample of the Saudi population as a risk factor for RTAs.

Materials and Methods

All drivers involved in road traffic accidents and admitted to King Abdulaziz Medical City in Jeddah, Saudi Arabia (January–June 2008) were interviewed using a questionnaire. The interview was conducted as early as possible after the time of admission, mostly within 24 hrs.

This questionnaire was in Arabic and included, in addition to demographic questions, inquiries about the possible causes of the accident from the driver's perspective, history of previous accidents, history of snoring at night, as well as the timing and duration of sleep. It also included a translated version of the Epworth Sleepiness Scale (ESS) to estimate the degree of chronic daytime sleepiness, and Stanford Sleepiness Scale (SSS) to estimate the level of sleepiness at the time of the accident. Although the Arabic version has not yet been validated, to ensure as close translation to the original scales as possible, the forward-backward-forward technique was used. The questionnaire was translated into Arabic (forward), then a second party with no previous knowledge of the questionnaire translated it back into English (backward), and the conceptual equivalence was compared and evaluated to generate the final Arabic translated questionnaire (forward).

The ESS is a self-administered questionnaire, first published in 1991, and is used for assessing the level of daytime sleepiness^[15]. The advantages of the ESS; it is a validated and reliable tool for assessing subjective sleepiness and is able to distinguish normal individuals from those with sleep disorders^[15,16]. The ESS asks people to rate, on a 4-point scale (0-3), their usual chances of dozing off or falling asleep in eight different situations or activities that most people engage in as part of their daily activities, although not necessarily every day^[15]. The sum of all 8 items is then calculated to give a score between 0 and 24, which is a measurement of the respondent's average sleep propensity in those 8 situations. The normal range is less than 10^[15].

The SSS is a quick, easy, and a well-validated way to assess the level of alertness^[16,17]. It consists of seven statements that resemble the feeling during the day. The subject is asked to choose one of seven statements that best describes his/her level of sleepiness. SSS is typically used as a research tool to measure the impact of short-term acute sleep loss on subjective sleepiness. A score from 1 to 3 (*i.e.*, the first three statements) reflects a normal or relatively normal level of alertness; however, a score of ≥ 4 (*i.e.*, the last four statements) is indicative of sleepiness.

The exclusion criteria consisted of patients who were either deceased (no interview was conducted for an escort) or did not have severe enough injuries to be admitted to the hospital.

Statistical Analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 16. The qualitative data are presented in the form of number and percentage. The relationship between the cause of the accident from drivers' perspective and their ESS as well as SSS scores are presented in the form of cross tabulation. The quantitative data are presented as mean \pm SD.

Results

The total number of interviewed drivers was 68; all were males with a mean age of 28.35 ± 11.66 and 95.6% were Saudi. History of previous RTAs and causes of the current RTA are illustrated in (Table 1). In regards to the cause of the accident, the majority, 42.6% (n = 29) chose the answer 'other'. On further inquiry, most of this group attributed the accident to other drivers' mistakes. The presence of any deaths or injuries at the scene of the accident, besides the studied participant, was reported as 19.1% (n = 13).

Table 1. Details of road traffic accident (RTA) history (n = 68).

	Number of Cases (N)	Percentage (%)
History of previous RTA	37	54.4
Cause of the RTA from drivers' perspective		
Sleepiness	7	10.3
Speed	15	22.1
Negligence	12	17.6
Mobile use	2	2.9
Other *	29	42.6
I don't know	2	2.9

*Other: Mostly other people's mistakes

Drivers' sleeping habits are presented in (Table 2). A quarter of participants (25%) had an SSS score of 4-7; and 14.7% scored >10 based on ESS. Table 3 shows the relationship between SSS scores, ESS scores and the cause of the accidents from the drivers' perspective. Of all drivers who were identified as sleepy by SSS, only about 40% recognized sleepiness to be a probable cause of their accident. Of all drivers identified as chronically sleepy by ESS, only 30% attributed their accident to sleepiness.

Table 2. Drivers' sleeping habits (n = 68).

	Number of Cases (N)	Percentage (%)
History of snoring		
Yes	19	27.9
No	49	72.1
Time of going to sleep		
10 pm – 11 pm	18	26.5
11 pm – 12am	18	26.5
12 am – 1 am	19	27.9
1 am – 2 am	6	8.8
2 am – 3 am	7	10.3
Total hrs of sleep		
6 or less	49	72.1
More than 6	19	27.9

Table 3. The relationship between SSS score, ESS score, and cause of accident from drivers' perspective (n = 8).

	Cause of Accidents											
	Sleepiness		Speed		Negligence		Mobile Use		Other		I don't Know	
SSS Score	N	%	N	%	N	%	N	%	N	%	N	%
1-3 (Alert) (n = 51)	0	0	13	25.5	9	17.6	2	4	26	51	1	2
4-7 (Sleepy) (n = 17)	7	41.1	2	11.7	3	17.6	0	0	3	17.6	2	11.7
ESS Score	N	%	N	%	N	%	N	%	N	%	N	%
≤ 10 (n = 58)	4	7	14	24	10	17.2	1	2	26	45	3	5
> 10 (n = 10)	3	30	1	10	2	20	1	10	3	30	0	0

*SSS: Stanford Sleepiness Scale

*ESS: Epworth Sleepiness Scale

Discussion

Most drivers in this study sample had poor sleep hygiene and one in ten attributed their accident to sleepiness. This is similar to the frequency reported in a survey carried out on sleep-related car crashes in the United Kingdom^[18]. In addition, close to half of the drivers (47%) in our study sleep after midnight, and more than two thirds (72.1%) sleep ≤ 6 hrs per night. This is more than four times the percentage of the general population in the United States (17.75%) as reported by the National Sleep Foundation^[19]. Staying up late is considered poor sleep hygiene,

and it leads to sleep restriction, chronic sleep deprivation, and excessive daytime sleepiness. Short sleep hours at night, that is, sleep deprivation puts drivers at risk of sleep related crashes, as reported in many studies^[20].

