La Medicina del Lavoro

Med Lav 2018; 109, 3: 190-200
DOI: 10.23749/mdl.v109i3.6731

Falling asleep at the wheel and distracted driving. The High-Risk Professional Drivers study

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Key words: Professional driving; truck and bus drivers; risky behaviour; traffic injury; near miss accidents; injuries; sleepy driving; cell phone use

Parole chiave: Guida professionale; autisti di camion e bus; comportamenti a rischio; incidenti stradali; incidenti mancati; infortuni; sonnolenza alla guida; utilizzo di cellulari

Summary

Background: *Sleepiness at the wheel and driving while engaged in other activities are well known risk factors for traffic accidents. This article estimates the prevalence of these factors among Italian Professional Drivers (PDs) and their impact on reported driving mistakes.* **Methods:** *A cross-sectional study was conducted using anonymous questionnaires. PDs (n=497) were divided into two groups: high-risk PDs (HiRis_PDs) (those who self-reported more than one incident during the last 3 years and/or more than one mistake during the past year) and non-HiRis_PDs (subjects who did not meet the above-mentioned inclusion criteria). Logistic regression analyses were performed to assess the association of self-reported sleepiness and/or risky driving behaviour with the condition of being a high-risk driver.* **Results:** *161 (32.4%) subjects were defined as HiRis_PDs. Forty-one percent of the interviewees experienced at least one episode per month of sudden-onset sleep at the wheel. Twenty-eight point two percent reported a regular use of a hand-held cell phone. Predictive factors for being HiRis_PDs were: at least one self-reported episode per month of falling asleep at the wheel [odds ratio (OR) 5, 95% confidence interval (CI) 3.21-7.80, P<0.001], driving while regularly engaged in other activities (mainly hand-held cell phone use) (OR 6.11, 95% CI 2.90-12.84, P<0.001), and young age (OR 0.96, OR 1 year of age increase, 95% CI 0.94-0.98, P=0.001).* **Conclusions:** *Focusing prevention efforts on recognizing sleepiness at the wheel and on avoiding other distracting activities while driving can reduce the possibility of driving errors on the road by about 5-6 times.*

Riassunto

«Colpi di sonno e distrazioni alla guida. Lo studio "High-Risk Professional Drivers"». **Introduzione:** *Guidare quando si è assonnati o mentre si è impegnati in altre attività sono ben noti fattori di rischio per la sicurezza stradale. Il presente studio stima la prevalenza dei principali fattori di rischio all'interno della categoria dei conducenti*

Pervenuto il 3.9.2017 - Revisione pervenuta il 4.1.2018 - Accettato il 19.3.2018
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professionali (professional drivers, PDs) italiani, valutando il loro impatto sugli incidenti stradali (reali e mancati). **Metodi:** *Attraverso questionari anonimi è stato condotto uno studio trasversale. Sulla base degli incidenti dichiarati i PDs (n=497) sono stati divisi in due gruppi: conducenti ad alto rischio (HiRis_PDs) e conducenti a basso rischio (non HiRis_PDs). Mediante regressioni logistiche è stata verificata l'associazione tra la condizione di HiRis_PDs e i principali fattori di rischio per la sicurezza stradale.* **Risultati:** *161 (32.4%) conducenti sono risultati HiRis_PDs. Il 41% degli intervistati ha riferito di aver vissuto un colpo di sonno alla guida con frequenza mensile. Il 28.2% ha ammesso un uso regolare del cellulare senza l'impiego di auricolari o viva-voce. Sono risultati fattori predittivi per la condizione di HiRis_PDs: l'esperienza di almeno un colpo di sonno al mese [odds ratio (OR) 5, 95% intervallo di confidenza (IC) 3.21-7.80, P<0.001], una guida regolarmente distratta da altre attività (principalmente l'utilizzo del cellulare) (OR 6.11, 95% IC 2.90-12.84, P<0.001) e la giovane età (OR 0.96, OR aumento di un anno età, 95% IC 0.94-0.98, P=0.001).* **Conclusioni:** *Concentrare gli sforzi preventivi sull'educazione a una corretta igiene del sonno e sull'astensione da attività distraenti durante la guida può ridurre la possibilità di errori stradali nella categoria dei PDs di 5-6 volte.*

