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# Evolution of work conditions for employees driving for work in France based on data from the 2003, 2010 and 2017 SUMER surveys (Surveillance Médicale des expositions aux risques Professionnels)

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## ABSTRACT

**Introduction:** The occupational road-accident risk on public roads and the work conditions for professional driving is still an important issue in occupational health despite lower road-accident rates. This study presents the evolution over time of the work-related constraints for these employees based on the Sumer surveys carried out in 2003, 2010 and 2017.

**Method:** Data from the 2010 and 2017 surveys were restricted to match the scope of the 2003 survey in order to enable prevalence data to be compared in equivalent populations. The main variable of interest was “driving (car, truck, bus, and other vehicles) on public thoroughfares” for work (during the last week of work: yes/no). Work time characteristics, work rhythm, autonomy and scope for initiative, collective work group, standards and evaluations variables were completed by the occupational health physicians. A self-administered questionnaire was also provided to employees and contained the Job Content Questionnaire, which assesses decision latitude, social support and psychological demands, the reward scale of Siegrist questionnaire, the hostile behaviour with inspired questions for Leymann, sick leave and work accidents during the past 12 months and job satisfaction. Finally, prevention in the workplace was also completed by the occupational health physicians.

**Results:** About 25% of employees in France were exposed to work-related driving in 2017, which was stable in comparison with 2003 and 2010. However, the population was older and there were more females, more often from the clerical staff/middle manager category and working in companies with fewer than 10 employees. Employees exposed to work-related driving were also more frequently exposed to sustained work schedules and physical constraints, but less exposed to psychosocial risks.

**Conclusions:** The percentage of employees exposed to occupational road accident risk, i.e., exposure to work-related driving, remained stable at about 25% in 2017 compared with previous surveys. These employees were also more frequently exposed to sustained work schedules and physical constraints, but less exposed to psychosocial risks.

**Practical Applications:** Prevention campaigns on work-related road accident risk should be provided to all employees in all companies since all jobs can be concerned.

## 1. Introduction

In France, according to the National Health Insurance Fund for Salaried Workers, road traffic accidents on duty represent 3% of all work-related accidents, but they represent 23% of work-related fatal

accidents in 2008 (Caisse nationale de l'assurance maladie des travailleurs salariés Direction des risques professionnels, n.d.-a), 20% in 2010 (Caisse nationale de l'assurance maladie des travailleurs salariés Direction des risques professionnels, n.d.-b), and 18% in 2018 (Caisse nationale de l'assurance maladie des travailleurs salariés Direction des

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risques professionnels, n.d.-c). The incidence of road traffic injuries occurring on duty decreased by more than 40% between 1997–2000 and 2003–2006, dropping from 45.2/100,000 workers to 26.6/100,000 workers. This decrease was also observed for work-related road fatal accidents between the same periods, from 1.51/100,000 workers to 0.83/100,000 workers (Charbotel et al., 2010). In 2021, there were 12,186 on duty road accident, an increase of 8% from 2020. Ninety fatal on duty accidents were recorded (Caisse nationale de l'assurance maladie des travailleurs salariés Direction des risques professionnels, n.d.-d).

The French National Institute for Statistics and Economic Studies (INSEE) reported increased mobility of workers between 1981 and 1993 (Crague, 2003). This seems to have reached a threshold since, in the 2003 Sumer survey (medical surveillance of employees' exposure to occupational risks) (Direction de l'animation de la recherche, 2006), a quarter of the employees questioned ( $n = 12,050$ , 25.4%) drove on public roads as part of their professional activities and in 2010, this was 26.4% (Fort et al., 2016). The number of women driving on public roads as part of their professional activities has increased relatively more rapidly, from 9% in 1994 to 13% in 2003, compared with men for whom the increase was from 32% in 1994 to 35% in 2003 (Coutrot et al., 2006; Demoli, 2014).

Some studies have reported that certain occupational risk factors may be associated with a risk of work-related road accidents (Fort et al., 2010). The number of hours worked and fatigue were shown to increase the risk of being involved in a road accident (Anund et al., 2018; Llamazares et al., 2021; Maynard et al., 2021; McCartt et al., 2000). Having difficulty meeting deadlines has been shown to be a risk factor for road traffic accidents on duty (Fort et al., 2013). This has also been observed for certain professional groups ambulance personnel under time pressure (Centers for Disease Control and Prevention, 2003; Kahn et al., 2001). In an analysis of risk factors for work-related road accidents in a cohort of workers of the French national electricity and gas companies (Électricité de France-Gaz de France), after taking into account the transport mode and distance, which were the primary risk factors, the lower socio-occupational groups, especially blue-collar workers, followed by white-collar workers, were more at risk than managers (Chiron et al., 2008). In addition, 'nervously tiring work' for males, and 'sustained standing' for females were associated with the occurrence of at-work road accidents.

About 25% of employees in the 2003 Sumer survey were concerned by exposure to work-related road accident risks. These employees could be grouped into 10 classes of employees based on their working conditions, defined by occupational characteristics, and level of exposure to driving (Fort et al., 2019). Four of these classes included employees who were overexposed to driving in the context of their professional activity. These employees, who were mostly men, were also overexposed to significant time pressure in their work. Other demographic, occupational (sales persons, public sector workers, and professional drivers in the transportation and warehousing were overrepresented in a group), and psychosocial characteristics (high decision latitude in a group) were also different between the groups.

The compensation following road accidents and related work absences are parameters that should be taken into account in public policy. A cumulative incidence of productivity loss (performing after TA any usual activities, including working, going to school, playing and doing chores, among others due to road accidents was observed in Brazil for 61% of the study population (Cardoso et al., 2020). In the Netherlands, the average cost of lost productivity for a nonfatal road accident was estimated to be 5,900 euros (van der Vlegel et al., 2020). In Australia, the rate of road accident compensation claims was estimated to be 12.9 per 100,000 working population, with 17% of the claims being due to work-related road accidents (Gray et al., 2020).

It is important to know the level of exposure of the French population to this occupational risk, as well as the characteristics of this population to enable the groups at risk to be identified and preventive actions

adapted. The objective of this study was to describe the changes in the occupational characteristics of employees exposed to work-related driving, based on the results from three Sumer surveys undertaken in 2003, 2010, and 2017.

## 2. Materials

### 2.1. Sumer survey

The Sumer survey is a medical monitoring survey of professional risks carried out as a cross-sectional repeated survey for evaluating the evolution of the intensity or duration of employees' occupational exposure to physical hazards, biological agents, and chemical products and any collective or individual protection measures available to them since the first survey published in 2003 (Memmi et al., 2019). SUMER project is managed jointly by the General Directorate of Labour (DGT) and the Directorate for Research, Studies and Statistics (Dares) of the - Ministry of Work, Employment, Vocational Training and Social Dialogue, and co-financed by the General Directorate of Administration and the Public Sector (DGAFFP). The study consists of interviews with employees conducted by volunteered occupational physicians during their regular compulsory medical examination of workers from any French company. In France, all employees are covered by an occupational medicine service. This applies to both the private and public sectors. Various types of medical examination are carried out. Occupational physicians are salaried employees of the company or of an occupational health service to which the company is affiliated. The occupational physician is not only independent from the employer, but also from the national authorities. This approach enables Dares to benefit from the occupational physician's expertise, as they have in-depth knowledge of the company and are able to provide additional information on exposure during the interview with the employee. Another advantage of this methodology is that it provides access to a large population, making it possible to measure the occurrence of relatively rare phenomena or subgroup analyses. Prior to 1994, data were collected during periodic visits by the occupational health physician (Arnaudo et al., 2004). Since 2003, a self-questionnaire has been used to collect information on the perception of work and the link between work and the employee's health (Direction de l'animation de la recherche, 2006; Guignon et al., 2008). The self-questionnaire was modified in 2010 to include standardized questionnaires to assess psychosocial risks, anxiety and depression, accidents, sick leave, job satisfaction, perceived health, the relationship between health and work, and maltreatment behaviors experienced in the workplace (Niedhammer et al., 2018). Over the course of the surveys, the sampling scope has been expanded so that the 2017 survey was representative of almost 22 million employees (i.e., 92% of employees in France). However, the analysis presented here used data from the 2010 ( $n = 41,907$ ) and 2017 ( $n = 21,548$ ) surveys restricted to the areas covered by the 2003 survey ( $n = 49,984$ ) to enable the prevalence of working conditions and occupational exposures to be compared in equivalent populations (Havet & Penot, 2022).

### 2.2. Sumer questionnaires

The occupational physician completed a questionnaire for each employee to collect demographic and professional characteristics (gender, age, socio-professional category), characteristics of the employer (number of workers), and the organizational and relational constraints of the job (various working conditions and exposures including working time, work rhythm, work autonomy, work group, and work standards). A self-questionnaire completed by employees collected information related to the perception of work, health at work, the psychosocial environment at work with the Job Content Questionnaire (Karasek, 1985; Karasek, 1979), the Reward (11 items) scale of the Siegrist questionnaire (Siegrist et al., 2004) and violence at work with the inspired questions from Leymann questionnaire (Niedhammer et al.,

2006).

For each item of the Reward scale of the Siegrist questionnaire, there were 5 levels of response: “agree,” “disagree and I am not at all distressed,” “disagree and I am somewhat distressed,” “disagree and I am

distressed,” and “disagree and I am very distressed,” scored 1 to 5; the sum of the item scores gave scale scores (Niedhammer et al., 2004).

