Obstructive sleep apnoea risk and excessive daytime sleepiness among intercity commercial drivers in Benin City, Nigeria

A R Isara and A Q Aigbokhaode

Abstract

The objective of this descriptive cross-sectional study was to assess the prevalence of obstructive sleep apnoea (OSA) and excessive daytime sleepiness (EDS) risk among intercity commercial drivers in Benin City, Nigeria. The Berlin Questionnaire and Epworth Sleepiness Scale were administered to drivers recruited from six randomly selected motor parks. Weight, height, and blood pressure were also measured. Data were analysed using IBM SPSS statistics version 20. A total of 214 commercial drivers with mean age of 45.9±10.0 years participated in the study. Obesity was observed in 29.9% participants while 79 (36.9%) were hypertensive. More than one third (36.4%) reported to have been involved in a road traffic accident. Almost half (105, 49.1%) of participants were found to have some OSA risk while 98 (45.8%) had a risk of EDS. Both OSA (p=0.007) and EDS (p=0.010) were significantly associated with road traffic accidents. Self-reported hypertension was significantly associated with both OSA and EDS (p<0.001). A higher proportion of drivers with OSA risk reported EDS (p<0.001). The most significant predictors of road traffic accidents was EDS risk (OR 1.931, 95% CI 1.013–3.541, p=0.033) and self-reported hypertension (OR 2.963, 95% CI 1.113–7.880, p=0.030). There was a high risk of both OSA and EDS among intercity commercial drivers in Benin City, Nigeria. Urgent measures aimed at reducing the risk of OSA and EDS among drivers should be taken to reduce the rates of road traffic accidents on Nigerian roads.

Introduction

Road traffic accidents (RTAs) are a daily occurrence in Nigeria, accounting for the deaths of 12 persons per day, with about 80% of these deaths occurring on the highways and involving intercity passengers and drivers.[1] The majority of people in developing and low-income countries like Nigeria depend heavily on road transportation for commuting between cities and towns. This reliance on commercial drivers makes operators of commercial vehicles an important component in the development of any society.[2] Undiagnosed obstructive sleep apnoea (OSA) resulting in excessive daytime sleepiness (EDS) among vehicle drivers, is one of the most serious medical disorders liable to result in major road accidents.[3]

Studies have revealed that people at risk of OSA may also get sleepy during the day because they do not feel sufficiently restored after a night of interrupted sleep, which is quite common among long-distance drivers. The combined risk factors of OSA and EDS

A R Isara, Department of Community Health, University of Benin Teaching Hospital, Benin City, Nigeria and A Q Aigbokhaode, Department of Public Health, Federal Medical Centre, Asaba, Delta State, Nigeria. Correspondence to: Dr A R Isara, Department of Community Health, University of Benin Teaching Hospital, PMB 1111, Benin City, Nigeria. Email: mansaray2001@yahoo.com

Variable	Frequency (n= 214)	Percent
Age group (years)*		
25–34	25	11.7
35–44	84	39.3
45–54	56	26.1
55 and above	49	22.9
Level of education		
None	6	2.8
Primary	91	42.5
Secondary	101	47.2
Tertiary	16	7.5
Marital status		
Single	5	2.3
Cohabiting	21	9.8
Married	187	87.4
Separated	1	0.5
BMI		
≥30	64	29.9
<30	150	70.1
Hypertension		
Yes	79	36.9
No	135	63.1

*Mean age 45.9±10.0 years.

Table 1: Socio-demographic characteristics of respondents

have been documented and have been found by researchers to raise the risk of RTAs among drivers driving long distances without sufficient sleep.[4,5]

The most common symptoms of sleep apnoea include snoring, sleepiness, and spousal reports of apnoea episodes during sleep. Risk factors for OSA include being overweight, male, related to someone who has OSA, over the age of 65 years, being black or Hispanic and tobacco smoking.[6]

In many countries, research studies have documented an association between RTAs and undiagnosed OSA and EDS among drivers;[4,5] however in Nigeria there is a paucity of data with regards to the relationship between OSA, EDS and RTAs in long-distance drivers. Complaints of sleep disorders

Variable	Road traffic accidents		p value
	Yes Freq. (%)	No Freq. (%)	
Obstructive sleep apnoea risk			
Risk present	48 (45.7)	57 (54.3)	0.007
Risk absent	30 (27.5)	79 (72.5)	
Excessive daytime sleepiness			
Risk present	45 (45.9)	53 (54.1)	0.010
Risk absent	33 (28.5)	83 (71.5)	

