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Epworth Sleepiness Scale In Assessment of Sleepiness and Fatigue Among Commercial Long Distance Drivers In Benin City, Edo State, Nigeria

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Abstract

Introduction: Sleepiness and fatigue occur commonly among drivers, especially those who commute long hours to meet set targets and schedules. Sleepiness, fatigue, and other impairments in concentration and attention can lead to road mishaps, crashes, and death. This study seeks to determine the level of Sleepiness and fatigue among commercial long-distance drivers in Benin City using Epworth Sleepiness Scale and the factors affecting it.

Materials and Methods: This was a descriptive cross-sectional study among 315 commercial long-distance drivers from May to August 2015. Respondents were recruited using a systematic random sampling technique. Study instruments included structured interviewer-administered questionnaires.

Results: For most drivers, 201 (63.8 %) slept for 4-6 hours, 102 (32.4 %) slept for more than 6 hours at night, and 12 (3.8 %) slept for less than 4 hours a night. Less than a third of the respondents, 101 (32.1 %), stated that the chance of them dozing off while sitting, reading, or watching TV was high; 96 (30.5 %) claimed they would never sleep off. A higher proportion of the respondents, 134 (42.5 %), stated that there was no chance of them dozing off while sitting quietly after lunch without alcohol, while 71 (22.5 %) claimed there was a slight chance. Most respondents, 295 (93.7 %), indicated no possibility of them dozing off in a car when stopped for a few minutes in traffic. Commercial Long Distance Drivers' likelihood of falling asleep using the Epworth Sleepiness Scale (ESS) shows that slightly more than two-thirds of the respondents, 213 (67.6 %), had an average ESS score while 67 (21.3 %) had an abnormal score (with a sleep disorder or sleep apnea), 35 (11.1 %) are on borderline or moderate and are at risk. Thus, over one-third had abnormal ESS.

Conclusion: Drivers Union should have peer group cooperation and enforcement of times off work and have adequate sleep and rest. Transport companies should provide drivers rest lodges and camps as part of occupational health services (OHS) available to all employed workers. Moreover, ensure drivers are on shift duty to support rest periods.

Keywords: Epworth Sleepiness Scale (ESS), Sleepiness, Fatigue, Long distance commercial drivers

Introduction

The movement of people from place to place is an essential aspect of humanity and survival **[1,2]**. Most people use vehicles on the road to transport themselves and their goods from place to place **[2,3]**. This needs for movement and safety when on the road necessitated the need for a global plan which started with the launch on 11th of May 2011 of the first-ever Decade of Action for Road Safety 2011–2020. This was followed in October 2021 by the declaration of the Decade of Action for Road Safety 2021-2030, with the lofty goal of preventing at least 50 % of all road traffic deaths and injuries by 2030 **[1,3,4]**. This global plan was developed by governments, WHO, and the UN regional commissions, in cooperation with other partners in the UN Road Safety Collaboration through a process facilitated by members of the United Nations Road Safety Collaboration, including the Commission for Global Road Safety, the Global Road Safety Partnership, the United Nations regional commissions, the World Health Organization and the World Bank. **[3,4,6,7]**. This was an effort to view the problem from a global perspective. This meeting-initiated road safety strategies and methods by reviewing standard and evidence-based techniques adopted by nations with existing road safety frameworks **[3,4,6,8]**. The Global Plan features five categories or "pillars "of activities to achieve its goal. **[3,4]** These include road safety management (Pillar 1); safer roads and mobility (Pillar 2); safer vehicles (Pillar 3); safer road users (Pillar 4); post-crash response (Pillar 5) **[3,4]**.

The importance of road users to road safety is enumerated in Pillar 4 **[3,8,9]**, which focuses on developing comprehensive programs to improve road user behavior. It includes activities like encouraging the development and adoption of model road safety legislation and

sustained or increased enforcement of road safety laws and standards, public awareness and education to increase seatbelt and helmet wearing, to reduce drinking and driving, reduce speeding, fatigue and Sleepiness and other risks **[7,8]**. This pillar is pivotal to road safety as human factors are responsible for most road traffic accidents and deaths. Human factors are responsible for 95 % of accidents investigated **[10,11,12]**. These human factors include fatigue, Sleepiness, inappropriate and excessive speed, the presence of alcohol, medicinal or recreational drugs, and poor eyesight of road users.

