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Association of Sleep Habits With Accidents and Near Misses in United States Transportation Operators

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Abstract

Objective—To explore sleep risk factors and their association with adverse events in transportation operators.

Methods—Self-reported sleep-related behaviors were analyzed in transportation operators (drivers, pilots, and rail operators) aged 26 to 78 years who completed the National Sleep Foundation's 2012 "Planes, Trains, Automobiles, and Sleep" survey. Regression analyses were used to assess the associations of various sleep-related variables with the combined outcome of self-reported accidents and near misses.

Results—Age- and body mass–adjusted predictors of accidents/near misses included an accident while commuting (odds ratio [OR] = 4.6; confidence interval [CI], 2.1 to 9.8), driving drowsy (OR = 4.1; CI, 2.5 to 6.7), and Sheehan Disability Scale score greater than 15 (OR = 3.5; CI, 2.2 to 5.5). Sleeping more than 7 hours nightly was protective for accident/near misses (OR = 0.6; CI, 0.4 to 0.9).

Conclusion—Recognized risk factors for poor sleep or excessive daytime sleepiness were significantly associated with self-reported near misses and/or accidents in transportation operators.

Excessive daytime sleepiness (EDS) is considered to be a major causal factor in transportation-related accidents. Roughly 16% to 20% of all traffic accidents and 29% to 50% of deaths and serious injuries related to motor vehicles are thought to be associated with driver sleepiness.[1,2] Sleep deprivation is known to impair vigilance and reaction time similar to having an elevated blood alcohol concentration.[2–4] Excessive daytime sleepiness

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has been reported to be common in trucking. Hakkanen and Summala[5] reported that 40% of long-haul truck drivers had problems in staying alert on at least 20% of their rides and that more than 20% of the truck drivers reported falling asleep at least twice while driving. The dangers associated with sleepiness and vehicle operation also pertain to other modes of transportation, including flying and train operation, because they require a similar degree of vigilance and acceptable reaction time.[4,6,7]

Despite the clear danger associated with motor vehicle operation and sleepiness, a large percentage of the population does not obtain adequate sleep.[8] The 2010 National Health Interview Survey found that 30% of employed US adults (roughly 41 million workers) reported an average sleep duration of 6 or fewer hours per day. An even higher prevalence of short sleep (70%) was reported among night-shift workers in transportation.[9]

Although the epidemic of inadequate sleep maybe largely explained by the competing demands of busy work, social and family schedules, multiple other risk factors are also known to affect the quantity and quality of sleep. These risk factors include sleep disorders (eg, obstructive sleep apnea [OSA], idiopathic insomnia, and narcolepsy) shift work (eg, rotating or night shifts), jet lag and other circadian factors (time of day), physical and medical conditions (eg, obesity, diabetes, and depression), social problems, and mental health and substance abuse issues.[3,5,10–15]

The National Sleep Foundation conducts an annual cross-sectional Sleep in America® Poll to explore various topics related to sleep. The 2012 survey “Planes, Trains, Automobiles, and Sleep” focused on transportation professionals and sleep. This study analyzed data collected from the 2012 Sleep in America® Poll to examine sleep-related risk factors and their potential associations with the occurrence of near-miss incidents and/or accidents during transportation operations. We hypothesized that various risk factors and markers for EDS are associated with an increased risk of self-reported near-miss incidents/accidents in transportation workers after controlling for age and body mass index (BMI).

METHODS

Survey Methodology

The 2012 “Planes, Trains, Automobiles, and Sleep” survey was conducted by WB&A Market Research on behalf of the National Sleep Foundation. It included pilots, truck drivers, rail transportation workers, as well as bus, taxi, and limo drivers who were at least 26 years of age.[16] To our knowledge, this was the first national survey of various transportation professionals and their sleep habits and work performance.