Introduction

Falling asleep at the wheel (FAW) and risky driving behaviour are the main causes of errors on the roadway in Professional Drivers (PDs), and factors such as cell phone use, alcohol consumption, smoking while driving, and age play a role in causing road traffic accidents and work injuries (1, 5, 9, 11). The real entity of these risk factors is still unknown but probably high. Some studies showed that the highest risk of crashes and near-crashes concerns subjects suffering from sleep disorders [obstructive sleep apnea, hypersomnia and multiple sleep disorders; odds ratio (OR) 1.46-3.16], with a range age between 18-30 years (OR 1.42) (11), and using the cell phone while driving (such behaviour seems to increase the risk of a crash by a factor of 4) (8, 9, 12). Additionally, younger age (18-34 years) and higher level of education were associated with distracted driving behaviour (8), defined as the "diversion of attention away from activities critical for safe driving toward a competing activity" (12).

Until today, Italian PDs' attitudes at the wheel have been scarcely studied, and the few data available derive from the periodical workplace health surveillance. Unfortunately, this kind of information does not disclose risky behaviours. In fact, due to a fear of negative repercussions on job fitness certification, PDs tend to deny or underestimate near-miss accidents, sleepiness or cell phone use at the wheel and, of course, not to declare alcohol consumption while driving (which is a violation of the law). Recently, it has become mandatory for PDs to attend Certificate in Professional Competence (CPC) courses. The aim of this training is to set and maintain high standards of safety and driving among drivers of trucks and buses across Europe. These courses represent an opportunity to meet and interview professional drivers (not only from different companies but also self-employed) in a situation different from health surveillance or other forms of inspection. Thus, they create a situation in which declarations are more likely to be sincere.

The current study used a simple self-administered questionnaire to address two main objectives: (i) to determine the prevalence of FAW and risky driving behaviours among Italian professional drivers; (ii) to assess the influence of such risk factors on the condition of High-Risk PDs (HiRis_PD: driver who declares numerous mistakes, i.e. traffic/work injuries or near-miss crashes). The main assumptions are: 1) PDs have a higher risk of crash involvement than the general population, due to work-related factors (driving mileage, work pressure, responsibilities, work-related fatigue, shift work etc.) (2, 4, 9); 2) Among drivers, those defined as HiRis_PDs have an increased risk of falling asleep at the wheel and of distracted driving, even after adjustment for important confounders such as age (PDs younger than 27 or over 63 years present higher rates of crash/fatality involvement) (6).

Methods

Sampling

From 1 October 2012 to 31 May 2013, we conducted a survey using a self-administered and anonymous questionnaire during mandatory CPC courses for professional truck and bus drivers. Study participants were recruited on a voluntary basis from driving schools and associations across six towns in the province of Cuneo (an area of the Piedmont region in northern Italy).

Before the administration of the questionnaire, PDs received detailed information on the purpose of the study and an explanation on how to fill in the questionnaire. Questionnaires not filled in were considered as refusals.

Questionnaire items

The questionnaire included a list of questions designed to extract the following information:

1) PD characteristics (7 questions about age, years of service, educational level, pharmacological treatment, smoking habits, coffee consumption, height and weight);
2) job characteristics (6 questions regarding the size and location of the company, type of routes travelled, type of transport, mileage and hours of work);
3) PD experiences and behaviours at the wheel (10 questions aimed at investigating prior crash and near-miss experiences, eating habits and alcoholic beverage consumption in the workplace, the experience of falling asleep at the wheel and the use of cell phones or other sources of distraction while driving).

It also included two validated questionnaires, the Alcohol Use Disorders Identification Test Consumption (Audit C) and the Chalder Fatigue questionnaire (3).

The Audit C is a revised and shorter version of AUDIT (a gold standard of identification tests, developed by WHO, consisting of 10 alcohol identification questions) (17). The Chalder Fatigue Questionnaire (CFQ) is a validated questionnaire to measure the severity of fatigue. A Likert scale was used with a range from 0 to 33 (3).

The years of service referred to the number of years that the subject had been a professional driver. The hours spent behind the wheel were estimated as the mean number of working hours per day during the past year. Body Mass Index (BMI) was calculated as weight divided by height squared and expressed as kg/m^2 (height and weight were self-reported). According to the standards established by the World Health Organization, a BMI of 30 kg/m^2 or greater signifies obesity (18). Overweight was defined by a BMI ranging between 25 kg/m^2 and 29.9 kg/m^2.

