Sleep habits, daytime sleepiness and working conditions in short-distance bus drivers

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Abstract

Purpose – Driving needs high levels of alertness. Increased somnolence is the most important negative influence to maintain proper watchfulness and vigilance. Drowsiness, working conditions and their affective impact must be taken into account to determine driving safety. The purpose of this paper is to assess excessive daytime sleepiness, sleep habits, quality of sleep, stress-related symptoms, and working conditions in a large sample of short-distance bus drivers in the city of Buenos Aires.

Design/methodology/approach – This was a cross-sectional study performed to evaluate sleep habits and obstructive apnea risk in short-distance bus drivers of the Metropolitan Area of Buenos Aires, Argentina. Questionnaires regarding anthropometric data, sleep habits, snoring, daytime sleepiness (Epworth Sleepiness Scale), quality of sleep (Pittsburgh Quality of Sleep Index, PQSI), working conditions and fatigue and anxiety related to work were administered to professional short-distance bus drivers ($n = 1023$).

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Findings – A prevalence of 34.6 percent of obesity and 80 percent of snoring was observed. Mean sleep time during workdays was 6.5 ± 0.1 h and bad sleep quality was reported by 54.6 percent of the subjects. Excessive daytime sleepiness had a prevalence of 48.8 percent and was independently associated with reduced sleep time, increased sleep debt, long time to wake up, snoring, and short resting time along the working day ($p < 0.05$).

Originality/value – Short-distance drivers in Buenos Aires, the largest urban area of Argentina, are a partially sleep-deprived, overweighted population, showing a high daytime somnolence, poor work-rest conditions and high levels of anxiety and fatigue. This association can be very harmful in view of the demanding working conditions considered.

Keywords Anxiety, Bus drivers, Daytime sleepiness, Sleep, Working conditions

Paper type Research paper

Introduction

Excessive daytime sleepiness, reduced number of sleep hours, shift work, excessive driving time, and the use of alcohol and other drugs are predictive factors of vehicle accidents. Souza *et al.* (2005) Short-distance bus drivers are exposed to a complex interaction of environmental factors including other vehicles, traffic lights, tight schedules, passenger's demands, and the complexity of ground transportation in large urban conglomerates (Diez *et al.,* 2011). Thus, a high level of alertness is required to accomplish bus drivers' task in an efficient and safe manner. For example, the response time in applying the brakes in an emergency is commonly impaired by sleepiness. Horne and Reyner (1999). In this regard, it has been reported that at the end of waking periods of 17-19 hours, performance levels were comparable to legally prescribed levels of alcohol intoxication (Williamson and Feyer, 2000).

In a previous study performed in Buenos Aires in a small sample of bus drivers, we reported an actigraphy-measured total sleep time of less than seven hours per day in 100 percent of the sample (Diez *et al.,* 2011). A recent study in a large sample of commercial drivers reported that the Epworth Sleepiness Scale (ESS) scores were related to accident risk (Howard *et al.,* 2004). Indeed, driver sleepiness is found typically in healthy people who experience insufficient sleep, and is not necessarily associated with the presence of sleep disorders (Philip *et al.,* 1996).

In addition, urban bus drivers suffer elevated health risks and exhibit high levels of medical disability and absenteeism that may be related to occupational stress (Evans, 1994). Symptoms of stress such as worry, irritation, and anxiety may result in cognitive interferences that impair performance as task demands increase (Kompier, 1996). Thus, in addition to sleep, fatigue and alertness, professional drivers' road traffic accidents should be approached from the standpoint of other human factors like stress-related psychological conditions (Taylor and Stress, 2006; Rey *et al.*, 2004).