Table 2: Association between obstructive sleep apnoea risk, excessive day time sleepiness and road traffic accidents among respondents

Variables	Obstructive sleep apnoea		p value	Excessive daytime sleepiness		p value
	Risk n (%)	No risk n (%)		Yes n (%)	No n (%)	
Age group						
25–34	8 (32.0)	17 (68.0)	**0.122**	6 (24.0)	19 (76.0)	**0.045**
35–44	38 (45.2)	46 (54.8)		46 (54.8)	38 (45.2)	
45–54	30 (53.6)	26 (46.4)		23 (41.1)	33 (58.9)	
55 and above	29 (59.2)	20 (40.8)		23 (46.9)	26 (53.1)	
BMI						
Underweight	0 (0.0)	1 (100.0)	**<0.001**	0 (0.0)	1(100.0)	0.596
Normal	20 (27.4)	53 (72.6)		30 (41.1)	43 (58.9)	
Overweight	31 (40.8)	45 (59.2)		38 (50.0)	38 (50.0)	
Obese	54 (84.4)	10 (15.6)		30 (46.9)	34 (53.1)	
Snoring						
Yes	86 (87.8)	12 (12.2)	**<0.001**	57 (58.2)	41 (41.8)	**0.001**
No	19 (16.4)	97 (83.6)		41 (35.3)	75 (64.7)	
Self-reported hypertension						
Yes	39 (83.0)	8 (17.0)	**<0.001**	32 (68.1)	15 (31.9)	**<0.001**
No	66 (39.5)	101 (60.5)		66 (39.5)	101 (60.5)	
Alcohol						
Yes	84 (52.2)	77 (47.8)	0.077	77 (47.8)	84 (52.2)	0.342
No	21 (39.6)	32 (60.4)		21 (39.6)	32 (60.4)	
Cigarette smoking						
Yes	24 (45.3)	29 (54.7)	0.317	25 (47.2)	28 (52.8)	0.874
No	81 (50.3)	80 (49.7)		73 (45.3)	88 (54.7)	
Kola nut*						
Yes	63 (53.4)	55 (46.6)	0.103	56 (47.5)	62 (52.8)	0.679
No	42 (43.8)	54 (56.2)		42 (43.8)	54 (56.2)	
OSA risk						
Yes	-	-	-	61 (58.1)	44 (41.9)	**<0.001**
No	-	-		37 (33.9)	72 (66.1)	

Table 3: Bivariate analysis of variables associated with obstructive sleep apnoea and excessive daytime sleepiness

among long-distance road drivers in Nigeria are largely undocumented. This non-availability of relevant data constrains the implementation of medical interventions for this causative factor of RTAs among long-distance drivers, a significant percentage of whom may be falling asleep while driving.

The objective of this study was to determine the prevalence of predictors of OSA and EDS among intercity, commercial long-distance drivers in Benin City, Nigeria. This will serve not only to provide a baseline for further studies in this area but also as a tool for the development of strategies and interventions aimed at reducing RTAs and prolonging the lives of drivers and passengers.

Factor	Odds ratio	p value	95% CI
Obesity	1.211	0.600	0.592–2.476
OSA risk	0.432	**0.019**	0.214–0.874
EDS risk	1.931	**0.033**	1.013–3.541
Self-reported hypertension	2.963	**0.030**	1.113–7.880

Table 4: Logistic regression model for the predictors of road traffic accidents among respondents

Materials and methods

Participants. This descriptive cross-sectional study was carried out in Benin City, Edo State, Nigeria. The city has a projected population of 1 085 676 and is made up of three Local Government Areas namely: Oredo, Egor, and Ikpoba-Okha.[7] The city is strategically located in the heart of Nigeria, with proximity to the west, east and north of the country, making it a major transportation link to many parts of the country. This makes commercial driving a major occupation and there are numerous commercial road transportation operators in the city.

Ethical approval to conduct this study was obtained from the University of Benin Teaching Hospital Ethics and Research Committee. Permission was also sought from the management of the transport companies involved. Written informed consent was obtained from each respondent before conducting interviews. Confidentiality and privacy of the respondents was ensured during the interviews.