Sleepiness and fatigue are common causes of driver error and road accidents [1,13,14]. Some other human factors and morbidities affect drivers as they perform their duties. These documented morbidities include back pain (74.6 %), malaria fever (66.0 %), headache (63.8 %), Fever from other causes (52.7 %), fatigue (51.7 %), cough (43.5 %), cold and catarrh (42.9 %), others were neck pain (41.9 %), drunk on alcohol (24.8 %), visual problems (26.0 %), Hypertension (9.5 %), ear ache (8.9%), pneumonia (7.0 %), hemorrhoids (5.7 %), 15 (4.8 %) diabetes, penile discharge (9.2 %) **[15,16]**

Fatigue and Sleepiness occur commonly among drivers, especially those who commute long hours to meet set targets and schedules. Various tools are used to assess Sleepiness, like the Epworth sleepiness scale **[17,18,19,20,21]**. Studies 17 have shown that 28.2 % had at least mild sleep apnea by conventional criteria, and 4.7 % had severe sleep apnea **[17]**. This put about 30 % at risk of road traffic crashes, while 4.7 % were unfit to drive. Further studies **[18]** revealed that 17.1 % in the minimum category, 52 % in moderate, and 22.9 % were at high risk of falling asleep during driving. In New South Wales, Victoria, and Queensland, Australia **[19]**, long-distance road transport drivers were classified as showing a standard profile (82.1 % had a score of less than 10), 15.9 % showed a moderate risk of sleep disorders (score of between 11 and 15), and only 2 % had a high risk of sleep disorder (score of 16 or more). These results indicated that 2 % of the commercial drivers were unfit to drive and were likely to have a significant tendency to Sleepiness or a sleep disorder, thus should not drive. Certain factors affect driving since the driving tasks occur within a dynamic system influenced by the complex relationship between the driver (host), vehicle (agent), and external road environment (environment).

Sleepiness, fatigue, and other impairments in concentration and attention can lead to road mishaps, crashes, and death. Common causes of Road Traffic Accidents (RTA) were fatigue in 23.7 % and nodding off in 5.3 % **[19]** of long-distance drivers. Higher proportions have been reported **[22]**, as 67 % attributed the crash to fatigue, and 33 % said that the crash was related to sleep problems. This study seeks to use Epworth Sleepiness Scale to assess Sleepiness and fatigue among commercial long-distance drivers in Benin City, Edo state, Nigeria.

Materials and Methods

This study was conducted in 2015 in Benin City, the capital of Edo State. The city comprises three Local Government Areas: Oredo, Egor, and Ikpoba-Okha **[23,24]**. The total population of Benin City as of 2006 was one million, eighty-five thousand, six hundred and seventy-six (1,085,676) **[25,26]**. The inhabitants of Benin City are small to medium-scale business operators, and the city is known for carvings and bronze works. Other occupations include transport operators, farmers, artisans, civil servants, students, and bankers. The predominant religion is Christianity; others are Islam and Traditional African worshipers. The majority of the inhabitants are Bini-speaking. **[23,24]**

Benin City serves as a transit area, with four major highways linking the eastern part of Nigeria to the northern and western parts of Nigeria to the East. The highways include the Lagos-Benin express road, which connects Benin to the Western part of Nigeria; the Benin-Sapele Highway, which connects Benin to the Niger-Delta region, Benin- Asaba- Onitsha Highway, which connects Benin to the East, the Benin-Auchi-Okene highway which connects Benin to the Northern parts of Nigeria **[27,28]**. Commercial driving is a common occupation, and numerous commercial road transport operators in the city carry passengers to different states in Nigeria. There are over 1000 commercial long-distance drivers in Benin City. There are 88 commercial transport parks in Benin City. Fifty-two are privately owned, while 36 are government owned. Of these, 17 commercial transport parks are involved in commercial long-distance transportation, 14 are privately owned, and state governments own 3. These parks cater to the travel needs of passengers to and from Benin City **[28,29,30]**

A descriptive cross-sectional study design was used in conducting this study among commercial long-distance drivers in Benin City and their vehicles, driving a distance above 300km and a minimum of 4 hours continuously. Included were commercial long-distance drivers operating within any registered transport company/ park with vehicles conveying passengers; any Commercial long-distance driver driving a distance above 300km per day [20]. Moreover, any commercial long-distance driver continuously drives for a minimum of 4 hours [20]. The study excluded all commercial long-distance drivers who did not consent to participate in the study.