Main questions relative to the HiRis_PD status were: 1) experience in traffic crashes or work-related injury during the previous three years (in which the driver was found culpable under the law and cited by police for infractions and/or found guilty by a traffic court) and 2) experience in errors that led to a near-miss crash in the past year (possible answers for both questions were: a) never, b) once, c) more than once). Main questions relative to different types of risks normally found in the field of road safety were: 1) In the 12 past months, have you experienced falling asleep at the wheel when driving? 2) Have you ever used a cell phone (without headphone or speakerphone) and/or PC and/or watched TV and/or read while driving, during the preceding year? Possible answers for the questions were: a) never, b) a few times (about once a month), c) often (about once a week), d) regularly (more than once a week). 3) Have you ever drunk alcohol during work or during lunch at work? (a) Never, b) only a few times, c) often, d) regularly while I am eating lunch). 4) Do you smoke? (a) Yes but never when I am driving, b) yes even while driving).

We also recorded other potential confounders, including drugs taken for anxiety, depression, allergies, epilepsy, diabetes, hypertension and heart disease. The questionnaire included also the following question: "When the workplace drug test took place: (a) I knew long before that I would have the test and, the day on which it would take place, it was not a surprise (i.e. it was when I did the annual medical examination for work), (b) it was a real surprise inspection that I did not expect, (c) I have never been subjected to WDT". Data obtained from this question have been published in a previous study (14).

Procedures

After two months of collecting data we performed an initial data analysis and, due to preliminary results (the answers have proven to be reliable), we decided to study in depth the question "have you ever used a cell phone (without headphone or speakerphone) and/or PC and/or watched TV and/or read while driving, during the preceding year?" by introducing additional sub-questions: 1) Have you ever used a cell phone (without headphone or speakerphone) while driving, during the preceding year? 2) Have you ever used a Personal Computer while driving, during the preceding year? 3) Have you ever watched TV while driving, during the preceding year? 4) Have you ever read while driving, during the preceding year? 5) Have you ever sent text messages while driving, during the preceding year? Possible answers for the questions were: a) never, b) rarely (about once a month), c) frequently (about once a week), d) regularly (more than once a week).

Based on the answers to the questions related to HiRis_PD status, we divided PDs into two groups: HiRis_PDs (drivers who experienced: more than one incident during the last 3 years and/or more than one near-miss crash during the past year or alternatively, one incident during the last 3 years and one near-miss driving crash during the past year) and non-HiRis_PDs (drivers who had at most one incident during the past 3 years or one near-miss crash during the past year). The condition of being a HiRis_PD was considered as the primary outcome. For these reasons our study has a case-control design, where the cases are defined as the subjects who caused more than one car crash and/or near-miss car crashes in the three years prior to interview, and the controls are the other professional drivers identified during the cross sectional survey.

Secondary outcomes of the study were: 1) reporting falling asleep at the wheel (we created a dummy variable coded 1 for PDs who experienced even one episode of falling asleep at the wheel and 0 otherwise), 2) reporting risky behaviour at the wheel (use of cell phone, PC, TV etc.), 3) the condition of being obese [the variable was coded 1 for PDs who were obese (BMI ≥30) and 0 otherwise].

The present study was approved by the local ethics committee (Comitato Etico Interaziendale dell'ASO S. Croce e Carle di Cuneo e dell'A.S.L. CN1).

Statistical analysis

Descriptive statistics were used to report the prevalence of various factors. We used parametric and non parametric tests as appropriate to explore differences and correlations across the study groups. Specifically, Student's T-tests were used for parametric values (Satterthwaite for unequal variances), Wilcoxon rank sum tests for nonparametric values, and Pearson χ^2 tests for dichotomous variables in univariate analysis (Fisher's exact test when sample sizes are small). A one-way analysis of variance (ANOVA) was used to determine whether there were any significant differences between the means of independent groups with Bonferroni test for post-hoc group comparisons. The Pearson correlation coefficient (r) was determined to analyse the correlation between quantitative variables. We included in a multivariate logistic regression model all the factors that were associated with the condition of being a HiRis_PD with a P value <0.20 in the univariate analysis. We adjusted the odds ratios for potential confounders, namely, demographic characteristics potentially associated with the condition of being a HiRis_PD: age, years of driving experience, occupational category, coffee and alcohol intake, annual mileage, daily working hours, smoking and medication intake. Results were considered significant if $P \leq 0.05$. All statistical calculations were performed on STATA software (version 11.0 STATA Corporation, College Station, TX, USA).