The Job Content Questionnaire evaluated three dimensions of the psychosocial work environment in 26 questions: psychological demand

**Table 1**  
Demographic and professional data.

	SUMER 2003				SUMER 2010				SUMER 2017			
	Non-driver		Driver		Non-driver		Driver		Non-driver		Driver	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Gender												
Male	50.2	49.7–50.8	77.4	76.5–78.2	47.9	47.1–48.8	75.7	74.5–76.9	45.0	43.6–46.4	70.9	68.8–73.0
Female	49.8	49.2–50.3	22.6	21.8–23.5	52.1	51.2–52.9	24.3	23.1–25.5	55.0	53.6–56.4	29.1	27.0–31.2
Nationality												
French	95.7	95.5–95.9	96.8	96.4–97.1	94.6	94.2–95.1	96.2	95.2–97.2	92.1	91.2–93.0	97.0	96.3–97.7
EU, other than French	1.9	1.7–2.0	1.9	1.6–2.1	2.0	1.7–2.2	2.5	1.5–3.4	2.9	2.4–3.3	1.7	1.1–2.2
Non EU	2.4	2.3–2.6	1.3	1.1–1.5	3.4	3.0–3.8	1.3	1.0–1.7	5.0	4.2–5.8	1.3	0.9–1.8
Age group												
Less than 25 years old	11.9	11.5–12.3	7.3	6.7–7.8	12.9	12.3–13.6	8.9	7.9–9.9	8.6	7.6–9.6	5.7	4.3–7.1
25 – 29 years	13.1	12.7–13.4	11.9	11.3–12.5	12.4	11.9–13.0	11.9	10.9–12.8	11.4	10.4–12.3	9.5	8.1–10.9
30 – 39 years	29.3	28.8–29.8	31.9	31.0–32.8	27.1	26.4–27.9	27.3	26.0–28.7	24.3	23.1–25.4	26.3	24.3–28.3
40 – 49 years	26.1	25.7–26.6	28.4	27.5–29.2	25.9	25.2–26.6	29.0	27.6–30.3	25.4	24.2–26.6	27.0	25.0–28.9
More than 50 years old plus	19.6	19.2–20.0	20.5	19.8–21.6	21.6	20.9–22.4	22.9	21.8–24.1	30.3	29.1–31.6	31.5	29.5–33.6
Seniority in the company												
Less than a year	9.1	8.7–9.4	7.0	6.5–7.5	12.9	12.3–13.5	10.5	9.4–11.6	15.2	13.7–16.6	11.8	9.7–14.0
Between 1 and 3 years	24.7	24.2–25.2	24.7	23.9–25.5	20.2	19.4–20.9	20.3	19.1–21.4	13.6	12.6–14.5	13.9	12.5–15.4
Between 3 and 10 years	26.6	26.2–27.1	30.6	29.7–31.5	31.8	31.0–32.6	35.6	34.1–37.1	30.2	29.0–31.5	32.8	30.8–35.0
More than 10 years	39.6	39.1–40.1	37.7	36.8–38.6	35.1	34.3–35.9	33.6	32.2–34.9	41.0	39.7–42.3	41.5	39.1–43.4
Number of workers in company												
1 – 9	22.6	22.1–23.1	30.7	29.8–31.6	21.2	20.4–21.9	26.5	25.1–27.8	27.3	25.8–28.8	31.6	29.3–34.0
10 – 49	22.8	22.4–23.3	34.4	33.5–35.3	23.8	23.1–24.6	34.7	33.2–36.1	22.1	21.0–23.2	32.3	30.2–34.4
50 – 199	21.3	20.9–21.8	21.1	20.3–21.9	22.1	21.4–22.8	22.5	21.3–23.7	24.4	23.2–25.6	23.1	21.2–25.0
200 – 499	13.8	13.4–14.1	6.5	6.0–7.0	12.8	12.3–13.4	7.4	6.7–8.2	9.2	8.5–10.0	4.5	3.6–5.3
≥ 500	19.5	19.1–19.9	7.3	6.9–7.6	20.1	19.4–20.7	8.9	8.1–9.7	17.0	16.1–17.9	8.5	7.0–9.9
Employment contract												
Full-time	83.8	83.4–84.2	91.2	90.7–91.8	77.9	77.1–78.7	85.7	84.4–87.0	77.3	75.9–78.6	82.7	80.6–84.8
Part-time	16.2	15.8–16.6	8.8	8.2–9.3	22.1	21.3–22.9	14.3	13.0–15.6	22.7	21.4–24.1	17.3	15.2–19.4
Choice of work time												
No	23.3	22.8–23.9	21.2	20.3–22.1	18.5	17.7–19.2	15.1	14.1–16.2	15.7	14.5–16.9	12.9	11.0–14.7
Yes	76.7	76.1–77.2	78.8	77.9–79.7	81.5	80.8–82.3	84.9	83.8–85.9	84.3	83.1–85.5	87.1	85.3–89.0
Socio-professional groups												
Managers and higher intellectual professions	11.8	11.5–12.2	19.5	18.7–20.3	13.9	13.3–14.5	18.3	17.3–19.3	16.4	15.5–17.3	17.5	16.0–17.0
Intermediate professions	21.8	21.4–22.3	28.8	28.0–29.6	22.7	22.0–23.4	26.8	25.5–28.0	18.1	17.2–18.9	21.8	20.1–23.5
Employees, clerical staff, middle managers	32.7	32.2–33.2	13.0	12.4–13.7	34.5	33.7–35.3	15.5	14.3–16.6	39.9	38.5–41.4	23.4	21.2–25.6
Manual workers (Skilled workers / Professional drivers / No-skilled workers / Agricultural workers)	33.4	32.9–33.9	37.9	37.0–38.8	28.9	28.1–29.6	39.4	38.0–41.0	25.6	24.3–26.9	37.3	35.1–39.5
Activity sector (NAF 2003) <sup>1</sup>												
A: Agriculture, hunting, forestry	1.5	1.4–1.6	2.5	2.2–2.8	1.4	1.2–1.5	2.3	1.9–2.7				
B: Fishing, aquaculture, related services	0	0–0.1	0	0–0.1	0.01	0–0.03	0	0–0.01				
C: Mining and quarrying	0.1	0.1–0.2	0.1	0–0.2	0.1	0.07–0.1	0.1	0–0.2				
D: Manufacturing	24.4	23.9–24.8	11.3	10.8–11.8	19.9	19.3–20.5	10.9	10.0–11.7				
E: Production and distribution of electricity, gas and water	0.9	0.8–1.0	2.2	1.9–2.4	1.0	0.9–1.0	1.9	1.7–2.2				
F: Construction	4.3	4.0–4.5	14.3	13.6–14.9	4.7	4.2–5.2	16.2	14.8–17.7				
G: Wholesale and retail trade and repair of motor vehicles and motorcycles	15.9	15.5–16.3	17.6	16.9–18.3	17.4	16.8–18.1	15.2	14.2–16.1				
H: Hotels and restaurants	5.3	5.0–5.5	1.4	1.1–1.6	4.6	4.2–4.9	1.0	0.8–1.3				
I: Transportation and et communication	6.2	5.9–6.5	13.5	12.9–14.2	6.4	5.9–6.8	12.7	11.7–13.6				
J: Financial activities	4.1	3.9–4.3	2.9	2.6–3.3	4.9	4.6–5.2	3.2	2.8–3.7				
K: Real estate activities and support service activities	17.1	16.7–17.6	16.2	15.4–16.9	17.7	17.0–18.4	16.6	15.5–17.6				
L: Public administration	1.9	1.7–2.0	1.1	0.9–1.3	1.9	1.8–2.1	1.2	0.9–1.5				
M: Education	1.6	1.4–1.7	1.4	1.2–1.6	1.3	1.1–1.4	0.8	0.6–1.1				
N: Human health and social work activities	12.1	11.7–12.4	10.1	9.6–10.7	13.9	13.3–14.5	13.1	12.1–14.2				
O: Community, Social and Personal Services	4.5	4.3–4.8	5.2	4.7–5.6	4.7	4.2–5.2	4.7	4.1–5.3				
P: Household activities	0.1	0.1–0.2	0.1	0–0.2	0.05	0–0.1	0	0–0.02				

1: Activity sector NAF 2003 is not available in Sumer 2017 survey.

(9 items), decision latitude (9 items) and social support (8 items). The proposed answers were: ‘strongly disagree,’ ‘disagree,’ ‘agree,’ ‘strongly agree.’ Each of the questions were therefore scored from 1 to 4 and overall scores for each of the 3 dimensions were calculated (Karasek, 1985). The median value of each of the scores was calculated. A score above the median for the psychological demand dimension classified employees as having high psychological demands. A score below the median for the decision latitude classified employees as having a little control over their work. Likewise, a score below the median for the social support dimension classified employees as having low social support. Employees were considered to have job strain if they had little control over their work and high psychological demands. Employees were considered to have isostrain if they had job strain and low social support (Lesuffleur et al., 2015).

### 2.3. Variable of interest

The main variable of interest was “driving (car, truck, bus, coach, etc.) on public thoroughfares” for work (during the last week of work). The variable was dichotomous, that is, no or yes to enable employees who drove as part of their professional activities to be distinguished from other employees who did not drive.

### 2.4. Statistical methods

The descriptive analyses were weighted by the sampling weight available for each Sumer survey. The analyses were performed with SAS software, version 9.4 and the *surveyfreq* and *surveymeans* procedures. The 95% confidence intervals were calculated to enable frequencies of exposure work-related driving in 2003, 2010, and 2017 and the frequencies for exposed and unexposed employees to be compared.

### 2.5. Ethical considerations

This study obtained approval use of Sumer surveys data from ADISP (National Archive of Data from Official Statistics) under the number 19462.