Sleep (Blanco *et al.*, 2003) and mood (Andreoli *et al.*, 2009) disorders are prevalent in Latin America megacities. World population is progressively and heavily concentrating in urban areas, especially in megacities like Buenos Aires, with population larger than ten million. Buenos Aires is the third megacity in Latin America (behind Mexico City and São Paulo) and the 18th in the world, with a population over 14 million. Prevalence of excessive daytime sleepiness in bus drivers from megacities range from 4.7 percent (Tokyo, population 35 million) (Asaoka *et al.*, 2010) to 75.5 percent (Tehran, population 13.5 million) (Razmpa *et al.,* 2011). Information about sleep, stress, and working conditions of commercial bus drivers in Latin America megacities is scarce. Therefore, the aim of the present study was to assess excessive daytime sleepiness, sleep habits, quality of sleep, stress-related symptoms and working conditions in a large sample of short-distance bus drivers in the city of Buenos Aires.

Subjects and methods

Subjects

Licensed short-distance bus drivers were invited to participate in the study. They were all males and no age restriction was applied. Subjects were recruited by exponential non-discriminative chain-referral sampling through the delegates of the Union Tranviarios Automotor, the labor union representing most of the passenger transport workers in Argentina. The four geographical areas that comprise Buenos Aires metropolitan region were selected: Capital City, North, West and South suburbs. Approximately 8,000 professional drivers work on each region. After contacting the main delegates of each area, they recruited other delegates and drivers so as to fulfill a minimum quota of 200 subjects per region. Subjects were informed about the nature of the study, and their participation was voluntary and anonymous. There was no monetary incentive involved. The study was approved by the ethics committee of Universidad Austral, Buenos Aires.

Methods

The survey was conducted between January and April of 2008. Basic demographic data regarding age, height, weight, hypertension, and smoking habits were collected. Age was asked by categories, and then dichotomized ($>$ 40 years) for analysis. Hypertension was defined when the participants reported that they had received a medical diagnosis of hypertension. Body mass index (BMI) was calculated as weight/height^2.

Questions from a working paper of the International Labour Organization on occupational stress in commercial drivers (Kompier, 1996) and from a battery of self-administered questionnaires about shift work elements (Tucker and Knowles, 2008) were translated into Spanish and tested for comprehension. The working conditions questionnaire included questions regarding work and resting schedules: length of working week and working day, number and length of break periods, daily rest between two consecutive working days, regular or day-to-day assignments, continuous or split shifts, days off and weekends off. These questions were asked as: "Do normal hours of work exceed 40 hours per week? (Yes/No)" or "Does the normal working day exceed eight hours? (Yes/No)." The questionnaire about job-related symptoms of stress included questions regarding anxiety and fatigue at home or at work. These questions were asked as: "How often do you feel anxious or tense due to […]?" Each statement was quantified through a seven-point Likert scale, ranging from 1 = "never" to 7 = "always." The stressor was considered present when it was "usually," "almost always" or "always" perceived as contributing to the feelings of anxiety or fatigue.

Excessive daytime somnolence was measured using a previously validated Spanish version of the ESS (Chiner *et al.,* 1999). A score of >10 is considered abnormal (Johns, 1991). ESS is a widely accepted measure of excessive daytime somnolence and it was previously used for its assessment in commercial drivers (Vennelle *et al.,* 2010). Sleep quality was measured using a Spanish version of the Pittsburgh Sleep Quality Index (PSQI) (Escobar-Cordoba and Eslava-Schmalbach, 2005) where a score of >5 is associated with bad sleep quality (Buysse *et al.,* 1989) PSQI is a widely accepted measure of sleep quality and it was previously used for its assessment in commercial drivers (Braeckman *et al.,* 2011). An insufficient sleep syndrome was defined when the difference between the number of hours slept on the weekends and the number of hours slept on weekdays was more than two hours.