The survey population was a randomly collected sample recruited through online marketing programs in such a fashion that it was assumed to be representative of each population of transportation professionals. Specifically, potential survey respondents were recruited through “E-Rewards” panels. Marketing companies form these panels by sending e-mails to members of various consumer loyalty programs (store credit card holders, hotel points members, airline frequent fliers, etc), inviting them to participate and gain additional loyalty points as rewards. If these consumers opt in to participate through the e-mail invitations, they then complete a series of demographic questions online, which subsequently allows them to be invited for specific future online surveys targeting various groups of interest. Each time these E-rewards panelists participate in a survey, they receive a “thank you” gift reward that is determined by the survey length, interest, complexity, and the topical expertise of the respondent. These rewards are typically redeemable as points in one of the loyalty programs (eg, points toward gift cards, hotel points, airline frequent flier miles, etc).

The eligible target population for the 2012 “Planes, Trains, Automobiles, and Sleep” survey was created by randomly inviting US residents belonging to a wide network of more than 300 diverse commercial brand loyalty programs who were identified as members of one of the transportation professions of interest. In addition, targeted Web site advertising was used. The goal was to recruit 200 pilots, 200 truck drivers, 200 rail transportation workers, and 200 bus/taxi/limo drivers for a total of 800 transportation operators.

For the Planes, Trains, Automobiles, and Sleep survey, respondents received the equivalent of about 7 US dollars in “E-Rewards” currency that they could redeem along with rewards from other surveys for gift cards, hotel points, airline miles, etc. Potential participants were informed that the questions regarded the “annual *Sleep in America* poll, a survey about sleep among people in America, on behalf of the National Sleep Foundation” and that their identity would be kept strictly anonymous.

The survey methodology included several safeguards to ensure that anyone accepting an online invitation was actually the desired participant and a transportation operator meeting the inclusion criteria. First, the survey required participants to log in. Second, they were required to reconfirm appropriate demographic information. Third, they were asked further screening questions regarding transportation work, and if their answers were not consistent with the inclusion criteria, the survey terminated automatically.

Survey data were not age- or ethnicity-weighted, because there was no reliable census data available for the selected transportation professions.[17] For the present study, de-identified survey data were obtained from the National Sleep Foundation. Institutional review board approval was not required to conduct or publish the results of a poll without any individual-identifying information conducted by the National Sleep Foundation, which is a nonprofit independent organization. Secondary use of de-identified data collected from the survey is also, therefore, exempt from human subjects review.

Questionnaire

The complete contents of the survey tool are publically available online through the National Sleep Foundation’s Web site at the end of a document regarding the 2012 poll (http://www.sleepfoundation.org/sites/default/files/2012%20Sleep%20in%20America%20Poll-%20Summary%20of%20Findings.pdf). The survey was designed to examine sleep disorders and how sleep affected various aspects of transportation workers lives. Demographic information included age, sex, race, ethnic identity, marital status, and location of residence. Using questions regarding job duties, respondents were categorized as pilots, truck drivers, rail transportation workers, or bus, taxi and limo drivers.

Sleep Questions

Respondents were asked about their normal sleep schedule during the past 2 weeks, including their bedtime routine and naps. Total sleep time was determined as the reported number of hours actually slept at night (between 6 PM and 8 AM) and during the daytime (between 8 AM and 6 PM) during both workdays and nonworkdays. They were also asked about typical sleep latency with responses given in 5-minute increments, that is, less than 5 minutes, 5 to 10 minutes, etc. Answers for sleep latency were then categorized into two separate dichotomous variables: short sleep latency—less than 5 minutes or greater than 5 minutes; and prolonged sleep latency—greater than 30 minutes or less than 30 minutes.

Measures of Daytime Sleepiness and Impact of Poor Sleep on Social Function

Modified versions of the Epworth Sleepiness Scale (ESS), and Sheehan Disability Scale (SDS) were embedded within the larger survey.[18,19] The ESS is a brief self-report instrument designed to identify persons with EDS either due to lifestyle circumstances (eg, chronic sleep deprivation based on work or social schedules) or a sleep disorder.[15,18] On the ESS, an individual self-rates his or her average likelihood of falling asleep (from 0 [no chance of dozing] to 3 [high chance of dozing]) during eight different commonly encountered situations (eg, watching television or sitting and talking to someone). A total score greater than 10 indicates probable EDS. This survey slightly modified the ESS by asking how often participants fell asleep in these situations on a weekly basis.