Results

Sample characteristics and HiRis_PD status

We received responses to the questionnaire from 497 of the 508 PDs (97.8%) participating in CPC courses. Table 1 shows the main characteristics of PDs.

In order to ensure anonimity the questionnaire did not include gender. Seventy-one point six percent of

Table 1 - Main sample characteristics

Variable	All drivers	High Risk drivers	Non High Risk drivers	P value
PDs' characteristics				
Number of PDs (%)	497	161 (32.4)	336 (67.6)	
Age (years, mean ± SD)	43.7±9.3	41.5±9.3	44.8±9.2	<0.001*
Seniority (year, mean ± SD)	18.2±9.88	16.5±9.2	19±10.1	0.0101*
BMI (n, %):				
- normal (≤25)	188 (38.4)	66 (41.5)	122 (37)	
- overweight	219 (44.8)	67 (42.1)	152 (46.1)	
- class I obesity	59 (12.1)	20 (12.6)	39 (11.8)	0.87**
- class II obesity	15 (3.1)	4 (2.5)	11 (3.3)	
- class III obesity	8 (1.6)	2 (1.3)	6 (1.8)	
Educational level (n, %):				
- elementary school	11 (2.4)	2 (1.3)	9 (2.9)	
- middle school	274 (58.8)	82 (53.3)	192 (61.5)	0.17**
- high school	174 (37.3)	67 (43.5)	107 (34.3)	
- university degree	7 (1.5)	3 (1.9)	4 (1.3)	
Treatment declared (n, %):				
- antihypertensive	59 (11.9)	18 (11.9)	41 (71.9)	
- antidiabetic	5 (1)	1 (1)	4 (7)	0.14**
- sedatives	2 (0.4)	1 (0.4)	1 (1.8)	
- other drugs	24 (4.8)	13 (4.8)	11 (19.3)	
Coffee (number of cups, mean ± SD)	3.1±2.1	3.5±2.6	2.9±1.8	0.08*
Job characteristics				
Main routes (n, %):				
- national	376 (86.4)	124 (84.3)	252 (87.5)	0.37**
- international	59 (13.6)	23 (15.7)	36 (12.5)	
Driven distance (miles/year x 1000, mean ± SD)	46.9±39	50.5±44.3	44.7±43.1	0.25*
Type of transport (n, %):				
- Truck	306 (71.6)	113 (78.5)	193 (68.2)	
- Bus	113 (26.3)	28 (19.4)	85 (29.7)	0.064**
- Bus and truck	9 (2.1)	3 (2.1)	6 (2.1)	
Time spent driving (h/day, mean ± SD)	6.8±2.6	7.4±2.7	6.5±2.5	0.004*
PDs' experiences and behaviours at the wheel				
Alcohol consumption during work hours (n, %)	105 (21.4)	43 (40)	62 (60)	0.039**
CFQ (mean ± SD)	19.9±4.5	21.4±4.5	19±4.3	<0.001*
Episodes of FAW (n, %):				
- never	287 (58.9)	52 (32.7)	235 (71.7)	
- about once a month	177 (36.4)	91 (57.2)	86 (26.2)	<0.001**
- about once a week	20 (4.1)	14 (8.8)	6 (1.8)	
- more than once a week	3 (0.6)	2 (1.3)	1 (0.3)	

(continued)