The minimum sample size for commercial long-distance drivers was calculated using Cochran's formula for minimum sample size determination in a cross-sectional study [31]. A minimum of 305 commercial long-distance drivers and their vehicles were recruited in the study using a systematic random sampling technique.

Data on commercial long-distance drivers' sleepiness use was done using Epworth Sleepiness Scale (ESS). Several studies have validated and used the ESS [18, 19, 20, 21]. It has been globally accepted as a method of assessing Sleepiness among respondents [20,21]. The Sleepiness of commercial drivers was assessed using the Epworth Sleepiness Scale (ESS) [17, 18,21]. This is a 7-item scale that measures Sleepiness during normal daily activities. It included questions like sitting and reading or watching TV, sitting, inactive in a public place (e.g., a meeting), as a passenger in a car for an hour without a break, lying down to rest in the afternoon when circumstances permit, sitting and talking to someone, sitting quietly after a lunch without alcohol in a car, while stopped for a few minutes in the traffic. After scoring, drivers are classified as normal, borderline, and abnormal.

The Epworth Sleepiness Scale (ESS) is an effective instrument for measuring average daytime Sleepiness. The ESS differentiates between average Sleepiness and excessive daytime Sleepiness that requires intervention. The client self-rates how likely he/she would doze in eight different situations. The scoring of the answers is 0-3, with 0 being "would never doze," 1 = slight chance of dozing, 2 = moderate chance of dozing, and 3 being "high chance of dozing." Score: 0-9 Normal range (respondent is getting enough sleep), 10-12 Borderline (average score), 13-21 Abnormal (Very sleepy, unfit, severe obstructive sleep apnea and should seek medical help) **[21]**. The researcher screened questionnaires for completeness, coded them, and entered them into the Statistical Package for Scientific Solutions (SPSS) version 21.0 software for analysis.

Ethical clearance to conduct this research was obtained from the University of Benin Teaching Hospital Research Ethics Committee. Permission to conduct this study was obtained from the Driving and Transport Department of the Transport Companies/ Parks, Edo State Ministry of Transport, and the National Union of Road Transport Workers (NURTW) in Benin City. Confidentiality and privacy were respected during the interview. Parks were identified by alphabet and respondents by serial numbers to ensure confidentiality. Respondents were informed that there were no penalties or loss of benefit for refusal to participate in the study or withdrawal from it. There was no risk of harm or injury to the participants during or after the study. The respondents with health risks were counseled and referred to the nearest health facility (with their test results) for appropriate treatment and management. At the same time, those with minor ailments were treated on the spot.

Result

Table 1: Number of hours commercial long-distance drivers sleep at night.

Number of hours	Frequency (n = 315)	Percent (%)
< 4	12	3.8
4 – 6 hours	201	63.8
>6 hours	102	32.4

A) Respondents' number of hours of sleep at night

Most drivers 201 (63.8 %) slept for 4-6 hours, 102 (32.4 %) slept for more than 6 hours at night, while 12 (3.8 %) slept for less than 4 hours a night.

Table 2: Drivers' likelihood of falling asleep using the Epworth Sleepiness Scale (ESS).