The SDS is another widely used instrument, which assesses social impairment due to particular symptoms or problems.[19] For the present study, participants were asked: “On a typical day, how much of an impact did ‘not getting adequate sleep’ have on the following?” Respondents then rated the impact as “major impact”; “some impact”; or “no impact”; “not applicable” or “don’t know” (missing) on the following five domains: work, social life/ leisure, family life/household responsibilities, mood, and intimate/sexual relations. For each domain, impacts were scored as major impact (10 points), some impact (5 points), no impact (1 point), or not applicable (0 points).

On the basis of standard scoring, an ESS greater than 10 was considered to indicate EDS. Concerning the SDS, a total score was derived from the sum of the scores on the three original Sheehan Disability domains (work/school, social life, and family life/home). A total of 0 represents no impairment, and 30 someone who is highly impaired. We set a cutoff of more than 15 to capture those with more than modest impairment in more than one domain.

In addition, respondents were also asked about the number of times in the last 2 weeks they had used caffeinated beverages (eg, Coke, Pepsi, Mountain Dew, and coffee or iced tea) specifically to help stay awake or alert at work, rather than caffeine use in general. They were separately asked a similar question regarding other stimulants (eg, nicotine/tobacco, prescription medications, etc) used specifically to stay awake at work. Responses to both questions were separately collapsed and dichotomously coded to reflect respondents who used caffeine or other stimulants, respectively, to help stay awake or alert at work compared with respondents who did not report this specific type of use.

Health Questions

Respondents were asked to provide their height and weight. Body mass index was calculated from self-reported weight and height responses. Participants were also asked whether they had ever been diagnosed with a sleep disorder. Affirmative answers prompted further questions about what type(s) of sleep disorder had been diagnosed (OSA, shiftwork sleep disorder, insomnia, or other). They were also asked about their history of snoring. This was re-characterized into a dichotomous variable (snore vs never snore).

Outcome Measure

The outcome variable consisted of self-reported accidents and/or near miss accidents at work. For this study, the outcome was positive if participants responded affirmatively to at least one of the following questions: "Have you ever experienced any of the following incidents at work because of sleepiness?"—"Had an accident" (yes/no), or "Had a near miss" (yes/no). Participants were not provided with any definitions, specifications, or qualifiers of accident or near miss within the survey instrument for these outcome questions.

Statistical Analyses

Self-reported near-miss incidents and accidents were assessed as a combined outcome variable because of the low number of reported accidents. The following variables were analyzed for statistical association with the combined outcome of interest: age, snoring, marital status, history of driving drowsy, physician-diagnosed sleep disorder, sleep duration of less than 7 hours (workdays/nonworkdays), abnormal sleep latency (less than 5 minutes, more than 30 minutes), ESS greater than 10, SDS greater than 15, caffeine use to stay awake at work, stimulant use to stay awake at work, history of accident while commuting, naps during workdays, exercise after work, and obesity.

Baseline characteristics were described using the mean (SD) in the case of continuous variables and the frequency (number and percentage) for categorical variables. Logistic regression models were used to calculate odds ratios and to adjust for covariates. A final regression model describing the independent association among exposure variables and the combined outcome of near-miss incidents and/or accidents was constructed using a backward elimination process. Associations with $P < 0.05$ were the criterion for keeping each variable in the model. Variables included in this model were age, sex, physician-diagnosed sleep disorder, sleep duration of less than 7 hours during workdays, caffeine use to stay awake at work, stimulant use to stay awake at work, history of driving drowsy, history of accident commuting, SDS of 15, BMI more than 30 kg/m^2, napping during work, and exercise after work. Goodness-of-fit was evaluated by the Hosmer-Lemeshow test.