## 3. Results

In the Sumer surveys 25% of employees were exposed to driving as part of their professional activities, with no change over time. Similarly, the duration of weekly exposure to driving was stable. Exposure was for less than 2 h per week for 30%, between 2 and 10 h for 40%, between 10 and 20 h for 15%, and more than 20 h for 15%.

### 3.1. Socio-demographic and occupational characteristics

The percentage of female among the population studied has increased from 49.8% in 2003 to 55.0% in 2017 for non-drivers and from 22.6% to 29.5%, respectively for drivers (Table 1). The average age of drivers has also increased from 39.5 years in 2003 to 42.6 years in 2017 (compared with 38.4 and 41.6 years for non-drivers). The percentages of employees with less than 1 year of service and more than 10 years of service increased also over the period.

Manual workers (Skilled workers / Professional drivers / No-skilled workers / Agricultural workers) were the most exposed to professional driving in 2017 with a stable level around 37 to 39% between 2003 and 2017, but the percentage of employee/clerical staff/middle managers among the exposed workers increased from 13.0% in 2003 to 23.4% in 2017. Workers exposed to driving during working hours were more frequently employed in microenterprises (1–9 workers) or very small enterprises (10–49 workers) than un-exposed workers. These figures did not change across the three surveys.

### 3.2. Organizational and relational constraints

#### 3.2.1. Work-time characteristics

The percentage of employees having worked more than 40 h the previous week was stable among the unexposed (25%) and decreased among the exposed (from 44% to 38%) (Table 2). The percentage of workers absent from home for more than 11 h for work decreased amongst drivers and increased amongst non-drivers. The percentage of non-drivers who worked on Saturdays or Sundays remained stable over time, while the percentage of drivers working on Saturdays decreased and the percentage of drivers working on Sundays increased slightly, independently of exposure. The percentage of drivers who had worked more than 30 Saturdays in the last 12 months remained stable while the percentage of non-drivers increased slightly. The percentage of drivers who had worked more than 25 Sundays or public holidays in the last 12 months increased slightly, whereas the percentage of non-drivers remained stable.

The percentage of employees working at night increased between 2003 and 2010 and remained comparable in 2017. In 2017, 39% of drivers worked overnight compared with 30% of non-drivers. The percentage of those working two or more shifts per day increased from 8% in 2003 to 9.0% in 2017 for non-drivers and from 9% to 12% for drivers. The percentage of those working flexible hours was also higher for drivers than non-drivers and increased in both groups over time. Knowing planned work schedules has improved over time for all workers, but was better for non-drivers than for drivers, with 10% fewer drivers knowing their schedules. Although there was a drop in the percentage of workers doing overtime from 2003 to 2010, in 2017 the percentage increased to similar levels as those in 2003, with 34% of drivers working overtime compared with 23% of non-drivers.

Drivers were twice as likely to have on-call duties compared with non-drivers, and this was constant over time. About 15% of drivers and non-drivers do not have the legal rest time of at least 48 consecutive hours (two days) off weekly specified by French work laws, in all three surveys.

#### 3.2.2. Work rhythm

Constraints related to the work schedules and autonomy were frequent in 2003 and have remained either stable or decreased over time (Table 3). In 2003, 41.2% of non-drivers and 34.9% of drivers had at least three work schedule constraints, compared with 34.3% and 32.7%, respectively, in 2017. The frequency of automated checks increased from 28.5% to 31.3% in 2003 among non-drivers and from 26.2% to 35.0% in 2017 among drivers. The percentage of drivers who said they were unable to vary time limits increase more over time compared with non-drivers.

#### 3.2.3. Work intensity, autonomy and margin of freedom

Overall, work intensity increased between 2003 and 2010, mainly among drivers, and then decreased between 2010 and 2017 (Table 3). The autonomy and room for initiatives improved for drivers and seem to have an improving margin of maneuver, but mistakes were more often considered to result in serious safety consequences in 2010 than in 2003. The percentage of drivers declaring they had to interrupt a task to do another unplanned task decreased from 2003 to 2017, whereas the percentage of non-drivers was higher and remained stable over time. In the event of an incident, the norm is to deal with the incident personally. While the global tendency is to deal with the incident personally for both exposed and unexposed employees, having to handle incidents personally, in specific situations that were planned in advance increase more in exposed salaries and reach 20%.

#### 3.2.4. Work organization and standards

Regardless of driving status, more than 80% of employees reported having sufficient clear information, appropriate equipment, appropriate training and number of colleagues or co-workers to carry out their work,

**Table 2**  
Working time characteristics and time constraints.

	SUMER 2003				SUMER 2010				SUMER 2017			
	Non-driver		Driver		Non-driver		Driver		Non-driver		Driver	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Worked > 40 h in previous week	25.7	25.3–26.2	44.7	43.8–45.7	24.4	23.7–25.2	42.3	40.8–43.7	25.1	24.0–26.2	38.3	36.2–40.5
Absent > 11 h from home for work	26.1	25.6–26.5	42.8	41.8–43.7	27.2	26.4–27.9	41.1	39.7–42.5	29.3	28.0–30.5	37.9	35.7–40.1
Work on Sundays or public holidays, even occasionally	31.2	30.7–31.7	32.4	31.5–33.3	32.9	32.1–33.7	33.4	32.0–34.8	34.6	33.3–36.0	36.5	34.3–38.7
Worked > 25 Sundays or public holidays in the last 12 months	26.9	26.0–27.8	14.1	12.9–15.3	25.7	24.4–27.0	16.0	14.0–18.0	27.5	25.2–29.9	17.0	13.9–20.2
Work on Saturdays, even occasionally	51.3	50.8–51.8	58.1	57.1–59.0	50.7	49.9–81.6	53.7	52.2–55.2	51.6	50.2–53.0	42.7	40.5–44.9
Worked > 30 Saturdays in the last 12 months	36.0	35.3–36.8	24.9	23.8–26.0	37.6	36.4–38.8	21.7	20.0–23.3	39.0	36.9–41.1	22.8	20.1–25.5
Work overnight, even occasionally	21.0	20.6–21.4	25.5	24.7–26.4	30.8	30.0–31.6	37.9	36.5–39.3	30.4	29.1–31.7	38.7	36.5–40.9
Worked two or more shifts per day	7.5	7.2–7.8	9.3	8.7–9.8	9.5	8.9–10.1	11.8	10.8–12.9	9.0	8.1–10.0	12.4	10.8–14.1
Work flexible hours	20.1	19.6–20.5	24.6	23.7–25.4	22.6	21.9–23.4	26.5	25.2–27.9	22.0	20.7–23.2	28.4	26.3–30.5
Know next day's work schedule	95.7	95.5–95.9	87.5	86.8–88.1	96.7	96.3–97.0	87.5	86.4–88.5	97.5	97.0–97.9	90.5	89.0–92.1
Know next week's work schedule	90.3	89.9–90.6	77.7	76.9–78.5	92.3	91.8–92.8	79.7	78.5–80.9	94.0	93.2–94.8	82.5	80.7–84.4
Know next month's work schedule	77.4	76.9–77.8	65.3	64.4–66.2	79.7	78.9–80.4	68.6	67.2–70.0	82.8	81.5–84.0	71.5	69.4–73.7
Overtime (always or often)	19.9	19.4–20.3	34.7	33.8–35.6	15.5	14.9–16.2	25.5	24.3–26.7	22.7	21.6–23.9	34.1	32.0–36.1
At least 48 consecutive hours off during the week	84.4	84.0–84.8	85.1	84.4–85.8	83.5	82.8–84.1	87.2	86.3–88.2	82.3	81.2–83.4	83.9	82.2–85.7
On-call duty as part of the job	8.9	8.6–9.2	15.7	15.0–16.4	6.8	6.5–7.2	14.6	13.6–15.6	6.6	5.9–7.3	13.0	11.6–14.3

with the percentages increasing over time (Table 4). The percentage of workers who reported having to follow strict quality procedures, increased from 38.7% and 32.0% in 2003 in non-drivers and drivers, respectively, to 44.8% and 43.3% in 2017.

### 3.2.5. Relationships and mental health at work

The percentage of employees who said that they were able to talk to their line manager if they encountered any disagreement about the way work was done increased in 2017, after a decrease in 2010 (Table 4). In contrast, a higher percentage of employees said that they could talk with colleagues in the event of disagreement about the way of work was done decreased in 2017.

The percentage of drivers who reported having experienced at least one episode of hostile behavior at work increased from 2003 to 2010 and then decreased in 2017. In 2003 and 2010 the most frequent psychological incidents involved a lack of recognition of work and in 2017 the most frequent was condescending attitude.

Among exposed employees, a drop from 20% to 16.5% in the reported prevalence of work-related verbal aggression from the public was observed between 2003 and 2010 and this remained stable in 2017. However, a small increase in physical or sexual aggression from the public was observed in 2017 among drivers.

### 3.2.6. Work-related psychosocial risk

The median psychological demand was 21.0 in 2003, 21.5 in 2010, and 21.1 in 2017 (Table 5) in the total population. The percentage of employees with high psychological demand increased between 2003 and 2010 and decreased in 2017, and this was slightly higher among non-drivers. The median of latitude decision decreased over time (70.0 in 2003, 69.7 in 2010, and 68.8 in 2017), with the non-drivers having much less autonomy than drivers. About 60% of employees were assessed to have low social support ( $\leq 23.4$ ), irrespective of driver status over the three surveys, with a trend to lower percentages in 2017.