The participants were intercity commercial drivers involved in long-distance transportation in Benin City. Only drivers in registered transport companies were included in the study. The sample size for the study was calculated using the formula for studying proportions.[8] Using an estimated EDS prevalence of 14.4% among drivers obtained from a previous study in Lagos, Nigeria,[9] and after correcting for non-response at a rate of 10%, the minimum sample size required for the study was 210. A cluster sampling technique was used to recruit drivers for this study. A list of the 35 registered transport companies operating in Benin City at the time of this study was obtained from the State Ministry of Transport; three companies were selected using a simple random sampling method from each of the three Local Government Areas that make up Benin City. Thus a total of nine transport companies were used for the study. All the drivers in the selected clusters who met the inclusion criteria were investigated.

Data collection. Data were collected using the validated Berlin Questionnaire[10] and the Epworth Sleepiness Scale validated for OSA risk profile.[11,12] The Berlin Questionnaire was used to identify subjects who were at high risk and low risk for OSA by identifying snoring behaviour, daytime sleepiness, obesity, and hypertension. The questionnaire was divided into three sections. A section was considered positive if there were two affirmative answers in either section 1 or 2, or one affirmative response in section 3. Individuals who had positive scores in two of the three sections were considered to be at risk for OSA.

An eight-question questionnaire was used to determine the level of the respondent's daytime sleepiness. The Epworth Sleepiness Scale is based on the assessment of the likelihood of the respondent falling asleep in certain situations commonly encountered in daily life. This was scored on a scale of increasing probability from 0 to three for the eight different situations that most people engage in during their daily lives, though not necessarily every day. The scores for the eight questions were added together to obtain a single number. A number in the 0–9 range was considered to be normal while a number in the 10–24 range indicated that expert medical advice should be sought because a score of 10 or higher indicates the patient is likely to have a sleep disorder such as OSA.

Anthropometric measurements. Bathroom weighing scales (Hana™) were used to measure the weights of the respondents. The weighing scales were zeroed and standardised daily. A standardised standiometer was used to measure height. When measuring the height, the participants were asked to stand erect with their feet together; heels, buttocks, shoulders, and occiput touching the meter rule behind, with eyes looking straight ahead. Body mass index (BMI) was derived from weights and heights and was then used to classify participants into: underweight (BMI<18.5), normal weight (BMI 18.5–24.9), overweight (BMI 25.0–29.9), and obese (BMI≥30), according to WHO guidelines.[13] Blood pressure (BP) was measured using a mercury Accosson's sphygmomanometer and was taken with the cuff covering about three-quarters of the left arm and over the brachial artery with the respondent in a sitting position. The BP measurement was done before and after the interviews and the average was recorded as the respondents' BP. An average systolic blood pressure of 140 mmHg and above and a diastolic pressure of 90 mmHg and above was regarded as hypertension as defined by the Joint National Committee on Hypertension (JNC) 7 classification.[14]

Data analysis. Data analysis was carried out using SPSS version 20.0 software (IBM Corp, Armonk, NY, USA). Qualitative data were summarised as proportions while continuous variables that were normal in distribution were expressed as means and standard deviation. The chi-square statistical test was used to test association between socio-demographic and OSA risk, EDS risk, and occurrence of RTAs. Variables that showed significant

association were fitted into the logistic regression model to determine statistically significant predictors of RTAs. The level of significance was set at a p value of less than 0.05.

Results

A total of 214 commercial drivers participated in this study. As shown in Table 1, their mean age was 45.9 (±10.0) years with a higher proportion (84, 39.3%) in the age group of 35–44 years. The majority of the drivers (89.7%) had either primary- or secondary-level education while 187 (87.4%) were married. Obesity was observed in 29.9% of the respondents while 79 (36.9%) were hypertensive. However, only 47 (22.0%) gave a history of self-reported hypertension.

More than one third (36.4%) of the respondents reported that they had been involved in an RTA while being the driver. Almost half (105, 49.1%) of respondents were found to be at risk of OSA while 98 (45.8%) were at risk of EDS. A higher proportion of obese respondents (54, 84.4%) had a risk of OSA compared with 51 (34.0%) of the non-obese respondents. This association was statistically significant ($p<0.001$). Table 2 shows that a statistically significant association was found between OSA risk and EDS risk and the reported incidence of RTAs among the respondents ($p=0.007$ and 0.010 respectively).