Analyses were performed using SAS 9.3 (SAS Institute Inc, Cary, NC) and the Statistical Package for Social Sciences version 20. All tests presented are two-sided, and $P < 0.05$ was considered significant.

RESULTS

Self-reported demographic, employment, and basic sleep characteristics of the sample are summarized in Table 1. More than 80% of participants were male and white. Their age ranged from 26 to 78 years, with a mean age of 49.5 years (SD = 10.7). The median BMI was 33.7 kg/m^2 with a 41% overall prevalence of obesity (BMI more than or equal to 30 kg/m^2). As a group, pilots were leaner than those in the other occupations, with only 20% reporting obesity. Study participants were equally distributed among the four different US geographic regions delineated by the United States Census Bureau (Northeast, South, Midwest, and West) with a slight oversampling of the South region (data not shown).

Forty-four percent of the total sample reported sleeping on average less than 7 hours per night on workdays, whereas only 14% reported sleeping on average less than 7 hours per night on nonwork-days. With respect to EDS and social functioning, approximately 15% of the sample scored greater than 10 on the ESS, while 19% scored greater than 15 on aggregate scoring of the SDS. Most respondents (86%) reported snoring a few nights per week or more. Overall, 16 (2%) reported having a transportation accident and 110 (14%) a near-miss incident while on the job.

Age-, occupation-, and BMI-adjusted odds of an accident and/or near miss are summarized in Table 2. Most measures of sleep status were significantly associated with the combined outcome of accidents and near misses when considered alone. The strongest associations with the outcome measure were observed with a history of an accident while commuting to work and a self-report of driving drowsy. Each was associated with more than a four-fold increase in risk. On the contrary, workers who reported sleeping more than 7 hours before workdays were almost 40% less likely to report an accident or near miss.

A logistic regression model, which considers all the variables of interest simultaneously through a process of backward elimination of not significant variables, is presented in Table 3. In this model, stimulants used to stay awake at work, driving while drowsy, short sleep latency, and an elevated SDS remained independently associated with accidents and/or near misses.

DISCUSSION

In this study of transportation operators, 15% of respondents self-reported an accident or near miss during their professional transportation duties. Multiple recognized risk factors for inadequate sleep, poor sleep quality, and EDS were significantly associated with this combined outcome measure after adjustment for age, BMI, and transportation sector/operator type. Although some of these self-reported factors are interrelated, several measures of sleepiness remained significantly associated with the risk of accident and/or near miss after further multivariate adjustments.

The most striking finding of this study is that very different ways of eliciting possible fatigue and EDS from a questionnaire were all so strongly associated with accident and/or near miss reports. The fact that a sleep disorder, short sleep latency, elevated ESS scores, the use of caffeine and stimulants specifically to stay awake at work, as well as reports of drowsy driving were all significantly associated with increased risk while sleep of more than 7 hours before workdays was associated with a protective effect strongly supports the validity of our results. The findings' high internal consistency, biologically plausibility, and agreement with past studies[2–4,14,20] make the likelihood of their occurrence by chance extremely low. Therefore, future research should explore how these sleep risk factors can be modified in this population to decrease accident risk.

Because sleep has been so closely tied to driver performance,[4] the high percentage of transportation operators found in our study to be sleeping less than the recommended 7 hours per night is particularly alarming. Decreased sleep duration due to experimental sleep deprivation results in increased reaction time and poor performance on driving simulation test.[4] Our study also suggested clear benefits for those with adequate sleep duration (more than 7 hours) during the workweek, with a roughly 40% decrease in the risk of a self-reported accident or near miss.