Road traffic accidents are a major health concern worldwide. They pose a serious health burden due to the associated significant morbidity and mortality of the victims, who are usually in their most productive years of their lives. In 2008, the World Health Organization (WHO) reported that RTAs were the ninth leading cause of death worldwide, accounting for 1.3 million and 2.2% of total deaths^[21]. In the same report, the WHO explored that the projected increase in deaths by 2030 due to injury is mainly related to increase in the number of RTAs, rising to the fifth leading cause of death globally^[21]. In 2002, the WHO also reported that mortality rates due to RTAs in the Eastern Mediterranean Region were the second highest in the world after the African region, and that the number of road traffic deaths in the same region has risen steadily over the past decade^[22]. Apart from loss of human lives, RTAs cause an enormous economic cost, with estimates suggesting an annual global loss of around US\$520 billion^[21,23].

Road traffic accidents pose a serious national problem in Saudi Arabia^[24]. From 1971 to 1997, (564,762) people were injured or died as a direct result of RTAs representing around 3.5% of the country's population^[25]. In a local report, 20% of bed occupants and about 80% of deaths in Ministry of Health hospitals were due to RTAs^[25]. Studies on the underlying causes of road traffic accidents in Saudi Arabia are limited. Putting the relatively young average age of our study population into consideration, recklessness in the form of speed and negligence is expected to play an important role in the accidents, which our results did confirm. National laws have been introduced over the past few years to control driving speed and promote the wearing of seat belts, but little has been done regarding public awareness about the underlying causes of accidents.

A quarter of drivers were classified as acutely sleepy at the time of the accident by SSS, and about 15% were found to be chronically sleepy during the daytime by ESS. The young study population and the results of the sleep habits questions suggest that poor sleep hygiene is the underlying cause to sleepiness. The discrepancies between reports of

sleepiness (mentioning sleepiness as the possible underlying cause of the accident), and the degree of sleepiness in our subjects with a high SSS and ESS score is not surprising. Since self-reported sleepiness is generally subjective and imprecise, it may underestimate the severity of sleepiness. This is of particular concern since individuals may have a false sense of security while driving^[26,27]. This suggests that more drivers in our study could have been seriously sleepy at the time of the accidents than actually reported, and hence, sleepiness as a risk factor for RTAs may be underestimated. The importance of sleepiness as a risk factor for RTAs was confirmed by a prospective cohort study on 13,299 people, which concluded that self-assessed sleepiness while driving was a powerful predictor of serious RTAs^[28].

In our study, two out of five drivers attributed their accidents to other people's mistakes. This may also underestimate the impact of sleepiness on the RTAs, as it was not part of our study methodology to interview the other drivers, and to determine their sleepiness status at the time of the accident. In future studies, the time of the accident may be included in the questionnaire, as circadian rhythm problems may play a role in sleepiness. In addition, the small size of the study population and the fact that it was not randomly selected but included drivers that required hospital admission further limited our study. However, this study points out to the necessity for a nationwide survey on a wider population to determine the exact role of sleepiness as a risk factor for car accidents.

Conclusion

The study revealed poor sleep hygiene among a majority of drivers involved in RTAs. Sleepiness as a risk factor for RTAs is common as per drivers' perspective; however, it may be underestimated. A nation-wide survey is needed to determine the actual impact of sleepiness as a risk factor for RTA and to find out its etiologies in an attempt to minimize such factor.

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مدى انتشار النعاس كعامل خطورة بين سائقي السيارات المتورطون في حوادث المرور؛ دراسة محلية على عينة من السائقين في المملكة العربية السعودية

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المستخلص. يعتبر فرط النعاس لدى السائقين أحد الأسباب المهمة لوقوع الحوادث المرورية. كان هدف هذه الدراسة اكتشاف مدى انتشار النعاس بين عينة من سائقي السيارات المتورطون في الحوادث المرورية في المملكة العربية السعودية ومعرفة مدى تأثيرها على وقوع هذه الحوادث. اعتمدت الدراسة على ملء استبيان مع جميع سائقي السيارات المذكورين والمنومين في مدينة الملك عبدالعزيز الطبية بجدة، المملكة العربية السعودية في الفترة ما بين يناير ويونيو ٢٠٠٨ وذلك خلال ٢٤ ساعة من التنويم. ولقد استخدم مقياسي ايبويرث وستانفورد لتحديد درجة النعاس لدى السائقين. ولقد اعتبر ٣,١٠٪ النعاس العامل الأساسي لوقوع الحادث، وذكر ٩,٢٧٪ أنهم يعانون من الشخير أثناء النوم. و أوضح ٤٧٪ أنهم ينامون بعد منتصف الليل، وكذلك أقر ١,٧٢٪ بنومهم ست ساعات أو أقل في الليلة الواحدة. من بين جميع السائقين الحاصلين على نتيجة بين ٤-٧ (نعاس مفرط حاد) في مقياس ستانفورد للنعاس، اعتبر ١,٤١٪ فقط النعاس سبباً رئيسياً لوقوع الحادث. ونسب ٧٠٪ من الحاصلين على

درجة ١٠ أو أكثر (نعاس مفرط مزمن) حسب مقياس إيبويرث وقوع الحادث إلى عوامل أخرى غير فرط النعاس. كمحصلة نهائية تميز أغلب السائقين المشاركين في الدراسة بعادات غير صحية أثناء النوم، كما أثبتت الدراسة انتشار النعاس كعامل خطورة لوقوع حوادث المرور لدى السائقين.