A further bivariate analysis of variables associated with OSA and EDS is shown in Table 3. There was no statistically significant association between age and OSA, but the older age groups reported more EDS and this was statistically significant ($p=0.045$). The risk of OSA was found to increase with increasing BMI of the respondents ($p<0.001$), however, no statistically significant association was found between BMI and EDS ($p=0.596$). Self-reported hypertension was significantly associated with both OSA and EDS ($p<0.001$). A higher proportion of respondents with OSA risk reported EDS and this was statistically significant ($p<0.001$). However, alcohol intake, cigarette smoking, and chewing of kola nut (a stimulant substance) were not statistically associated with both OSA and EDS.

Table 4 shows the logistic regression model for the predictors of RTAs among the respondents. The most significant predictors of RTAs among the respondents were EDS risk ($p=0.033$) and being hypertensive ($p=0.030$).

Discussion

This study showed a high risk of both OSA and EDS among intercity commercial drivers in Benin City, Nigeria, thus revealing a potentially huge public health challenge in Nigeria. The high prevalence of OSA in this study is comparable with previous studies in Lagos[9] and Ile-Ife,[15] all in south-west Nigeria, but the prevalence of EDS was far higher in this study than in both previous studies. A similar finding of high OSA and EDS has also been reported among drivers in Malaysia.[16]

The majority of the commercial drivers were aged between 35 and 54 years, and this represents the economically productive age group in Nigeria. Apart from increasing age being a risk factor for OSA, the fact that the drivers in this study were all males, with a greater proportion either overweight or obese, and with a history of hypertension, may have accounted for the high prevalence of OSA. This in turn probably explains the high prevalence of EDS, since OSA was found to be significantly associated with EDS. Over one third of the drivers had been involved in RTAs in this study, with the rate of RTA associated with OSA, EDS, and self-reported hypertension. The high prevalence of RTAs among the drivers was concerning. Although, we did not explore whether the RTAs were associated with fatalities, most RTAs in Nigeria are associated with injuries and fatalities, probably compounded by the lack of emergency ambulance services. Thus many drivers and passengers may be losing their lives from RTAs in Nigeria as a result of EDS among commercial drivers. A study of occupational drivers in Iraq revealed a high prevalence (40%) of poor sleep quality and one quarter of the drivers were reported to have records of RTAs.[17] Excessive sleepiness and likely sleep apnoea increase the risk of RTAs for occupational drivers. This is similar to our study in which OSA, EDS, and self-reported hypertension increased the likelihood of RTAs among the commercial drivers. It was observed that objective measurement of blood pressure revealed more drivers to be hypertensive than those who had self-reported as hypertensive. The reason for this may be either the drivers were truly not aware of their hypertensive status or they deliberately did not want to admit and report that they were hypertensive. Again this can jeopardise and compromise their health status.

In Nigeria, the majority of commercial drivers do not have enough rest and do not get a good night's sleep. Also, many of them use stimulant substances of various forms and types to keep awake while driving. This leads to poor sleep quality and excessive daytime tiredness, and poses a significant risk of cardiovascular conditions such as stroke, heart attack, heart failure, and cardiac rhythm disturbances – especially intermittent atrial fibrillation. Inadequate sleep is also associated with low work performance, poor personal relationships, and ultimately poor quality of life. The management of transport companies operating in Nigeria do not carry out medical examinations on their drivers before they are allowed to drive on the roads. In addition, there is poor regulation of the activities of drivers by government authorities leading to poor health outcomes and poor productivity on the part of the drivers and increased RTAs, resulting in avoidable morbidities and mortalities in both drivers and their passengers. Apart from the increase in the rate of RTAs, a large proportion of commercial drivers with OSA risk and EDS have remained undiagnosed, which poses a risk of increasing numbers of fatalities on Nigerian highways. This has serious implications for both the drivers, passengers, local communities, and the country at large.

In this study, we observed that almost one third of the respondents were obese. The sedentary lifestyle of the drivers coupled with an unhealthy diet and little or no physical exercise may have accounted for this finding. A similar finding of overweight and obesity among drivers was reported in the Lagos study.[9] Also, another study documented a strong correlation between BMI and the degree of OSA, and obese drivers are highly prone to be sleepy during the day.[18] Although being obese did not significantly predict RTAs in the regression model in this study, increasing BMI was significantly associated with OSA in the bivariate analysis. This finding underscores the need for commercial drivers to embark on weight reduction activities that will keep their BMI within an acceptable range and limit

complications that may arise from overweight and obesity.