Situations (n = 315)	Likelihood of falling asleep			
	Never (0) n (%)	Slight (1) n(%)	Moderate (2) n(%)	High (3) n(%)
Sitting/reading/watching TV	96 (30.5)	74 (23.5)	44 (14.0)	101 (32.1)
Sitting inactive in a public place	146 (46.3)	69 (21.9)	24 (7.6)	76 (24.1)
As a passenger in a car for an hour without break	147 (46.7)	64 (20.3)	66 (20.9)	38 (12.1)
Lying down to rest in the afternoon	81 (25.7)	85 (27.0)	52 (16.5)	97 (30.8)
Sitting and talking to someone	277 (87.9)	18 (5.7)	20 (6.3)	0 (0.0)
Sitting quietly after lunch without alcohol	134 (42.5)	71 (22.5)	43 (13.7)	67 (21.3)
In a car, while stopped for a few minutes in the traffic	295 (93.7)	9 (2.9)	7 (2.2)	4 (1.3)

B) Commercial Long-Distance Drivers llikelihood of falling asleep using the Epworth Sleepiness Scale (ESS)

Less than a third of the respondents, 101 (32.1 %), stated that the chance of them dozing off while sitting, reading, or watching TV was high; 96 (30.5 %) claimed they would never sleep off.

A higher proportion of the respondents, 146 (46.3 %), mentioned that there was no chance of them sleeping off in a public place, while 76 (24.7 %) declared that it was high.

Nearly half of the respondents, 147 (46.7 %), stated that there was no chance of them falling asleep as a passenger in a car for an hour without a break, while 66 (20.9 %) claimed there was a moderate chance.

Less than a third of the respondents, 97 (30.8 %), stated that the chance of them dozing off while lying down to rest in the afternoon was high, while 81 (25.7 %) said there was no chance.

Most of the respondents, 277 (87.9 %), claimed that the chance of them sleeping off while sitting and talking to someone was zero, while 20 (6.3 %) felt there was a moderate chance.

A higher proportion of the respondents, 134 (42.5 %), stated that there was no chance of them dozing off while sitting quietly after lunch without alcohol, while 71 (22.5 %) claimed there was a slight chance.

The majority of the respondents, 295 (93.7 %), indicated no chance of them dozing off in a car when stopped for a few minutes in traffic.

Slightly more than two-thirds of the respondents, 213 (67.6 %), had an average ESS score, while 67 (21.3 %) had an abnormal score.

Table 3: Epworth sleepiness scale

Parameters	Frequency (n = 315)	Percent
Normal (0-10)	213	67.6
Borderline (11-12)	35	11.1
Abnormal (13-21) **	67	21.3
Total	**315**	**100.0**
** Unfit to drive		

In summary, the ESS score shows that slightly more than two-thirds of the respondents, 213 (67.6 %), had an average ESS score, while 67 (21.3 %) had an abnormal score (with a sleep disorder or sleep apnea), 35 (11.1 %) are on borderline or moderate and are at risk. Thus, over one-third had abnormal ESS.

Discussion

Assessment of Sleepiness and fatigue using the Epworth Sleepiness Scale showed that 21.3 % of the commercial long-distance had an abnormal score (currently experiencing excessive daytime sleepiness), more than two-thirds of the respondents had an average Epworth Sleepiness Score, and 11.1% had moderate scores. Drivers with abnormal ESS can be categorized as having severe obstructive sleep apnea and narcolepsy, which has profound implications for road safety. These categories of commercial long-distance drivers are not fit to drive. Sleepy drivers can veer off the road, lose vehicle control and cause severe accidents and avoidable deaths and injuries **[32,33,34]**. Studies have shown that a higher percentage of drivers who are unfit to drive have been involved in RTA **[2,5,7]**. This daytime sleepiness indicates a high risk for road traffic crashes **[13,14]**.