Regarding the Job Content Questionnaire, about 40% of the drivers were in the 'active work' category, compared with fewer than 30% of non-drivers, and this was stable over time. The percentages of drivers and non-drivers in the job strain category increased over the years, with 22% of drivers in 2017 compared with 19% in 2003, and 36% of non-drivers in 2017 compared with 31% in 2003.

The percentages of drivers and non-drivers in the low reward category, based on the median reward scale score of the Siegrist model,

decreased in similar proportions between 2010 and 2017 (50.9% in 2010 and 47.9% in 2017 for drivers; 55% in 2010 and 50.8% in 2017 for non-drivers). This questionnaire was not included in the 2003 survey.

The percentage of drivers and non-drivers reported ongoing systematically hostile behavior on the part of one or more persons at work decreased between 2010 and 2017. The prevalence, however, was still higher in non-exposed employees (15.8% vs. 13.8%).

### 3.2.7. Health status

The perceived general health status of drivers improved from 2003 to 2010 but worsened between 2010 and 2017 (Table 5). The feeling that work negatively influenced health increased over the surveys (from 29% to 33%), although the percentages of those who reported job satisfaction increased from 89.7% in 2003, to 90.5% in 2010, and 92.5% in 2017.

The frequency of sick leave in the last 12 months increased more rapidly among drivers, from 24% in 2003 to 32% in 2017 compared with 30% and 34%, respectively, of non-drivers. The number of employees who reported accidents at work in the last 12 months slightly increased from 2003 to 2017 but remained less than 10% for both drivers and non-drivers.

### 3.2.8. Prevention in the workplace

The percentage of employees working for companies with a workplace health and safety committee (in French: *comité d'hygiène, de sécurité et des conditions de travail*: CHSCT) increased between 2003 and 2017 (Table 6). This was higher than the percentage of employees who worked in companies with more than 50 workers, the threshold above which a CHSCT is compulsory in France.

The indicators enabling the investigating occupational physician to assess the quality of work organization or measures to prevent exposure to physical constraints, chemical agents, or biological agents, show an overall improvement over time, without any real difference in relation to driving occupational exposure.

## 4. Discussion

### 4.1. Effect of the socio-demographic evolution of the professional drivers

With regard to socio-demographic parameters, in 2003 and 2010, three-quarters of drivers were men and the proportion of men increased significantly with the weekly length of driving (Fort et al., 2016). In

**Table 3**  
Work schedules and autonomy.

	SUMER 2003				SUMER 2010				SUMER 2017			
	Non-driver		Driver		Non-driver		Driver		Non-driver		Driver	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
More than 3 different work schedules	41.4	40.8–41.9	34.9	34.0–35.8	41.3	40.4–42.1	37.5	36.0–38.9	34.3	33.0–35.7	32.7	30.6–34.8
Work rhythm imposed by:												
automatic movement of a product or part	6.5	6.2–6.7	1.0	0.8–1.2	5.8	5.4–6.1	1.3	1.0–1.6	5.2	4.3–6.0	1.2	0.8–1.6
automatic rate of a machine	8.5	8.2–8.8	1.1	0.9–1.3	6.6	6.2–6.9	0.8	0.6–1.0	5.8	5.0–6.7	1.0	0.6–1.4
other technical constraints	17.9	17.5–18.3	16.5	15.8–17.2	15.6	15.0–16.3	14.6	13.4–15.7	13.0	12.0–14.0	11.1	9.8–12.4
immediate dependence on the work of one or more colleagues	32.6	32.1–33.1	24.7	23.8–25.5	29.5	28.7–30.3	23.3	21.9–24.7	26.7	25.5–28.0	19.7	18.0–21.3
production standards or deadlines to be met within one hour	21.9	21.5–22.4	16.6	15.9–17.4	22.6	21.9–23.3	19.0	17.9–20.2	19.5	18.3–20.7	16.7	14.9–18.4
production standards or deadlines to be met within one day	45.2	44.7–45.8	44.1	43.1–45.0	42.3	41.5–43.2	41.3	39.8–42.8	35.2	33.9–36.6	35.6	33.5–37.8
external request requiring immediate response	54.5	54.0–55.1	60.9	59.9–61.8	56.0	55.2–56.9	62.0	60.5–63.4	55.0	53.6–56.3	57.5	55.2–59.8
permanent (or at least daily) controls or supervision by the hierarchy	28.7	28.2–29.2	21.2	20.4–21.9	28.1	27.3–28.8	22.9	21.6–24.2	25.1	23.9–26.3	23.2	21.3–25.1
computerised control or monitoring	28.5	28.0–28.9	26.2	25.4–27.1	30.5	29.7–31.2	30.5	29.2–31.8	31.3	29.9–32.6	35.0	32.9–37.1
Having to interrupt a task frequently to do an unplanned task	58.7	58.2–59.3	56.4	55.4–57.3	57.1	56.3–58.0	54.2	52.7–55.7	60.3	58.8–61.7	52.4	50.1–54.7
Having to go faster to do the job (always, often)	40.7	40.2–41.3	40.0	39.1–41.0	39.4	38.6–40.3	36.4	35.0–37.8	38.0	36.5–39.4	32.4	30.3–34.4
Multi-tasking in jobs or functions												
regular rotation between jobs	19.8	19.3–20.2	17.4	16.7–18.1	20.5	19.8–21.2	16.9	15.7–18.1	22.1	20.8–23.4	18.8	17.0–20.6
changing jobs to cover for emergency or absence of a colleague	25.2	24.7–25.6	21.6	20.8–22.4	22.9	22.2–23.6	19.6	18.4–20.7	18.9	17.8–20.0	18.1	16.3–19.9
Inability to vary deadlines	38.5	37.9–39.0	31.7	30.8–32.6	37.6	36.8–38.4	31.6	30.2–32.9	42.3	40.8–43.7	39.0	36.7–41.3
Not being able to interrupt work momentarily when you want to	18.8	18.3–19.2	13.8	13.2–14.5	16.6	16.0–17.2	12.9	11.9–14.0	19.8	18.6–21.1	18.1	16.3–19.9
Having to take work home (always, often)	2.6	2.4–2.8	8.9	8.4–9.5	3.4	3.1–3.6	10.1	9.2–11.1	3.8	3.3–4.3	9.2	8.1–10.3
Autonomy and room for initiative												
Not able to change the order of tasks	16.1	15.7–16.5	10.9	10.3–11.5	14.4	13.8–14.9	9.8	8.9–10.6	14.4	13.3–15.6	11.8	10.3–13.3
Have to handle incidents personally	53.8	53.3–54.4	66.7	65.9–67.7	54.8	53.9–55.6	66.8	65.4–68.2	53.1	51.7–54.5	60.8	58.6–63.3
Have to handle incidents personally, in specific situations that were planned in advance	21.4	20.9–21.8	17.5	16.7–18.2	19.3	18.6–19.9	16.7	15.7–17.7	20.6	19.5–21.7	20.7	18.9–22.5

2017, more women had driving duties as part of their job. Many studies have shown that being male is a risk factor for road traffic accidents, including work-related road traffic accidents (Fort et al., 2010). Males are over-represented in the populations concerned by exposure to driving on company business and they travel more kilometers on company business than women (Salminen, 2000). Driving-exposed workers were older in 2017 than in 2003. For professional drivers, a higher risk of accident involvement for both younger and older drivers was already found (Duke et al., 2010).

#### 4.2. Effect of the working conditions of the professional drivers

This study highlights the specific working conditions of professional drivers.

Employees driving for work are more likely to work for small companies. According to a French national annual social report on road freight transport, companies with fewer than 50 workers accounted for 47% of the workforce in 2015 (Bilan social annuel du transport routier de marchandises – Édition 2018 | Données et études statistiques n.d.). This analysis of Sumer survey data confirmed that drivers are still particularly concerned by time constraints, even if there were fewer concerned in 2017 than in 2003 and 2010. Drivers work more frequently evenings or nights. Driving at night increases the risk of road traffic

accidents, and shift working increases the risk of accidents among workers going home (di Milia et al., 2012). An increased risk of road traffic accidents on mission was reported for workers operating at night, on weekends, or without two consecutive rest days and with working hours fixed by the company (Fort et al., 2010).

#### 4.3. Effect of the relationship at work

The psychosocial constraints assessed with the Job Content Questionnaire, according to the median values of 2003, evolved negatively between 2003 and 2010 and were stable between 2010 and 2017. Dehumanisation in interpersonal relationships (according to the depersonalization of work dimension of the Maslach Burnout Inventory scale) has been shown to be a risk factor for road accidents among teachers (Salvagioni et al., 2020). Although teachers are not exposed to occupational driving, this result may be applicable to other occupations where low social support and hostile behavior exist. Significant associations were found between socio-professional variables (type of jobs: taxi drivers, city bus drivers, and interurban bus drivers, number of hours worked per week) and key performance indicators, such as traffic violations and road accidents, among professional drivers in Bogota, Colombia (Useche et al., 2018a). In a recent study, perceived stress at work, while driving, has been shown to possibly increase self-reported