In conclusion, this study showed that there was high risk of both OSA and EDS among intercity commercial drivers in Benin City, Nigeria. The burden of RTAs resulting from this finding is of serious public health concern. Therefore, urgent measures aimed at reducing the risk of OSA and EDS among drivers should be taken by government agencies to reduce the rates of RTAs on Nigerian roads. Transport companies should be made to carry out pre- employment screening of drivers for OSA and EDS risk before they are employed to drive.

Acknowledgements

We sincerely express our appreciation to the management of the transport companies and all the commercial drivers who participated in this study.

Author declaration

Competing interests: none.
Any ethical issues involving humans or animals: none.
Was informed consent required: yes.

References

1. Federal Road Safety Corps (FRSC). Federal Road Safety Annual Report. Abuja, Nigeria; 2006: 22– 67. Available at: www.frsc.gov.gov.ng.
2. Adofo MO-OG. Poor vision, refractive errors and barriers to treatment among commercial vehicle drivers in the Cape Coast municipality. *Afr Hlth Sci* 2011; 11 (1): 97–102.
3. Vaa T. Impairments, diseases, age and their relative risk of accident involvement: Results from a meta-analysis. Institute of Transport Economics, 2003. Oslo, Norway.
4. Philip P, Sagaspe P, Lagarde E, et al. Sleep disorders and accidental risk in a large group of regular registered highway drivers. *Sleep Med* 2010; 11 (10): 973–9.
5. Amra B, Dorali R, Mortazavi S, et al. Sleep apnea symptoms and accident risk factors in Persian commercial vehicle drivers. *Sleep Breath* 2012; 16 (1): 187–91.
6. Smith, M, Robinson L, Segal R. Sleep Apnea, Symptoms, Causes, Cures and Treatment Options, 2012. www.Helpguide.org.
7. National Population Commission of Nigeria. Population and Housing Census: Population Distribution by Age and Sex (State and Local Government Area). Abuja, Nigeria, 2006: 110–114. Available from: http://www.population.gov.ng/factssand figures 2006.
8. Cochrane WG. *Sampling Techniques*, 3rd Edition. New York: John Wiley and Sons, 1977.
9. Ozoh OB, Okubadejo NU, Akanbi MO, et al. High-risk of obstructive sleep apnea and excessive daytime sleepiness among commercial intra-city drivers in Lagos metropolis. *Niger Med J* 2013; 54 (4): 224–9.
10. Netzer NC, Stoohs RA, Netzer CM, et al. Using the Berlin Questionnaire to identify patients at risk for the sleep apnea syndrome. *Ann Intern Med* 1999; 131: 485–91.
11. Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. *Sleep* 1991; 14 (6): 540–5.
12. Johns MW. Sensitivity and specificity of the multiple sleep latency test (MSLT), the maintenance of wakefulness test and the Epworth Sleepiness Scale: failure of the MSLT as a gold standard. *J Sleep Res* 2000; 9 (1): 5–11.
13. World Health Organization. Obesity: preventing and managing the global epidemic. WHO, Geneva, 1997.
14. Chobanian AV, Bakris GL, Black HR, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC7). *JAMA* 2003; 289: 2560–72.
15. Obaseki DO, Erhabor GE, Obaseki JE, et al. Obstructive sleep apnea, excessive daytime sleepiness, and road traffic accidents among interstate commercial vehicle drivers in Nigeria. *J Resp Med* 2014. http://dx.doi.org/10.1155/2014/580264.
16. Wahida A, Ilhamah O, Suffian A, et al. Obstructive sleep apnea among commercial vehicle drivers in Malaysia: issues and initiatives. *Health* 2013; 5: 80–6. DOI: 10.4236/health.2013.58A2012.
17. Ebrahimi MH, Sadeghi M, Dehghani M, et al. Sleep habits and road traffic accident risk for Iranian occupational drivers. *Int J Occup Med Environ Health* 2015; 28 (2): 305–12.
18. Dagan Y, Doljansky JT, Green A, et al. Body mass index (BMI) as a first-line screening criterion for detection of excessive daytime sleepiness among professional drivers. *Traffic Inj Prev* 2006; 7 (1): 44–8.