Table 1 ***(continued)*** - Main sample characteristics

Variable	All drivers	High Risk drivers	Non High Risk drivers	P value
Cell phone use while driving (n, %):				
- never	67 (18.7)	10 (8.1)	57 (24.4)	
- about once a month	100 (27.9)	28 (22.6)	72 (30.8)	<0.001**
- about once a week	90 (25.2)	33 (26.6)	57 (24.4)	
- more than once a week	101 (28.2)	53 (42.7)	48 (20.5)	
TV wacthing while driving (n, %):				
- never	309 (96.3)	107 (93)	202 (98)	
- about once a month	6 (1.9)	3 (2.6)	3 (1.5)	0.022**
- about once a week	4 (1.2)	4 (3.5)	0 (0)	
- more than once a week	2 (0.6)	1 (0.9)	1 (0.5)	
PC use while driving (n, %):				
- never	306 (95.6)	106 (91.4)	200 (98)	
- about once a month	8 (2.5)	6 (5.2)	2 (1)	0.009**
- about once a week	5 (1.6)	4 (3.4)	1 (0.5)	
- more than once a week	1 (0.3)	0 (0)	1 (0.5)	
Text messaging while driving (n, %):				
- never	138 (43)	29 (25)	109 (53.2)	
- about once a month	75 (23.4)	29 (25)	46 (22.4)	<0.001**
- about once a week	68 (21.2)	34 (29.3)	34 (16.6)	
- more than once a week	40 (12.4)	24 (20.7)	16 (7.8)	
Reading while driving (n, %):				
- never	183 (56.8)	49 (42.2)	134 (65)	
- about once a month	89 (27.6)	36 (31)	53 (25.7)	<0.001**
- about once a week	36 (11.2)	20 (17.2)	16 (7.8)	
- more than once a week	14 (4.4)	11 (9.5)	3 (1.5)	
Smoking while driving (n, %)	116 (23.4)	50 (43.1)	66 (56.9)	0.005**

* Student's T-tests or Satterthwaite test (for unequal variances)
** Pearson χ^2 tests or Fisher's exact test (when sample sizes are small)

the responders were truck drivers, 26.3% bus drivers and 2.1% truck and bus drivers. Fifty-nine point one percent of PDs declared that their company had ≤10 employees. Ninety-five point seven percent of PDs declared a maximum distance ≤150,000 kilometres/year and reported working less than 10 h/day. Truck drivers declared driving more hours per day than bus drivers (7.7 hours/day versus 5.8, P<0.001). BMI ranged from 17 to 44 kg/m^2. Eighty-two subjects (16.8%) had a body mass index indicating obesity (BMI ≥30). Twenty-one point four percent declared drinking alcoholic beverages during working hours or work breaks. Fifteen percent of the participants had an AUDIT C score ≥5, as previously reported (14).

Among the PDs interviewed, 421/495 (85.1%) declared no crash (with culpability) during the past three years, 63/495 (12.7%) declared one and 11/495 (2.2%) reported more than one. Of the participants, 136/492 (27.6%) reported one near-miss crash during the previous year and 138/492 (28.1%) more than one. The number of HiRis_PDs was found to be 161 (32.4%).

FAW and risky behaviours

Two hundred and eighty-seven (58.9%) of the responders denied episodes of FAW, while 177/487 (36.3%) of the drivers declared about one episode

of FAW per month, 20/487 (4.1%) reported about one episode per week and 3/487 (0.6%) more than one episode per week. An increasing risk of being a HiRis_PD was detected when comparing those who answered "never" with those who declared: one episode of FAW per month (unadjusted OR 4.78, 95% CI 3.14-7.28, *P*<0.001), one episode of FAW per week (unadjusted OR 10.54, 95% CI 3.87-28.73, *P*<0.001) and more than one episode of FAW per week (unadjusted OR 9.04, 95% CI 0.80-101.56, *P*=0.074).

Using having had episodes of FAW or not as a dependent variable, multivariate logistic regression showed as best predictive factors: age >55 years old (OR 3.80, 95% CI 1.35-10.71, *P*=0.011), travelling more than 100,000 kilometres per year (OR 2.49, 95% CI 1.35-4.60, *P*=0.003) and fatigue, measured with the CFQ, considered as a continuous variable (OR 1.09, 95% CI 1.02-1.17, *P*=0.015). The analysis of determinants of FAW have been presented in a previously published study (13).