Statistical analysis
A descriptive statistical analysis was performed. Numerical variables are expressed as mean±SEM and categorical variables are expressed as frequency (percent). Differences between normal and abnormal values of ESS for numerical variables were assessed by means of an independent-samples *t*-tests. Categorical variables were compared by means of a χ^2 test. A multivariate binary logistic regression analysis was used to determine the independent factors that were associated with daytime sleepiness. Variables to be included in the model were selected by univariate analyses and subsequently selected in a stepwise forward conditional manner with an entry significance level of 0.05 and a removal significance level of 0.10. Statistical analysis was performed with SPSS 15.0 software. $p < 0.05$ was considered as statistically significant.

Results

A total of 1,023 subjects completed the survey (278 subjects from Capital City, 207 from North, 277 from West, and 261 from South suburbs). Based on delegate reports, the estimated response rate for each region was 90 percent.

The ESS was answered by 908 (88.7 percent) subjects, with a prevalence of 48.8 percent of excessive sleepiness (ESS > 10). Subjects' demographic characteristics are summarized in Table I. For the sample as a whole, a prevalence of 34.6 percent of obesity, 23.5 percent of hypertension and 49 percent of smoking habit was observed. Higher ESS values were associated with higher cigarette consumption during weekdays, and higher prevalence of hypertension (Table I).

Sleep data are shown in Tables II and III. PQSI questionnaire was answered accurately by 443 (43 percent) subjects. Excessive sleepiness was associated with higher values of PSQI and higher rates of snoring, sleep debt and insufficient sleep syndrome (Table II). Also, abnormal ESS was associated with higher values of sleep time, desired sleep time, sleep debt, and time to wake up during weekdays, as well as with desired sleep time and time to wake up during off days (Table III).

Working conditions and stress-related symptoms are depicted in Tables IV and V. Drowsy drivers reported worse working conditions (Tables IV), and higher rates of anxiety and fatigue related to work (Table V), than drivers with lower ESS values.

Table VI summarizes the characteristics of the subjects with daytime sleepiness. The results of the model (28.9 percent of the subjects included) explained 26 percent of

	ESS Low	ESS High	Total
Age > 40 years	281 (52.6%)	180 (48.6%)	461 (51.0%)
BMI (kg/m^2)	28.8 ± 0.2	29.1 ± 0.3	28.9 ± 0.2
BMI > 25	426 (81.3%)	294 (80.5%)	720 (81.0%)
BMI > 30	172 (32.8%)	122 (33.4%)	294 (33.1%)
Seniority in transport (years)	16.5 ± 0.3	16.17 ± 0.4	16.3 ± 0.2
Seniority in bus driving (years)	16.3 ± 0.3	15.59 ± 0.4	16.0 ± 0.2
Hypertension	106 (20.5%)	100 (28.8%) *	206 (23.8%)
Smoking habit (%)	244 (46.1%)	194 (52.2%)	438 (48.6%)
Smoking weekdays (cigarettes)	16.1 ± 0.6	18. 7 ± 0.8 *	17.2 ± 0.5
Smoking off days (cigarettes)	12.7 ± 0.5	13.6 ± 0.8	13.1 ± 0.5

Notes: ESS, Epworth Sleepiness Scale; BMI, Body Mass Index. Values expressed as mean±SEM or frequency (%). *$p < 0.05$

Table I. Demographic characteristics and excessive daytime somnolence the variance. Daytime sleepiness was associated with long working journeys, poor quality of sleep, long time to wake up, and high difference between sleep during days off and sleep during weekdays. A second model was built due to the relatively low number of complete responses in the PSQI. Excluding the latter, the model included the 58.9 percent of the subjects and explained 13 percent of the variance. Daytime sleepiness was associated with reduced sleep time and increased sleep debt during weekdays, long time to wake up, snoring, and short resting time along the working day.

Discussion

The main finding in this survey is the high prevalence of excessive daytime sleepiness and its association with poor sleep quality, snoring, bad working conditions and high rates of fatigue and anxiety among bus drivers working at Buenos Aires.