**Table 4**  
Organisation, work standards, relationships and mental health at work.

	SUMER 2003				SUMER 2010				SUMER 2017			
	Non-driver		Driver		Non-driver		Driver		Non-driver		Driver	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
To do your job properly, you usually have:												
sufficient, clear information	81.4	81.0–81.8	80.8	80.1–81.6	85.7	85.1–86.2	84.6	83.5–85.7	85.1	84.1–86.1	85.5	84.0–87.1
sufficient, appropriate equipment	79.0	78.6–79.5	80.7	80.0–81.5	83.8	83.3–84.4	84.4	83.3–85.5	83.8	82.8–84.9	85.7	84.2–87.2
sufficient and appropriate training	79.5	79.0–79.9	82.1	81.4–82.8	84.1	83.5–84.7	85.7	84.6–86.7	85.1	84.0–86.3	87.7	86.2–89.2
enough colleagues or collaborators	73.4	72.9–73.9	75.2	74.3–76.0	78.6	77.9–79.3	80.6	79.4–81.9	77.6	76.4–78.8	79.6	77.8–81.4
possibility to cooperate	92.7	92.4–93.0	93.6	93.1–94.0	93.5	93.1–93.9	92.9	92.0–93.7	92.7	91.9–93.5	93.2	91.8–94.6
Manage ≥ 1 person	24.5	24.1–25.0	34.5	33.5–35.4	22.1	21.4–22.8	31.3	29.9–32.7	21.2	20.2–22.3	28.3	26.4–30.2
Follow stringent quality procedures	38.7	38.2–39.3	32.0	31.1–32.9	50.0	49.1–50.9	49.7	48.2–51.2	44.8	43.4–46.2	43.3	41.0–45.5
Cannot discuss difficulties encountered with colleagues	1.4	1.3–1.5	1.3	1.0–1.5	4.5	4.2–4.9	5.8	5.1–6.6	6.0	5.2–6.7	6.0	4.6–7.4
Cannot discuss difficulties encountered with line managers	2.7	2.6–2.9	1.8	1.5–2.0	6.2	5.8–6.6	5.4	4.7–6.1	4.6	3.9–5.3	4.6	3.5–5.8
Direct oral or in-person contact with the public	64.3	63.8–64.8	86.8	86.1–87.4	70.0	69.3–70.8	87.2	86.1–88.2	66.1	64.7–67.4	88.6	87.1–90.0
Permanently deal with hostile behaviour	2.7	2.5–2.9	2.9	2.6–3.3	2.1	1.8–2.4	1.9	1.5–2.3	1.7	1.2–2.1	1.0	0.6–1.3
At least one current hostile behaviour	17.8	17.2–18.4	15.1	14.1–16.1	22.8	22.1–23.5	19.8	18.7–21.0	15.8	14.7–16.9	13.8	12.1–15.4
At least one contemptuous behaviour	6.8	6.4–7.2	5.1	4.5–5.7	8.4	7.9–8.9	6.4	5.6–7.1	11.0	10.1–11.9	10.0	8.4–11.5
At least one denial of recognition at work	9.1	8.7–9.6	8.3	7.6–9.1	11.5	11.0–12.1	10.9	10.0–11.7	9.7	8.8–10.6	8.9	7.6–10.3
At least one degrading behaviour	1.9	1.7–2.1	1.7	1.3–2.1	2.9	2.6–3.1	2.6	2.1–3.1	2.0	1.6–2.4	2.0	1.1–2.9
Have experienced from the public in the context of work:												
verbal aggression	16.4	15.8–17.0	20.3	19.2–21.4	14.4	13.7–15.1	14.4	13.4–15.3	16.4	15.1–17.7	16.5	14.4–18.7
physical aggression	1.5	1.3–1.7	1.7	1.4–2.1	1.5	1.3–1.8	1.7	1.3–2.0	1.7	1.2–2.2	2.2	1.5–2.9

risky driving behaviors among truck drivers (Delhomme & Gheorghiu, 2021). This stress was also closely linked with organizational factors and mental health.

4.4. Effect of the job strain for professional drivers

Although employees driving for work were generally less exposed to job strain than non-drivers, the percentage who were exposed increased from 2003 to 2017. A study among bus drivers showed that job strain was predictive of risky driving and more globally, one third of Colombian professional drivers were considered to have high levels of job strain (Useche et al., 2018a; Useche et al., 2017). Job strain was reported to be associated with traffic violation fines and as a risk factor for road traffic accidents among public transport drivers (Montoro et al., 2018; Useche et al., 2018b). Finally, lack of social support from supervisors was reported to be associated with road traffic accidents among bus drivers (Gómez-Ortiz et al., 2018).

4.5. Impact of road accidents on professional driver health

With regards to medical characteristics, drivers did not take more sick leave than non-drivers, and there was no difference in the average number of sick leave days between drivers and non-drivers in our study. However, more drivers reported at least one work-related accident requiring medical treatment in the last 12 months than non-drivers. This is consistent with the previously reported results, which have shown that road traffic accidents are more serious than other types of work-related accidents (Charbotel et al., 2003). The average number of years of life lost for a work-related road traffic accident was among the highest compared with other causes of fatal occupational accidents (Brière et al., 2010).

4.6. Effect of environmental and climatic factors on professional driver road safety

In addition to occupational exposures associated with risk of work-related road traffic accidents, climatic factors, such as extreme temperatures, may also be a risk among professional drivers, especially among those with higher exposure in terms of distance traveled and hours of driving in the work environment (Gariazzo et al., 2021). Climatic conditions can negatively affect fatigue and lassitude and increase difficulties in decision-making (Makowiec-Dąbrowska et al., 2019). As this type of risk is difficult to assess and manage, it is important to know more about the occupational exposure to these risks for professional drivers in order to minimize occupational road accident risks.

4.7. Effect of Covid-19 on road safety among professional drivers

Employees who drive are generally more exposed to other occupational constraints. These occupational inequalities have been amplified by the COVID-19 health crisis. Although the various lockdowns and curfews led to reductions in workers' mobility and a significant decrease in road traffic accidents, deleterious effects were also observed on driving behavior, with an increase in risky behaviors. Drivers were less affected by work-related lockdowns and curfews and thus continued to be exposed to occupational road traffic accident risks (Lin et al., 2021). The distance traveled by commercial vehicles fell by 20% in the United States for five weeks after mid-March 2020, but risky behaviors (such as speeding, and failure to obey traffic signs) increased (Teletrac-Navman, 2020). A reduction in road traffic accidents was also reported in Spain (Saladié et al., 2020) and Greece (Katrakazas et al., 2020). However, while a reduction in minor accidents was observed, this was not the case for serious or fatal accidents (Qureshi et al., 2020). The French Road Safety Observatory (Observatoire national interministériel de la sécurité routière: ONISR) reported that, while overall fatalities decreased by 29% from January to March 2021 compared with the average of the previous



**Table 5**  
Work-related psychosocial risk (Job Content Questionnaire) and health status.

	SUMER 2003				SUMER 2010				SUMER 2017			
	Non-driver		Driver		Non-driver		Driver		Non-driver		Driver	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
High psychological demand (≥21.1))	59.4	58.6–60.2	58.5	57.1–59.9	64.9	64.0–65.7	63.6	62.0–65.2	64.8	63.3–66.2	60.1	57.6–62.6
Low decision latitude (≤68.8)	53.5	52.8–54.3	35.0	33.6–36.3	56.5	55.6–57.4	38.2	36.7–39.7	55.8	54.3–57.3	39.4	37.1–41.8
Low social support (≤23.4)	65.1	64.3–65.9	64.3	62.9–65.6	65.2	64.3–66.1	64.5	62.9–66.1	61.2	69.7–62.7	59.3	56.9–61.7
Job strain	30.8	30.1–31.6	18.8	17.7–19.9	36.3	35.5–37.2	22.7	21.5–23.9	35.6	34.1–37.0	21.8	19.9–23.7
Isostrain	25.1	24.4–25.8	15.2	14.2–16.3	29.3	28.5–30.1	18.7	17.5–19.9	27.4	25.9–28.8	18.2	16.4–20.1
Level of work-related stress												
relaxed <sup>a</sup>	18.1	17.4–18.7	25.2	23.9–26.4	14.9	14.3–15.6	20.9	19.5–22.3	14.7	13.7–15.7	20.9	18.8–23.0
passive <sup>b</sup>	22.5	21.8–23.1	16.1	15.0–17.1	20.0	19.3–20.7	15.3	14.1–16.5	19.8	18.6–21.0	17.7	15.8–19.5
active <sup>c</sup>	28.6	27.9–29.4	39.9	38.6–41.4	28.7	27.9–29.5	41.2	39.6–42.7	29.9	28.5–31.3	39.6	37.4–41.9
stressed <sup>d</sup>	30.8	30.1–31.6	18.8	17.7–19.9	36.3	35.5–37.2	22.7	21.5–23.9	35.6	34.1–37.0	21.8	19.9–23.7
≥1 absence due to illness in the last 12 months	30.1	29.4–30.8	23.9	22.7–25.0	34.3	33.5–35.1	28.2	26.8–29.5	33.7	32.3–35.0	31.9	29.7–34.2
≥1 accident at work in the last 12 months	5.9	5.5–6.3	6.6	5.9–7.3	7.9	7.4–8.4	9.0	8.2–9.9	7.3	6.5–8.1	8.0	6.9–9.1
Job satisfaction (agree, strongly agree)	86.4	85.9–87.0	89.7	88.9–90.5	87.0	86.4–87.6	90.5	89.7–91.3	89.0	88.0–89.9	92.5	91.3–93.8
Influences of work on my health does not influence my health	48.7	47.9–49.5	44.4	43.0–45.8	55.4	54.5–56.3	51.2	49.6–52.7	50.5	49.0–52.0	43.6	41.2–46.0
generally good for my health	24.1	23.4–24.7	26.9	25.7–28.2	17.6	16.9–18.2	20.3	19.0–21.6	19.4	18.2–20.6	23.0	20.9–25.1
generally bad for my health	27.2	26.5–27.9	28.7	27.4–29.9	27.0	26.3–27.8	28.5	27.2–29.8	30.1	28.7–31.5	33.4	31.1–35.7
Low reward (11 items) (one scale of the Siegrist questionnaire) (≥17.9) <sup>e</sup>					55.0	54.1–55.9	50.9	49.4–52.4	50.8	49.3–52.3	47.9	45.5–50.3
Hostile behaviour												
At least one degrading behaviour	17,8	17,2–18,4	15,1	14,1–16,1	22,8	22,1–23,5	19,8	18,7–21,0	15,8	14,7–16,9	13,8	12,1–15,4
At least one contemptuous behaviour	6,8	6,4–7,2	5,1	4,5–5,7	8,4	7,9–8,9	6,4	5,6–7,1	11,0	10,1–11,9	10,0	8,4–11,5
At least one denial of recognition at work	9,1	8,7–9,6	8,3	7,6–9,1	11,5	11,0–12,1	10,9	10,0–11,7	9,7	8,8–10,6	8,9	7,6–10,3
At least one degrading behaviour	1,9	1,7–2,1	1,7	1,3–2,1	2,9	2,6–3,1	2,6	2,1–3,1	2,0	1,6–2,4	2,0	1,1–2,9

<sup>a</sup>Low psychological demand and high decision latitude.  
<sup>b</sup>Low psychological demand and low decision latitude.  
<sup>c</sup>High psychological demand and high decision latitude.  
<sup>d</sup>High psychological demand and low decision latitude.  
<sup>e</sup>Not available in Sumer 2003 survey.