Seventy-nine point two percent admitted risky behaviour while driving (cell phone use, PC use, TV watching, text messaging, and/or reading). Main risky behaviours were related to cell phone use. In particular, more than eighty percent (81.3%; 291/358) of the PDs declared the use of hand-held mobile phones to converse (with equal distribution of responses between rarely, frequently or regularly), and almost sixty percent (57%; 139/322) admitted its use for text messaging while driving. Young drivers were more likely to use a mobile phone while driving than older drivers (both for calls and text messaging). The mean age of PDs who declared hand-held mobile phone use with high frequency (frequently or regularly) was 42 years (SD 9.5) versus 44.8 years (SD 9) of those who did not (*P* <0.001). The difference in age was more evident in the attitude of text messaging while driving. The mean age for each answer (never, rarely, frequently or regularly) was, respectively: 47.9 (SD 8.1), 41.9 (SD 8.7), 38.4 (SD 7.9) and 37.7 (SD 8.5), with a *P* value <0.001. The Bonferroni test showed a significant statistical difference between the first group (those who denied text messaging) and all the other groups (*P*<0.001). A similar trend was detected in those who declared reading while driving frequently or regularly: mean age 38.2 (SD 9.2) years versus 44 (SD 8.9) of those who did not (*P*<0.001). TV watching and PC use while driving showed the same tendency, but in the second case the differences were not statistically significant, due to the small number of PDs who admitted PC use.

Factors associated with HiRis_PD status

Two different models were developed to find factors associated with the condition of being a HiRis_PD. Results are shown in table 2.

Both FAW and Overall Risking Driving Behavior (ORDB) showed a similar trend in increasing the odds of being a HiRis_PD as passing from about once a month to more than once a week. In the univariate analysis, most of the factors considered in the aggregated variable ORDB proved to be related to the condition of being a HiRis_PD. In the multivariate analysis, only cell phone use, text messaging and reading while driving showed an association with the condition of being a HiRis_PD (table 2, model 2, reports the OR of each factor, moving from a frequency of "never" to "more than once a week").

In the first model age was inversely correlated with the condition of being a HiRis_PD (OR 0.97), while in the third model the length of service had a similar correlation with the dependent variable (OR 0.95). In particular, age is inversely related to ORDB (table 3) and almost all the factors included in the ORDB, with the exclusion of PC use while driving. Furthermore, age was demonstrated to be correlated to the length of service (r=0.71; *P*<0.001) and the Audit C score (r=-0.16; *P*=0.010).

The Audit C score among those who declared drinking alcohol during working hours was found to be higher than among those who did not (Audit C mean score 3.6 versus 2 respectively, *P*<0.001). Similarly, those who reported at least one episode of FAW had a higher Audit C score compared with those who did not (Audit C mean score 2.9 versus 2 respectively, *P*<0.001). This score was also higher among those who declared smoking while driving (mean score 3.3 versus 2.2, *P*<0.001). The Audit C score was progressively higher among those who declared an ORDB (none: score=2; rarely, score=2.2;

Table 2 - Different models of multivariate analysis, developed to find factors associated with the condition of being a HiRis_PD [(odds ratio (OR), 95% confidence interval (CI) and *P* value)].

Variables	Model 1* OR (95% CI) p value	Model 2** OR (95% CI) p value
Age	0.97 (0.95-0.99) 0.008	0.98 (0.95-1.01) 0.276
Falling asleep at the wheel (FAW)		
- never	1	
- about once a month	4.65 (2.95-7.34) 0.000	
- about once a week	8.79 (3.07-25.18) 0.000	
- more than once a week	6.80 (0.56-82.51) 0.132	
	p for trend <0.0001	
Overall risky driving behaviour (ORDB)		
- never	1	
- about once a month	1.81 (0.85-3.83) 0.124	
- about once a week	3.04 (1.43-6.47) 0.004	
- more than once a week	6.09 (2.91-12.73) 0.000	
	p for trend <0.0001	
Cell phone use while driving		
- never		1
- about once a month		2.25 (0.78-6.50) 0.133
- about once a week		3.31 (1.17-9.36) 0.024
- more than once a week		5.51 (1.97-15.36) 0.001
		p for trend 0.001
Text messaging while driving		
- never		1
- about once a month		1.73 (0.85-3.52) 0.133
- about once a week		2.23 (1.05-4.75) 0.038
- more than once a week		2.17 (0.87-5.45) 0.099
		p for trend 0.015
Reading while driving		
- never		1
- about once a month		1.45 (0.80-2.63) 0.217
- about once a week		1.69 (0.70-4.07) 0.246
- more than once a week		5.55 (1.33-23.16) 0.019
		p for trend 0.011
TV wacthing while driving		
- never		1
- about once a month		1.20 (0.14-10.57) 0.870
- about once a week		1 (omitted)
- more than once a week		1 (omitted)
		p for trend 0.202
PC use while driving		
- never		1
- about once a month		3.02 (0.52-17.61) 0.219
- about once a week		2.52 (0.20-32.33) 0.478
- more than once a week		1 (omitted)
		p for trend 0.861

* Propensity of being a HiRis_PD considering FAW & ORDB, adjusted model with age (n=476)

** Propensity of being a HiRis_PD considering factors that lead to an ORDB, adjusted model with age (n= 304)

frequently, score=2.3; regularly, score=3.1); the difference was statistically different between those who declared having ORDB "regularly" compared with "never" and "rarely", *P* value 0.015 and 0.034, respectively.