This Epworth Sleepiness Scale (ESS) score was a summation of the findings that a third of the respondents stated that the chance of sleeping off while sitting, reading, watching TV, and lying down to rest in the afternoon or in a public place was high. In addition, there was a moderate chance that 20.9 % of them would fall asleep as a passenger in a car for an hour without a break. The majority felt there was no chance of them sleeping off while sitting and talking to someone, in a car, while stopped for a few minutes in the traffic, or while sitting quietly after lunch without alcohol. This corresponds to findings from studies done in Iran **[35]**, where 52 % were moderate, and 22.9 % were at risk of falling asleep during driving. However, it contrasts with studies done at the University of Pennsylvania, Philadelphia, **[36]** USA, where lower percentages of 4.7 % and 28.7 % are abnormal and moderate, respectively. A study was done in three Australian cities, New South Wales, Victoria, and Queensland **[19]**, by the National Road Transport Commission, which indicated that 82.1% had average scores, 15.9 % moderate levels, and 2 % showed a high risk of sleep disorder, thus making them unfit to drive. A study in New South Wales, Australia **[20]** also reported that 5.8 % had a high risk of falling asleep while driving. This disparity may be explained by the fact that this study was a survey done by a nonregulatory authority (independent researcher). Thus, drivers may have been more truthful and expressed themselves freely compared with the latter studies **[17,19,20]**, which were done by regulatory bodies. Thus, drivers may give reports that are favorable to them for fear of penalty by the organizations, leading to lower proportions based on self-report. There were no laid down work schedules for the drivers in this study. Commercial driving is done for profit and business. Thus, drivers may be mandated to embark on trips based on passengers' availability rather than the maximum allowable trips. This situation leads to tiredness, fatigue, and sleepiness during driving due to overwork. Sleepiness reduces reaction time which is a critical element of safe driving. It also reduces vigilance, alertness, and concentration during driving **[37,38]**. The speed at which

information is processed is also reduced by sleepiness, thus affecting the quality of decision-making **[37,38]**. This phenomenon is not found in Western developed countries where drivers only embark on trips based on a regulated schedule; in the United Kingdom, there is a 10-hour driving limit in the Federal Highway Administration Hours-of-Service (HOS) regulations **[1]**, while Australia allows a maximum of 14 hours of driving in a workday, (including non-driving work). These regulations are designed to prevent drivers from driving unreasonably long periods and consequently falling asleep at the wheel **[19]**.

A limiting factor in this study was that the Epworth Sleepiness Scale score is a self-reported sleepiness scale; this may lead to response bias, that is, individuals with self-report sleepiness were more likely to respond to the survey. Despite the validity of both tools, they depend on the truthfulness of the participant, but explaining the benefits of providing this information often motivates the respondent to answer accurately **[30]**. This study did not find any association between those with a high risk of falling asleep while driving and the number of road traffic accidents.

Conclusion

Most drivers, 201 (63.8 %), slept for 4-6 hours, 102 (32.4 %) slept for more than 6 hours at night, and 12 (3.8 %) slept for less than 4 hours a night. Less than a third of the respondents, 101 (32.1%), stated that the chance of them dozing off while sitting, reading, or watching TV was high; 96 (30.5 %) claimed they would never sleep off. A higher proportion of the respondents, 134 (42.5 %), stated that there was no chance of them dozing off while sitting quietly after lunch without alcohol, while 71 (22.5 %) claimed there was a slight chance. The majority of the respondents, 295 (93.7 %), indicated no chance of them dozing off in a car when stopped for a few minutes in traffic.

Commercial Long Distance Drivers' likelihood of falling asleep using the Epworth Sleepiness Scale (ESS) shows that slightly more than two-thirds of the respondents, 213 (67.6 %), had an average ESS score while 67 (21.3 %) had an abnormal score (with a sleep disorder or sleep apnea), 35 (11.1 %) are on borderline or moderate and are at risk. Thus, over one-third had abnormal ESS.

Recommendation

The following recommendations are advanced based on the findings from this study.

To Commercial Long-Distance Drivers and Drivers Union

Drivers Union should have peer group cooperation, discussions, and advocacy on how best to ensure all members utilize their regular times off work and have adequate sleep and rest. It is recommended that the drivers' Union should organize health education and enlightenment program in collaboration with other transport stakeholders on the need for sleep, recreation, and rest periods. They can stop at specific bus stops to rest and have ergonomic breaks. Drivers should make personal and collective efforts to avoid driving when tired, make formal reports, and request to be given time off work to rest in cases of emergency.

Transport companies and parks

Transport companies should provide drivers rest lodges and camps as part of occupational health services (OHS) available to all employed workers. Moreover, ensure adequate driver communication on health and fatigue status. Initiate and ensure drivers are on shift duty to support rest periods. This is in fulfilment of the Target 11 of the global plan for the decade of action for road safety, which targets that by 2030, all countries are to enact regulations for driving time and rest periods for professional drivers and accede to international, regional regulation in this area **[3,4,39]**. The companies should ensure the approved transport schedule and driving hours are not exceeded to avoid fatigue and sleepiness.

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