More than 80 percent of the subjects were overweight or obese, far from the 50 percent prevalence value of the Argentine general population (Ferrante and Virgolini, 2007). Short sleep duration is associated with an increase in future weight gain and incident obesity, as reported in a study that followed 68,000 women during 16 years (Patel *et al.,* 2006). In addition, it is known that increased weight is a risk factor for obstructive sleep apnea (Young *et al.,* 2002). Poor sleep quality, as measured by the PSQI was present in 54.6 percent of the subjects. Several factors could account for this observation, including short sleep at night during workdays or the high prevalence of overweight and obesity (Young *et al.,* 2002). Short sleep time during weekdays was partially compensated during days off, with an important sleep debt (higher than 2 h) in 55 percent of the subjects. Indeed, early evening bedtime is difficult to achieve possibly due to tight work schedules or subject's lifestyle (Diez *et al.,* 2011).

Prevalence of excessive daytime sleepiness (ESS > 10) was more than threefold higher than general population of other major Latin-American cities, (Bouscoulet *et al.*, 2008) with near half of the sample showing pathological values. Also, excessive daytime sleepiness was studied in bus drivers from other countries. The prevalence of excessive daytime sleepiness was 75.5 percent in Tehran (Razmpa *et al.,* 2011). A lower prevalence of EDS was found in a sample of Australian commercial drivers (12.2 percent) (27) and Japanese public transportation drivers (4.7 percent) (Asaoka *et al.,* 2010). In Brazil, 68 percent of the bus drivers from the city of Brasilia and 41 percent of the bus drivers from the city of Florianopolis had ESS scores > 10 (Santos *et al.,* 2013). In Perú, excessive daytime sleepiness was present in 33 percent of the bus drivers from the city of Lima (Risco *et al.,* 2013). Thus, our results are comparable to some other cities of South America, where working conditions may be similar (Risco *et al.,* 2013).

Table II. Sleep quality and excessive daytime somnolence

	ESS Low	ESS High	Total
Sleep time days off – Sleep time weekdays	1.78 ± 0.09	2.57 ± 0.11**	2.11 ± 0.07
Insufficient sleep syndrome	172 (33.2%)	189 (51.5%)**	361 (40.8%)
PQSI	5.19 ± 0.22	8.58 ± 0.28**	6.66 ± 0.19
PSQI > 5	94 (39.2%)	140 (76.1%)**	234 (55.2%)
Snoring	364 (76.0%)	301 (87.2%)**	665 (80.7%)

Notes: ESS, Epworth Sleepiness Scale; PSQI, Pittsburgh Sleep Quality Index; Insufficient sleep syndrome, Sleep time days off – sleep time weekdays > 2 hours. Values expressed as mean ± SEM or frequencies (percentages). $^{**}p < 0.001$

Table III. Sleep habits and excessive daytime somnolence

	Sleep on weekdays			Sleep on days off		
	ESS Low	ESS High	Total	ESS Low	ESS High	Total
Sleep time (hours)	6.8 ± 0.1	6.2 ± 0.1**	6.5 ± 0.1	8.6 ± 0.1	8.7 ± 0.1	8.6 ± 0.1
Sleep desired (hours)	8.2 ± 0.1	8.4 ± 0.1*	8.3 ± 0.1	8.7 ± 0.1	9.1 ± 0.1*	8.7 ± 0.1
Sleep debt (hours)	1.4 ± 0.1	2.2 ± 0.1**	1.8 ± 0.1	0.1 ± 0.1	0.3 ± 0.1	0.2 ± 0.1
Sleep latency (minutes)	30.4 ± 1.2	32.8 ± 1.3	31.4 ± 0.9	26.9 ± 1.0	28.3 ± 1.2	27.5 ± 0.8
Time to wake up (minutes)	19.1 ± 0.6	25.7 ± 1.3 **	22.0 ± 0.7	16.2 ± 0.6	20.1 ± 0.8**	17.8 ± 0.5
Number of naps	1.5 ± 0.1	1.4 ± 0.1	1.5 ± 0.1	1.5 ± 0.1	1.5 ± 0.1	1.5 ± 0.1
Nap duration (hours)	2.0 ± 0.1	1.9 ± 0.1	1.2 ± 0.1	2.1 ± 0.1	2.2 ± 0.1	2.1 ± 0.1