Among those who reported having an ORDB, there was an incremented risk of drinking alcohol while working (rarely: unadjusted OR 2.21, 95% CI 1.09-3.17, *P*=0.023; frequently: unadjusted OR 3.42, 95% CI 1.64-7.12, *P*=0.001; constantly: unadjusted OR 10.03, 95% CI 2.68-37.46, *P*=0.001; referent: never).

Discussion

The proportion of subjects with previous crashes (14.9%) or near misses (65.7%) in the last 3 years in our study was found to be much higher than that found by Sagaspe et al. (15) in the general population (11% of drivers who self-reported at least one near-miss in the previous year, and 5.8% of drivers who self-reported at least one crash), and higher than that found by Ozer et al. (10) in a Turkish study, in which 15.3% of 320 public drivers reported at least one sleepiness-related motor vehicle crash and/or near-miss.

Thus, our data confirm that PDs have a higher risk of crash and/or near-missed crash involvement than the general population. Previous studies have detected as possible risk factors of the category: the high amount of driving mileage (7, 10, 16), work pressure, responsibilities, work-related fatigue and shift work (2, 9). The present investigation identified additional risk factors and incorrect attitudes at the wheel that can bring about work-related traffic crashes. The problem of driving while phoning, texting or, even worse, TV watching, PC use or reading seems to be a widespread phenomenon among Italian PDs.

Some of these risky behaviours are related to the age of the driver. For instance, we found that younger PDs have a greater tendency toward risky behaviours involving the use of technological devices. Accordingly, Duke and coll. found higher rates of crash involvement among heavy vehicle drivers younger than 27 years (6).

Distracted driving, a significant public safety issue, is typically categorized by cell phone use. The present study confirmed the detrimental effects of such risky behaviours, and identified other forms of distracted driving (at least among PDs), namely: TV watching, PC use, and reading, showing their association with an increased crash risk.

Curiously, in the multivariate analysis, when we tested the effect of sleepiness and ORDB (corrected for the age of the driver) on the risk of being a HiRis_PD (table 3, model 1), we detected a rather similar effect of the two factors.

Individuals who reported frequent ORDB were found to have a higher AUDIT C score (therefore a higher alcohol consumption), and a higher coffee consumption. These results indicate that a greater reported frequency of ORDB while driving is associated with a broader pattern of behaviours that are likely to increase the overall risk of crash involvement.

This study was intended to generate hypotheses for further investigation. It was conducted investigating a sample of PDs, most of whom work for companies based in only one Italian province. This characteristic may appear as a limitation of the study. However, to our knowledge there are no local factors which impact or influence the application or interpretation of the results of this study on a national basis. Nevertheless, it has considered only Italian PDs, which somewhat limits the generalizability of the findings. The study population was selected from those doing the CPC and there was no randomisation. In order to reduce the risk of selection bias, we collected a quite large number of questionnaires from six different area in the province of Cuneo, reaching a very high response rate (97.8%) (blank questionnaires were considered as refusals). In our opinion the main reason for this was because participants had fully understood the purpose of the study and trusted the course instructor. The results are based on data that include only a range of variables that can potentially determine distracted driving, sleepiness at the wheel and, more generally errors while driving. Indeed, we do not record the role of work-family conflict, lack of physical activity, varying driving shifts, etc.