**Table 6**  
Prevention in the workplace

	SUMER 2003				SUMER 2010				SUMER 2017			
	Non-driver		Driver		Non-driver		Driver		Non-driver		Driver	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Presence of a health, safety and working conditions committee* for this establishment	54.9	54.3–55.4	39.9	38.9–40.8	56.4	55.6–57.3	43.6	42.1–45.1	58.1	56.6–59.5	47.3	45.0–49.7
Occupational physician's assessment of quality of the work position in terms of occupational risks												
Poor or very poor work organisation	18.8	18.4–19.3	19.2	18.5–20.0	22.2	21.5–22.8	21.4	20.2–22.6	15.6	14.6–16.7	15.3	13.7–16.8
Poor or very poor prevention of exposure to physical constraints	29.5	29.0–30.1	27.1	26.2–28.0	34.4	33.5–35.3	32.4	30.9–34.0	22.5	21.1–23.9	21.6	19.4–23.8
Poor or very poor prevention of exposure to chemical agents	11.0	10.3–11.7	14.3	13.0–15.7	33.8	32.5–35.1	40.0	37.5–42.6	22.8	20.6–25.0	27.9	24.7–31.0
Poor or very poor prevention of exposure to biological agents	26.1	25.4–26.9	32.1	30.8–33.5	19.9	18.5–21.3	25.4	22.3–28.4	11.6	9.4–13.8	14.0	10.9–17.0

\*In French: comité d'hygiène, de sécurité et des conditions de travail (CHSCT).

5 years, fatalities following accidents involving heavy goods vehicles increased by 2% (ONISR, 2021).

4.8. Effect of working conditions and prevention actions on driver health

One intervention that frequently emerges in the literature is the

positive impact of road traffic accident prevention campaigns in the workplace, especially in companies that employ professional drivers (Lefio et al., 2018; Newnam & Watson, 2002). In Norway, representatives of the maritime sector said that responsibility for preventing occupational accidents need to be clearly defined, unlike representatives from the road sector who make more efforts to prevent accidents due to

the implementation of safety management systems (SMS) (Nævestad et al., 2021). In addition to driver training programs for workers that have shown their potential to reduce work-related accidents, programs that combine assessment and performance monitoring to manage road safety risks for about 95,000 workers in the telecommunications sector in the United Kingdom showed a 50% reduction in the company's collision rate and costs (Wallington et al., 2014). Another study reported that a good relationship between a manager or supervisor and employees positively influences safer work-related driving (Newnam et al., 2012). With the comparison of bus drivers in Norway and Greece, Nævestad concluded that a positive organizational safety culture may reduce aggressive violations in traffic (Nævestad et al., 2019).

In our study the assessment of the quality of the workplace in terms of various occupational risks found that about 15% of employees experienced poor or very poor quality of work organization and 25% experienced poor or very poor quality of prevention of exposure to physical constraints for both drivers and non-drivers. This suggests that risk prevention in these companies should be reconsidered. Companies can have an impact on the organization of work, on the safety of the professional travel, and the quality of the means (e.g., the safe and well-maintained vehicles, the appropriate use of communication and remote communication techniques). They can also have an impact on the management of human resources (e.g., recruitment, training, information and on the quality of relationships between managers and employees). Particular attention should be paid to the choice of vehicle and its equipment to ensure that it satisfies a certain number of minimum requirements for the safety of the driver.

In France, the National Research and Safety Institute for the Prevention of Occupational Accidents and Diseases (In French: *Institut national de recherche et de sécurité pour la prévention des accidents du travail et des maladies professionnelles INRS*) has produced practical recommendations for reducing the risk of work-related road traffic accidents to protect the health and safety of professional drivers (INRS, 2019, 2021). Their risk assessment guide can be used to identify work-related journeys, to measure the number of accidents, to analyze the organization of journeys, the fleet management, communication practices and needs, and the management of skills related to the use of vehicles. The guide classifies road accident risk factors according to four dimensions (i.e., journeys, skills, vehicles and communication) and implements an action plan (i.e., travel management, fleet management, communication management and skills management). It has recently been reported that when safety at work was the highest priority in the organization of work, then the risk of work-related road traffic accidents was reduced (Malka et al., 2018). In contrast, when customer satisfaction was the most important priority in work organization, even an increased prioritization of road safety in work organization was not associated with a decrease in road traffic accidents. The French Ministry of Labour and the Ministry of the Interior, together with the National Health Insurance (In French: *Caisse nationale d'assurance maladie, CNAM*), the Agricultural Health Insurance (In French: *Mutualité sociale Agricole, MSA*), the French Public Health Authority (In French: *Santé publique France*), and the Gustave Eiffel University, have developed a communication campaign with an infographic presenting the key figures relating to this risk, which remains the leading cause of death at work (Ministère du Travail, 2020). There are four areas of management proposed to reduce occupational road accident risk: organizing travel, choosing and maintaining vehicles, organizing communications and training all company players. Finally, the French National Health Insurance (In French: *Caisse Nationale d'Assurance Maladie des Travailleurs Salariés, CNAM/TS*) offers training in the safe use of light commercial vehicles for professional drivers and a reference framework of skills (*L'assurance maladie - Risques professionnels, n.d.-a, L'assurance maladie - Risques professionnels, n.d.-b*).

## 5. Conclusion

The percentage of employees exposed to occupational road accident

risk (i.e., exposure to work-related driving) remained stable at about 25% in 2017 compared with previous surveys. These employees were also more frequently exposed to sustained work schedules and physical constraints, but less exposed to psychosocial risks. In the private sector, most exposures to physical constraints fell between 1994 and 2017 (Memmi et al., 2019). These exposures to physical risks are part of an organizational context that remains highly constrained. Work intensity has increased over the past 20 years, although it stabilized between 2010 and 2017. Although the initiative and freedom that fosters autonomy at work is declining, employees in 2017 are less likely than in 2003 to say they lack the means to do their job properly. After peaking in 2010, reports of hostile behaviors in 2017 returned to 2003 levels, while tension at work stabilized at a high level, and gaps between employees widened in terms of lack of recognition at work.

It is necessary that campaigns for prevention of occupational road accident risk should be provided to all employees and all companies because the risk exists in all sectors of activity. Recent changes in the French labor legislation, with the creation of the social and economic committee to replace the former health and safety committee, and the requirement for companies with 11 or more employees to set up such a committee (versus 49 for previous HSC), could be a step forward in the implementation of road safety considerations in small companies. Indeed, less than a half of the exposed workers were covered by formal occupational risk prevention practices versus 58% for non-exposed employees.

## Data

This study obtained approval use of Sumer surveys data from ADISP (National Archive of Data from Official Statistics) under the number 19462. Databases used were:

- Surveillance médicale des expositions aux risques professionnels (SUMER) – 2017, DARES Ministère du Travail et de l'Emploi [producteur], ADISP [diffuseur].
- Surveillance médicale des expositions aux risques professionnels (SUMER) – 2010, DARES Ministère du Travail et de l'Emploi [producteur], ADISP [diffuseur].
- Surveillance médicale des risques professionnels (SUMER) – 2003, DARES – Ministère du Travail et de l'Emploi [producteur], ADISP [diffuseur].

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## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## References

- Anund, A., Fors, C., Ihlström, J., & Kecklund, G. (2018). An on-road study of sleepiness in split shifts among city bus drivers. *Accident Analysis and Prevention*, 114, 71–76. <https://doi.org/10.1016/j.aap.2017.05.005>
- Arnaudo, B., Magaud-Camus, I., Sandret, Nicolas., Coutrot, Thomas., Flourey, M. C., Guignon, N., Hamon-Cholet, S., & Waltisperger, D. (2004). L'exposition aux risques et aux pénibilités du travail de 1994 à 2003. Premiers résultats de l'enquête SUMER 2003. In *Premières Synthèses* (Vols. 52–1). [http://travail-emploi.gouv.fr/IMG/pdf/publication\\_pips\\_200412\\_n-52-1\\_exposition-risques-penibilites-travail.pdf](http://travail-emploi.gouv.fr/IMG/pdf/publication_pips_200412_n-52-1_exposition-risques-penibilites-travail.pdf).
- Brière, J., Chevalier, A., & Imbernon, E. (2010). Surveillance of fatal occupational injuries in France: 2002–2004. *American Journal of Industrial Medicine*, 53(11), 1109–1118. <https://doi.org/10.1002/AJIM.20874>
- Caisse nationale de l'assurance maladie des travailleurs salariés Direction des risques professionnels. (n.d.-a). *Rapport de gestion Branche Accidents du travail et maladies professionnelles - 2008*. Retrieved October 30, 2023, from <https://assurance-maladie.ameli.fr/etudes-et-donnees/2008-rapport-annuel-assurance-maladie-risques-professionnels>.
- Caisse nationale de l'assurance maladie des travailleurs salariés Direction des risques professionnels. (n.d.-b). *Rapport de gestion Branche Accidents du travail et maladies professionnelles - 2010*. Retrieved October 9, 2023, from <https://assurance-maladie>.