In this study, not surprisingly, reporting an accident while commuting and a history of driving while drowsy were each associated with more than a four-fold increase in the risk of an accident or near miss. It is likely that both are potential markers of EDS that may represent important precursors to more serious outcomes. Means to identify such operators would be potentially valuable but difficult to elicit spontaneously in the occupational setting.[21] On the contrary, it may be possible to educate such operators that they are at high risk for an accident and persuade them to improve their sleep hygiene, be medically evaluated for a sleep disorder, or both. In addition, technologies that can identify drowsiness in real time through objective measures are also attractive as occupational safety strategies in the transportation industry. These may include psychomotor vigilance testing, driving simulators, and eye movement sensors. [21–26]

Sleep duration and quality are important determinants for physical, social, and mental health. It is interesting that operators with likely impaired work, family, or social functioning secondary to sleep symptoms (as defined in this study by an SDS score of more than 15) were also three times more likely to report an accident or near miss. It is possible that eliciting impairment in work, family, and social functioning through the use of the SDS could be an indirect but sensitive indicator for sleepiness that operators might answer honestly and could be incorporated into transportation screening questionnaires.

The prevalence of drivers reporting a history of snoring in this study is much higher (more than 85%) than that reported by truck drivers at commercial driver medical examinations (less than 15%).[27,28] The difference is most likely explained by the anonymous nature of this online survey, which allowed for more candid responses by participants. The present findings are consistent with another anonymous survey of truck drivers[29] where 66% of truck drivers reported snoring and 20% reported falling asleep while driving.

The high prevalence of snoring along with the high median BMI and obesity prevalence are concerning. de Pinho[3] found a nearly two-fold risk for EDS among truck drivers with a history of snoring and further noted that more than a quarter of reported accidents in his study resulted from EDS. Moreover, the very high prevalence of reported snoring in contrast to less than 8% of the sample reporting physician-diagnosed OSA strongly argues for a much higher prevalence of OSA in this study population. A series of studies of OSA screening among truck drivers has found the prevalence to range from 12% to 28% with most of those truck drivers previously undiagnosed.[15,21] Those investigations using more sensitive methods have found an OSA prevalence among truck drivers in excess of 20%.[11,30,31]

Our findings that reports of caffeine and stimulant use to stay awake at work were associated with a greater risk of near misses and accidents are interesting. Although the judicious caffeine use is an accepted fatigue countermeasure, studies of stimulant use and accidents have reached apparently conflicting results. For example, one recent study of fatal truck crashes found that truck drivers testing positive for stimulants (amphetamine and methamphetamine; cocaine as well as other stimulant drugs [chlorphentermine and phentermine]) were 78% more likely to have engaged in unsafe driving actions than truck drivers who tested stimulant-negative.[32] On the contrary, a recent case–control study of truck drivers found those who consumed caffeinated substances for the purpose of staying awake had a more than 60% reduced likelihood of crashing compared with other drivers.[33] Further research is needed to determine and separate the effects of legal versus illegal stimulants, the effects of the stimulants on driving safety, and confounding where increased stimulant use is reported by sleepy drivers in general.

This study does have several limitations. First, the cross-sectional nature cannot evaluate causation. For example, as mentioned earlier, our findings for caffeine use to stay awake at work are unlikely to imply that caffeine increases the risk of an accident or near miss; rather reporting caffeine to stay awake at work probably is a marker of daytime sleepiness. Regarding the strong association between the outcome and sleep disorders, it is also possible that accidents or near misses triggered the evaluation for the sleep disorder, but this would still suggest a true association.

Another potential limitation inherent to an anonymous Web-based survey is that objective verification of data was not possible, thus creating the possibility of reporting biases. For example, eliciting weight and height data by self-reports may have been imprecise; and we could not measure neck circumference, a commonly employed marker of OSA risk. Nevertheless, in the case of transportation operators who try to avoid sleep disorders diagnoses because these can affect their work status, anonymous surveys are more likely to obtain truthful responses to sleep questions.[21,27,34] In addition, with respect to obesity, the high obesity prevalence among truck and bus drivers in our current survey was consistent with past studies.[30,31]

Another related limitation regards the fact that the outcome measure was also self-reported and somewhat subjective in nature. The survey tool did not qualify or define “near miss” incidents to the participants. Thus, the same incident might be considered a near miss for one transportation operator, while another might not consider it as such. In addition, operators in different transport sectors (road, rail, or air) may interpret near misses differently.