Finally, the study relied on self-reported data that are prone to bias (especially self-reported alcohol use and other risky driving behaviour). For these rea-

Table 3 - Univariate analysis that reports the OR of each factor considered in the present study, moving from a frequency of "never" to "constantly"

Variables	Overall risky driving behaviour				
	Never	Rarely (about once a month)	Frequently (about once a week)	Regularly (more than once a week)	P value
Number of PDs (n, %)	102 (20.8)	147 (29.9)	117 (23.8)	125 (25.5)	
Age (years, mean ± SD)	46±9.1	44.4±8.8	42.3±9.5	42.1±9.6	N vs F 0.020* N vs RE 0.012*
Seniority (years, mean ± SD)	18.6±10.3	19.2±9.3	16.2±9.4	18.2±10.3	0.543*
Main routes:					
- regional	51 (60.7)	66 (51.6)	62 (60.8)	60 (51.3)	
- national	26 (31)	41 (32)	26 (25.5)	40 (34.2)	0.460**
- international	7 (8.3)	21 (16.4)	14 (13.7)	17 (14.5)	
BMI (mean ± SD)	26.4±4	27±4.2	26.5±4.1	26.7±4.8	0.710*
Education level (n, %):					
- elementary or middle schools	60 (63.2)	87 (62.6)	65 (59.6)	69 (58.5)	0.865**
- high schools or university	35 (36.8)	52 (37.4)	44 (40.4)	49 (41.5)	
Type of transport (n, %):					
- bus drivers	48 (61.5)	77 (63.6)	79 (76.7)	100 (87)	<0.001**
- truck drivers	30 (38.4)	44 (36.4)	24 (23.3)	15 (13)	
Alcohol consumption during work hours (n, %):					
- No	90 (89.1)	115 (78.8)	86 (73.5)	89 (73.6)	0.012**
- Yes	11 (10.9)	31 (21.2)	31 (26.5)	32 (26.4)	
Audit C score (mean ± SD)	2±2.3	2.2±1.7	2.3±1.8	3.1±2.4	N vs RE 0.015* RA vs RE 0.034*
Falling asleep at the wheel (n, %):					
- less than once a month	79 (77.5)	81 (57.5)	61 (53.5)	62 (50)	<0.001**
- more than once a month	22 (22.5)	60 (42.5)	53 (46.5)	62 (50)	
Smoking habits (n, %):					
- Not	70 (69.3)	106 (72.6)	75 (64.1)	73 (58.4)	
- Yes, never while driving	14 (13.9)	21 (14.4)	10 (8.5)	5 (4)	<0.001**
- Yes, even while driving	17 (16.8)	19 (13)	32 (27.4)	47 (37.6)	
Treatment declared					
- none	87 (85.3)	116 (78.9)	96 (82)	103 (82.4)	
- antidiabetic	0 (0)	4 (2.7)	0 (0)	1 (0.8)	
- antihypertensive	3 (12.7)	16 (10.9)	16 (13.7)	14 (11.2)	0.559**
- sedatives	0 (0)	1 (0.7)	0 (0)	1 (0.8)	
- other drugs	2 (2)	10 (6.8)	5 (4.3)	6 (4.8)	
Coffee (number of cups) (mean ± SD)	2.8±1.8	2.9±1.6	2.9±1.7	3.4±2.7	0.051*
Driven distance (miles/year x 1000) (mean ± SD)	35.7±25.1	45±29	48.1±52.7	53.6±38.3	0.122*
Time spent driving (h/day) (mean ± SD)	6.1±2.5	6.5±2.6	6.5±2.4	7.7±2.7	0.001*

Overall risky driving behaviour: cell phone use, PC use, TV watching, text messaging, and/or reading.
N: never; RA: rarely; F: frequently; RE: regularly
* Bonferroni t-test
** Pearson χ^2 tests or Fisher's exact test (when sample sizes are small)

sons participants were assured confidentiality, questionnaires were clear and completely anonymous (therefore less likely to promote under-reporting). Notwithstanding this, it is likely that participants under-reported their risky behaviour. Hence, the associations seen in this study are most likely to be an under-estimation of the outcomes selected. This is a cross-sectional study, and therefore we cannot infer any causal links or directionality between the variables studied. Nevertheless, the current associations are strong and are of interest regardless of direction.

The results highlighted in this study provide precious information to focus attention on PDs who fail to perceive the dangers inherent in distracted driving. Prevention and outreach education should not be limited to sleepiness and cell phone use, but should target all forms of ORDB and alcohol consumption. Younger drivers should be the primary target for educational programs in the PD category.

More effective road safety measures are needed to prevent and mitigate the adverse effects on driving performance of risky behaviours and sleepiness among professional drivers.

No potential conflict of interest relevant to this article was reported by the authors

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Acknowledgement: *The authors would like to thank Dr Laurence Preston for his cooperation in checking the language used in this article.*