Notes: ESS, Epworth Sleepiness Scale. Values expressed as mean±SEM. $*p < 0.05$; $**p < 0.001$

	ESS ⩽ 10	ESS > 10	Total
Work more than 5 days	463 (86.9%)	325 (87.6%)	788 (82.7%)
Work more than 40 hours a week	450 (84.6%)	331 (89.0%)	781 (86.4%)
Work more than 10hr/day (if the schedule is not fixed)	269 (52.6%)	241 (66.0%)**	510 (58.2%)
More than 4 hours of continuous driving	114 (27.1%)	152 (41.1%)**	296 (32.9%)
20 min break every 2 hours	225 (42.9%)	111 (30.7%)**	336 (37.9%)
Rest of 11 consecutive hours between 2 working days	409 (78.2%)	251 (69.1%)*	660 (74.5%)
Travel unsafely according schedule	418 (79.2%)	342 (92.7%)**	760 (84.7%)
Travel illegally according schedule	452 (85.3%)	346 (93.5%)**	798 (88.7%)
Work rotating shifts	261 (49.5%)	185 (50.4%)	446 (49.9%)
Schedule fixed monthly	252 (52.5%)	144 (43.6%)*	396 (48.9%)
Days off guaranteed	466 (87.8%)	284 (77.2%)**	750 (83.4%)
Two days straight free	290 (55.0%)	170 (45.9%)*	460 (51.3%)

Notes: ESS, Epworth Sleepiness Scale. Values expressed as frequencies (percentages). *$p < 0.05$; **$p < 0.001$

Table IV. ESS and working conditions

	ESS ⩽ 10	ESS > 10	Total
Anxiety at home	179 (35.0%)	180 (50.0%)	359 (41.2%)
Anxiety at work	194 (37.7%)	215 (59.4%)	409 (46.6%)
Anxiety at the beginning of work	104 (22.1%)	120 (35.9%)	224 (27.9%)
Anxiety after work	267 (53.1%)	261 (72.1%)	528 (61.0%)
Anxiety due to task duration	235 (45.9%)	254 (69.6%)	489 (55.8%)
Anxiety due to trip duration	245 (48.0%)	250 (67.9%)	495 (56.4%)
Anxiety due to route type	224 (45.3%)	257 (71.8%)	481 (56.5%)
Anxiety due to lack of sleep	124 (24.8%)	180 (49.7%)	304 (35.3%)
Anxiety due to traffic	405 (79.9%)	327 (89.1%)	732 (83.8%)
Physical fatigue at home	232 (44.4%)	236 (63.8%)	468 (52.4%)
Mental fatigue at home	235 (45.4%)	253 (68.9%)	488 (55.1%)
Physical fatigue at work	199 (38.3%)	225 (61.5%)	424 (47.9%)
Mental fatigue at work	231 (44.0%)	237 (64.4%)	468 (52.4%)
Fatigue at the beginning of work	84 (17.9%)	114 (33.2%)	198 (24.4%)
Fatigue after work	325 (63.2%)	310 (84.5%)	635 (72.1%)
Fatigue related to task duration	233 (46.9%)	256 (70.1%)	489 (56.7%)
Fatigue related to duration of the route	244 (49.7%)	249 (69.0%)	493 (57.9%)
Fatigue related to lack of sleep	118 (24.4%)	187 (52.1%)	305 (36.2%)
Fatigue related to the traffic	382 (77.8%)	322 (89.0%)	704 (82.5%)

Notes: ESS, Epworth Sleepiness Scale. [a]All variables $p < 0.001$. Values expressed as frequencies (percentages)