- ameli.fr/sites/default/files/2011-12\_rapport-de-gestion-2010-risques-professionnels\_assurance-maladie.pdf.
- Caisse nationale de l'assurance maladie des travailleurs salariés Direction des risques professionnels. (n.d.-c). *Rapport de gestion Branche Accidents du travail et maladies professionnelles - 2018*. Retrieved October 30, 2023, from [https://assurance-maladie.ameli.fr/sites/default/files/2019-12\\_rapport-annuel-2018-risques-professionnels\\_assurance-maladie.pdf](https://assurance-maladie.ameli.fr/sites/default/files/2019-12_rapport-annuel-2018-risques-professionnels_assurance-maladie.pdf).
- Caisse nationale de l'assurance maladie des travailleurs salariés Direction des risques professionnels. (n.d.-d). *Rapport de gestion Branche Accidents du travail et maladies professionnelles - 2022*. Retrieved November 16, 2023, from [https://assurance-maladie.ameli.fr/sites/default/files/rapport\\_annuel\\_2021\\_de\\_l'assurance\\_maladie\\_-\\_risques\\_professionnels\\_novembre\\_2022\\_0.pdf](https://assurance-maladie.ameli.fr/sites/default/files/rapport_annuel_2021_de_l'assurance_maladie_-_risques_professionnels_novembre_2022_0.pdf).
- Cardoso, J., Mota, E., Rios, P., & Ferreira, L. (2020). Associated factors from loss productivity among people involved in road traffic accident: A prospective study. *Revista Brasileira de Epidemiologia = Brazilian Journal of Epidemiology*, 23. <https://doi.org/10.1590/1980-549720200015>
- Centers for Disease Control and Prevention. (2003). Ambulance crash-related injuries among Emergency Medical Services workers—United States, 1991–2002. In *Morbidity and Mortality Weekly Report (MMWR)*, (Vol. 52, pp. 154–156). <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5208a3.htm>.
- Charbotel, B., Martin, J. L., & Chiron, M. (2010). Work-related versus non-work-related road accidents, developments in the last decade in France. *Accident Analysis and Prevention*, 42, 604–611.
- Charbotel, B., Martin, J. L., Gadegebku, B., & Chiron, M. (2003). Severity factors for truck drivers' injuries. *American Journal of Epidemiology*, 158, 753–759. <https://doi.org/10.1093/aje/kwg200>
- Chiron, M., Bernard, M., Lafont, S., & Lagarde, E. (2008). Tiring job and work related injury road crashes in the GAZEL cohort. *Accid Anal Prev*, 40, 1096–1104. [http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list\\_uids=18460378](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=18460378).
- Coutrot, T., Flouy, M.-C., Guignon, N., Hamon-Cholet, S., Waltisperger, D., Arnaudo, B., Magaud-Camus, I., & Sandret, N. (2006). L'exposition aux risques et aux pénibilités du travail de 1994 à 2003. In *Conditions de travail et relations professionnelles*. <http://www.insee.fr/fr/fic/docs/fic/DONSOC06yr.PDF>.
- Crague, G. (2003). *Des lieux de travail de plus en plus variables et temporaires*. In *Economie et Statistique (Vols. 369–370)*, 191–212.
- Delhomme, P., & Gheorghiu, A. (2021). Perceived stress, mental health, organizational factors, and self-reported risky driving behaviors among truck drivers circulating in France. *Journal of Safety Research*, 79, 341–351. <https://doi.org/10.1016/J.JSR.2021.10.001>
- Demoli, Y. (2014). Les femmes prennent le volant. *Travail, Genre et Sociétés*, 32(32), 119–140. <https://doi.org/10.3917/TGS.032.0119>
- di Milia, L., Rogers, N. L., & Åkerstedt, T. (2012). Sleepiness, Long Distance Commuting and Night Work as Predictors of Driving Performance. *Plos One*, 7, e45856.
- Direction de l'animation de la recherche, des études et des statistiques (DARES). (2006). *Les expositions aux risques professionnels. Les ambiances et contraintes physiques. Résultats SUMER 2003. : Vol. Document d*.
- Duke, J., Guest, M., & Boggess, M. (2010). Age-related safety in professional heavy vehicle drivers: A literature review. *Accident Analysis & Prevention*, 42, 364–371. <https://doi.org/10.1016/j.aap.2009.09.026>
- Fort, E., Gadegebku, B., Gat, E., Pelissier, C., Hours, M., & Charbotel, B. (2019). Working conditions and risk exposure of employees whose occupations require driving on public roads – Factorial analysis and classification. *Accident Analysis and Prevention*, 131, 254–267. <https://doi.org/10.1016/j.aap.2019.07.001>
- Fort, E., Daveziez, P., Chiron, M., Bergeret, A., & Charbotel, B. (2013). Driving behaviors and on-duty road accidents: A French case-control study. *Traffic Injury Prevention*, 14 (4), 353–359. <https://doi.org/10.1080/15389588.2012.719091>
- Fort, E., Ndagire, S., Gadegebku, B., Hours, M., & Charbotel, B. (2016). Working conditions and occupational risk exposure in employees driving for work. *Accident Analysis and Prevention*, 89, 118–127. <https://doi.org/10.1016/j.aap.2016.01.015>
- Fort, E., Pourcel, L., Daveziez, P., Renaux, C., Chiron, M., & Charbotel, B. (2010). Road accidents, an occupational risk. *Safety Sciences*, 48(10), 1412–1420. <https://doi.org/10.1016/j.ssci.2010.06.001>
- Gariazzo, C., Bruzzone, S., Finardi, S., Scortichini, M., Veronico, L., & Marinaccio, A. (2021). Association between extreme ambient temperatures and general indistinct and work-related road crashes. A nationwide study in Italy. *Accident Analysis and Prevention*, 155. doi: 10.1016/j.aap.2021.106110.
- Gómez-Ortiz, V., Cendales, B., Useche, S., & Bocarejo, J. P. (2018). Relationships of working conditions, health problems, and vehicle accidents in bus rapid transit (BRT) drivers. *American Journal of Industrial Medicine*, 61(4), 336–343. <https://doi.org/10.1002/ajim.22821>
- Gray, S. E., Gabbe, B. J., & Collie, A. (2020). Work absence due to compensable RTCs in Victoria. *Australia. Injury Prevention*, 26(1), 11–17. <https://doi.org/10.1136/injuryprev-2018-043019>
- Guignon, N., Niedhammer, I., & Sandret, N. (2008). Les facteurs psychosociaux au travail. Une évaluation par le questionnaire de Karasek dans l'enquête SUMER 2003. *Document Pour Le Médecin Du Travail*, 115, 389–398. <http://www.google.fr/url?sa=t&rct=j&q=&esrc=s&source=web&cd=6&ved=0CFAQFjAF&url=http%3A%2F%2Fwww.inrs.fr%2Faccueil%2Ffms%2Ffms%2FCataloguePapier%2FDMT%2FTI-TF-175%2Ftf175.pdf&ei=fDXUq3XFYjQ0Wu6IdgDg&usq=AFQjCNHPNywjBNrfw2jyOe91NjgRqCga6Q&bvm=bv.5956812>
- Havet, N., & Penot, A. (2022). Trends in exposures to physically demanding working conditions in France in 2003, 2010 and 2017. *European Journal of Public Health*, 32 (1), 73–79. <https://doi.org/10.1093/eurpub/ckab195>
- Inrs. (2019). Le risque routier, un risque professionnel à maîtriser. *ED*, 6352. <http://www.inrs.fr/media.html?refINRS=ED%206352>.
- INRS. (2021). *Agir pour réduire les risques d'accident de la route des salariés*. <https://www.inrs.fr/dms/inrs/CataloguePapier/ED/TI-ED-6462/ed6462.pdf>.
- Kahn, C. A., Pirrallo, R. G., & Kuhn, E. M. (2001). Characteristics of fatal ambulance crashes in the United States: An 11-year retrospective analysis. *Prehosp Emerg Care*, 5, 261–269.
- Karasek, R. (1985). *Job Content Questionnaire and User's Guide*. Los Angeles, CA: Department of Industrial and Systems Engineering, University of Southern California.
- Karasek, R. A. (1979). Job Demands, Job Decision Latitude, and Mental Strain: Implications for Job Redesign. *Administrative Science Quarterly*. <https://doi.org/10.2307/2392498>
- Katrakazas, C., Michelaraki, E., Sekadakis, M., & Yannis, G. (2020). A descriptive analysis of the effect of the COVID-19 pandemic on driving behavior and road safety. *Transportation Research Interdisciplinary Perspectives*, 7, Article 100186. <https://doi.org/10.1016/j.trip.2020.100186>
- L'assurance maladie - Risques professionnels. (n.d.-a). *Fiche descriptive de la formation type à l'usage professionnel d'un VUL*. Retrieved January 23, 2023, from <https://www.ameli.fr/content/fiche-descriptive-de-la-formation-type-lusage-professionnel-dun-vul>.
- L'assurance maladie - Risques professionnels. (n.d.-b). *Prévention du risque routier*. Retrieved January 23, 2023, from <https://www.ameli.fr/entreprise/sante-travail/risques/risque-routier>.
- Lefio, A., Bachelet, V. C., Jiménez-Paneque, R., Gomolán, P., & Rivas, K. (2018). A systematic review of the effectiveness of interventions to reduce motor vehicle crashes and their injuries among the general and working populations. In *Revista Panamericana de Salud Publica/Pan American Journal of Public Health* (Vol. 42). Rev Panam Salud Publica. doi: 10.26633/rpsp.2018.60.
- Lesuffleur, T., Chastang, J. F., Sandret, N., & Niedhammer, I. (2015). Psychosocial factors at work and occupational injury: Results from the French National SUMER Survey. *Journal of Occupational and Environmental Medicine*, 57(3), 262–269. <https://doi.org/10.1097/JOM.0000000000000345>
- Lin, L., Shi, F., & Li, W. (2021). Assessing inequality, irregularity, and severity regarding road traffic safety during COVID-19. *Scientific Reports*, 11(1), 13147. <https://doi.org/10.1038/s41598-021-91392-z>
- Llamazares, J., Useche, S. A., Montoro, L., & Alonso, F. (2021). Commuting accidents of Spanish professional drivers: When occupational risk exceeds the workplace. *International Journal of Occupational Safety and Ergonomics*, 27(3), 754–762. <https://doi.org/10.1080/10803548.2019.1619993>
- Makowiec-Dąbrowska, T., Gadzicka, E., Siedlecka, J., Szykowska, A., Viebig, P., Kozak, P., & Bortkiewicz, A. (2019). Climate conditions and work-related fatigue among professional drivers. *International Journal of Biometeorology*, 63(2), 121–128. <https://doi.org/10.1007/s00484-018-1643-y>
- Malka, R. A., Leibovitz-Zur, S., & Naveh, E. (2018). Employee safety single vs. dual priorities: When is the rate of work-related driving accidents lower? *Accident Analysis & Prevention*, 121, 101–108. <https://doi.org/10.1016/J.AAP.2018.08.020>
- Maynard, S., Filtness, A., Miller, K., & Pilkington-Cheney, F. (2021). Bus driver fatigue: A qualitative study of drivers in London. *Applied Ergonomics*, 92. <https://doi.org/10.1016/j.apergo.2020.103309>
- McCartt, A., Rohrbach, J., Hammer, M., & Fuller, S. (2000). Factors associated with falling asleep at the wheel among long-distance truck drivers. *Accident Analysis & Prevention*, 32, 493–504. [https://doi.org/10.1016/S0001-4575\(99\)00067-6](https://doi.org/10.1016/S0001-4575(99)00067-6)
- Memmi, S., Rosankis, É., Sandret, N., Duprat, P., Léonard, M., Morand, S., & Tassy, V. (2019). *Premiers résultats de l'enquête SUMER 2017 : comment ont évolué les expositions des salariés aux risques professionnels sur les vingt dernières années ? (159; RÉFÉRENCES EN SANTÉ AU TRAVAIL)*. <https://www.inrs.fr/media.html?refINRS=TF%20273>.
- Ministère du Travail, de l'Emploi et de l'Insertion. (2020). *Risque routier professionnel : des chiffres-clés pour sensibiliser à la première cause de mortalité au travail*. [https://travail-emploi.gouv.fr/IMG/pdf/infographie\\_risque\\_routier\\_2020.pdf](https://travail-emploi.gouv.fr/IMG/pdf/infographie_risque_routier_2020.pdf).
- Montoro, L., Useche, S., Alonso, F., & Cendales, B. (2018). Work environment, stress, and driving anger: A structural equation model for predicting traffic sanctions of public transport drivers. *International Journal of Environmental Research and Public Health*, 15(3). <https://doi.org/10.3390/ijerph15030497>
- Nævestad, T. O., Elvebakk, B., & Ranestad, K. (2021). Work-related accident prevention in norwegian road and maritime transport: Examining the influence of different sector rules. *Infrastructures*, 6(5). <https://doi.org/10.3390/INFRASTRUCTURES6050072>
- Nævestad, T. O., Phillips, R. O., Laiou, A., Bjørnskau, T., & Yannis, G. (2019). Safety culture among bus drivers in Norway and Greece. *Transportation Research Part F: Traffic Psychology and Behaviour*, 64, 323–341. <https://doi.org/10.1016/j.trf.2019.05.006>
- Newman, S., Lewis, I., & Watson, B. (2012). Occupational driver safety: Conceptualising a leadership-based intervention to improve safe driving performance. *Accident Analysis and Prevention*, 45, 29–38. <https://doi.org/10.1016/J.AAP.2011.11.003>
- Newman, S., & Watson, B. C. (2002). *A comparison of the factors influencing the safety of work-related drivers in work and personal vehicles*. [https://www.researchgate.net/publication/27464435\\_A\\_comparison\\_of\\_the\\_factors\\_influencing\\_work-related\\_drivers\\_in\\_work\\_and\\_personal\\_vehicle](https://www.researchgate.net/publication/27464435_A_comparison_of_the_factors_influencing_work-related_drivers_in_work_and_personal_vehicle).
- Niedhammer, I., David, S., Degioanni, S., & travail, 143 Médecins du. (2006). [The French version of the Leymann's questionnaire on workplace bullying: the Leymann Inventory of Psychological Terror (LIPT)]. *Revue d'Epidémiologie et de Santé Publique*, 54, 245–262. doi: 10.1016/S0398-7620(06)76720-7.
- Niedhammer, I., Lesuffleur, T., Labarthe, G., & Chastang, J. F. (2018). Role of working conditions in the explanation of occupational inequalities in work injury: Findings from the national French SUMER survey. *BMC Public Health*, 18(1). <https://doi.org/10.1186/s12889-018-5254-7>