Other limitations regard the survey sampling and interview strategy. This study is only representative of American transportation workers with Internet access, although most transport workers would be expected to have access to the Internet. Also, the survey tool solicited responses for some sleep-related experiences only over the past 2 weeks. This may not adequately represent the average experience of workers over the course of longer periods of time. Another consideration is recall bias, which may have been present if those who experienced an adverse work outcome were more likely to recall certain exposures like driving drowsy in the past, or were more likely to report an accident while commuting.

The investigation also has several important strengths. First, we examined a large population of different types of transportation workers dispersed fairly evenly throughout the United States. Our sample is also likely to be generalizable to transportation workers in the United States who have access to the Internet. Moreover, this study population's demographic characteristics closely match those of the Bureau of Labor Statistics Current Population Survey for employed transportation workers aged 20 years and older.[16] Another strength of the study was its anonymous nature. Drivers may have felt more comfortable reporting the outcome, symptoms of EDS, a history of snoring, and other sleep symptoms in a setting without job-related consequences. In contrast, in the case of commercial drivers trying to avoid sleep-related diagnoses during certification examinations, self-reported data are notoriously inaccurate.[15,21] Finally, the data set contained sufficient variables, allowing for reasonable adjustment for multiple confounders, which strengthened the analyses.

CONCLUSION

Multiple risk factors or makers for inadequate or poor quality sleep were associated with the self-reported adverse combined outcome of occupational accidents and near misses among transportation workers. Future research should explore how these risk factors can best be identified in the occupational settings and modified in this population.

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TABLE 1

Demographic and Background Characteristics of the Study Population

	Worker Type					
	Pilots (*n* = 202)	**Truck Drivers (*n* = 203)**	**Rail (*n* = 180)**	**Bus (*n* = 164)**	**Taxi/Limo (*n* = 46)**	**Total (*n* = 765)**
Age, mean (SD)	46.1 (10.3)	51.0 (9.9)	45.7 (9.8)	54.8 (9.9)	45 (49.5)	49.5 (10.7)
Race: white, *n* (%)	182 (90.1)	182 (89.7)	147 (81.7)	143(87.2)	35 (76.1)	689 (86.7)
Race: other, *n* (%)	20 (8.9)	21(10.3)	33(8.3)	21 (12.8)	11 (23.9)	106 (13.3)
Sex (male), *n* (%)	190 (94.1)	179 (88.2)	155 (86.1)	104 (63.4)	36 (78.3)	664 (83.5)
Obese, *n* (%occ)	40 (19.8)	101 (49.8)	86 (47.8)	67 (40.9)	13 (28.3)	307 (38.6)
Snore, *n* (%occ)	147 (86.5)	159 (91.9)	123 (80.4)	114 (85.1)	31 (88.6)	574 (86.3)
Sleep >7 hr (work), *n* (%occ)	120 (59.4)	113 (55.7)	89 (49.4)	99 (60.4)	26 (56.5)	447 (56.2)
Nap (work), *n* (%occ)	117 (58.8)	85 (42.3)	100 (55.9)	86 (53.4)	26 (56.5)	414 (52.7)
Sleep >7 hr (nonwork), *n* (%occ)	179 (88.6)	168 (82.8)	153 (85.0)	145 (88.4)	40 (87.0)	685 (86.2)
Married, *n* (%occ)	153 (75.8)	141 (69.5)	133 (73.9)	121 (73.8)	29 (64.4)	577 (72.7)
Near miss/accident, *n* (%occ)	24 (12.2)	29 (14.5)	33 (18.8)	14 (8.8)	14 (30.4)	114 (14.7)
BMI (*n*), mean (SD)	196	196	168	149	41	750
	27.0 (3.9)	30.7 (5.7)	30.4 (5.9)	30.0 (6.2)	29.0 (7.8)	29.43 (5.8)
ESS (*n*), mean (SD)	185	181	168	148	41	723
	6.3 (4.7)	5.2 (4.4)	6.5 (4.9)	5.7 (4.4)	6.8 (6.3)	6.0 (4.7)
SDS (*n*), mean (SD)	202	203	180	164	46	795
	7.1 (6.4)	6.1 (6.4)	8.5 (7.4)	4.8 (5.0)	6.5 (7.5)	6.66 (6.6)
ESS > 10, *n* (%occ)	29 (15.7)	19 (10.5)	30 (17.9)	22 (14.9)	8 (19.5)	108 (15.0)
SDS ≥ 15, *n* (%occ)	45 (22.4)	30 (14.8)	54 (30.0)	13 (7.9)	8 (17.4)	150 (18.9)