Table V. Stress-related symptoms and excessive daytime somnolence

As expected, excessive daytime sleepiness was significantly associated with measures of sleep quantity and sleep quality. Excessive daytime sleepiness is considered an essential feature of behaviorally induced insufficient sleep syndrome and is commonly caused by disturbance of sleep quality, sleep quantity or other contributors (Slater and Steier, 2012). In this regard, drivers with excessive daytime sleepiness were found to drive more, restless, and took more risks than drivers without excessive daytime sleepiness, supporting an increase in accident risk (Souza *et al.,* 2005; Howard *et al.*, 2004;

Folkard, 1997; Hamelin, 1987; Noce *et al.*, 2008). Also, snoring and excessive daytime sleepiness were associated in our study. It must be noted that excessive daytime sleepiness was reported by as low as 17 percent of the subjects with sleep-disordered breathing (Young *et al.,* 1993). Although sleep fragmentation due to sleep-disordered breathing is common in subjects with obesity, ESS was not associated with BMI in our sample. Lastly, drowsy drivers had higher rates of anxiety and fatigue either at home or at work. Stress and anxiety are prevalent among bus drivers (Evans, 1994). These symptoms may be linked with impaired sleep quality by some kind of "hyperarousal" underlying the pathophysiology of insomnia (Buysse *et al.*, 2008) which in turn may explain excessive daytime sleepiness.

The multivariate regression model showed an independent relation between excessive daytime sleepiness and snoring, extended working shift, short rest during work, poor sleep quality, short sleep, sleep debt and increased time for wake up, and increased sleep time during days off as compared with weekdays. Among these, the extended shift and snoring were recognized as independent predictors of excessive daytime sleepiness in other studies performed in professional drivers (Risco *et al.*, 2013; de Pinho *et al.*, 2006). Although the study performed at Lima (Risco *et al.*, 2013) also recognized anxiety as an independent risk factor, in our work stress-related symptoms were not multivariate predictors of sleepiness.

A limitation of the present study may be a certain response bias in relation to a potential improvement in working conditions if subjects reported poor sleeping conditions or excessive daytime sleepiness. While this bias may inflate prevalence rates, it should not affect the reported statistical associations between variables. Another limitation is that the validation of questionnaires does not take into account cultural differences that may led to untended results, like the acceptability of daytime napping. Finally, we were unable to demonstrate the impact of sleep decrements on driver and public safety, as questions regarding safety or accidents were not included.

Further studies are needed to assess the impact that sleep disruption and working conditions have in accident rates in a megacity like Buenos Aires. However, the reported associations point out that bus drivers work embedded in a complex of interacting stressors that are related to excessive daytime sleepiness. Restrictive policies over extended shifts and improvement of working conditions, early detection and treatment of sleep disorders, and educational campaigns that emphasize the importance of sleep

	OR	95% CI	*p*
Number of cases included 296 (28.9%)[a]			
Work more than 10hr/day	1.91	1.63-2.18	0.018
Rest of 11 consecutive hours between 2 working days	1.96	1.63-2.28	0.039
Pittsburgh Quality of Sleep Index	1.24	1.20-1.28	< 0.001
Sleep time (weekdays) – sleep time (days off)	1.18	1.12-1.25	0.011
Number of cases included 603 (58.9%)[b]			
20 min break every 2 hours	0.65	0.45-0.83	0.019
Sleep time (weekdays)	0.85	0.77-0.93	0.039
Sleep debt (weekdays)	1.23	1.16-1.31	0.005
Time to wake up (weekdays)	1.01	1.01-1.02	0.019
Snoring	1.63	1.39-1.86	0.036

Notes: OR, to odds ratio; CI, confidence interval. [a]Nagelkerke $R^2 = 0.261$; [b]Nagelkerke $R^2 = 0.135$

Table VI. Factors associated with daytime sleepiness: a multivariable binary logistic regression model should be considered as part of a systems-based approach to improve driver's health and public safety

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