ESS, Epworth Sleepiness Scale; occ, occupation; SDS, Sheehan Disability Scale.

TABLE 2

Associations of Sleep Risk Factors With Self-Report of Near Miss and/or Accident

	(+) Near Miss/Accident, *n* (%) = 114 (14.7)	(−) Near Miss/Accident, *n* (%) = 664 (85.4)	*P**	OR (95% CI)*
Sleep disorder†	19 (16.7)	57 (8.6)	0.027	2.59 (1.43–4.71)
Sleep duration >7 hr (workdays)	51 (44.7)	391 (58.9)	0.026	0.62 (0.41–0.94)
Sleep latency <5 min	17 (18.5)	52 (9.3)	<0.001	2.33 (1.26–4.30)
ESS > 10	32 (30.8)	72 (69.2)	<0.001	3.01 (1.81–5.00)
SDS ≥ 15	47 (41.2)	100 (15.1)	<0.001	3.54 (2.25–5.55)
Caffeine use to stay awake at work‡	85 (74.6)	362 (55.0)	0.008	2.01 (1.26–3.20)
Stimulant use to stay awake at work§	22 (19.3)	67 (10.2)	0.046	1.91 (1.09–3.35)
Drove drowsy	87 (77.0)	271 (42.2)	<0.001	4.13 (2.54–6.72)
Accident commuting	14 (12.3)	18 (2.7)	<0.001	4.57 (2.13–9.79)
Nap (workdays)	66 (58.9)	339 (51.5)	0.395	1.34 (0.88–2.05)
Exercise after work	51 (44.7)	326 (49.7)	0.322	0.81 (0.53–1.24)
Snore	91 (88.4)	471 (85.8)	0.340	1.51 (0.77–2.96)

**P* value adjusted for occupation type, BMI, and age.

†Sleep disorders include a history of obstructive sleep apnea, insomnia, or shiftwork sleep disorder.

‡Caffeine use was defined as any use of caffeine (eg, coffee, soda, energy drinks, caffeine pills) to help stay awake or alert at work over the past 2 weeks.

§Stimulants other than caffeine were defined as any use of nicotine or tobacco, prescription medications, etc to help stay awake while at work over the past 2 weeks.

BMI, body mass index; CI, confidence interval; ESS, Epworth Sleepiness Scale; OR, odds ratio; SDS, Sheehan Disability Scale.

TABLE 3

Multivariate Backwards Elimination Model*

	Coefficient (*B*)	SE	Wald χ^2	*P*	OR	95% Wald CI
Intercept	−2.857	0.277	106.299	<0.001	NA	NA
Stimulant use to stay awake at work	0.848	0.379	5.013	0.025	2.33	1.11–4.90
Drove drowsy	0.963	0.314	9.387	0.002	2.62	1.42–4.85
Sleep latency <5 min	0.866	0.378	5.242	0.022	2.38	1.13–4.99
SDS ≥ 15	1.229	0.309	15.812	<0.001	3.42	1.87–6.26

*Model required a $P < 0.05$ for staying in the final model.

CI, confidence interval; NA, not applicable; OR, odds ratio; SDS, Sheehan Disability Scale; SE, standard error.