- ONISR. (2021). *Impact monitoring of the health crisis - First quarter of 2021 (1 January - 31 March)*. [https://www.onisr.securite-routiere.gouv.fr/sites/default/files/2021-04/2021\\_Q1\\_M\\_Dashboard\\_Covid.pdf](https://www.onisr.securite-routiere.gouv.fr/sites/default/files/2021-04/2021_Q1_M_Dashboard_Covid.pdf).
- Qureshi, A. I., Huang, W., Khan, S., Lobanova, I., Siddiq, F., Gomez, C. R., & Suri, M. F. K. (2020). Mandated societal lockdown and road traffic accidents. *Accident Analysis and Prevention*, 146, Article 105747. <https://doi.org/10.1016/j.aap.2020.105747>
- Saladié, Ó., Bustamante, E., & Gutiérrez, A. (2020). COVID-19 lockdown and reduction of traffic accidents in Tarragona province. *Spain. Transportation Research Interdisciplinary Perspectives*, 8, Article 100218. <https://doi.org/10.1016/j.trip.2020.100218>
- Salminen, S. (2000). Traffic accidents during work and work commuting. *International Journal of Industrial Ergonomics*, 26, 75–85. [https://doi.org/10.1016/S0169-8141\(00\)00003-2](https://doi.org/10.1016/S0169-8141(00)00003-2)
- Salvagioni, D. A. J., Mesas, A. E., Melanda, F. N., dos Santos, H. G., González, A. D., Giroto, E., & de Andrade, S. M. (2020). Prospective association between burnout and road traffic accidents in teachers. *Stress and Health*, 36(5), 629–638. <https://doi.org/10.1002/smi.2958>
- Siegrist, J., Dagmar, S., Chandola, T., Godin, I., Marmot, M., Niedhammer, I., & Peter, R. (2004). The measurement of effort–reward imbalance at work: European comparisons. *Social Science & Medicine*, 58, 1483–1499. [https://doi.org/10.1016/S0277-9536\(03\)00351-4](https://doi.org/10.1016/S0277-9536(03)00351-4)
- Teletrac-Navman. (2020). *The Impact of the COVID-19 Crisis on Driving Behaviors*. <https://www.teletracnavman.com/resources/resource-library/infographics/covid-19-crisis-on-driving-behavior-infographic>.
- Useche, S. A., Cendales, B., Montoro, L., & Esteban, C. (2018). Work stress and health problems of professional drivers: A hazardous formula for their safety outcomes. *PeerJ*, 2018(12). <https://doi.org/10.7717/peerj.6249>
- Useche, S. A., Gómez, V., Cendales, B., & Alonso, F. (2018). Working Conditions, Job Strain, and Traffic Safety among Three Groups of Public Transport Drivers. *Safety and Health at Work*, 9(4), 454–461. <https://doi.org/10.1016/j.shaw.2018.01.003>
- Useche, S. A., Ortiz, V. G., & Cendales, B. E. (2017). Stress-related psychosocial factors at work, fatigue, and risky driving behavior in bus rapid transport (BRT) drivers. *Accident Analysis and Prevention*, 104, 106–114. <https://doi.org/10.1016/j.aap.2017.04.023>
- van der Vlegel, M., Haagsma, J. A., de Munter, L., de Jongh, M. A. C., & Polinder, S. (2020). Health care and productivity costs of non-fatal traffic injuries: A comparison of road user types. *International Journal of Environmental Research and Public Health*, 17(7). <https://doi.org/10.3390/IJERPH17072217>
- Wallington, D., Murray, W., Darby, P., Raeside, R., & Ison, S. (2014). Work-related road safety: Case study of British Telecommunications (BT). *Transport Policy*, 32, 194–202. <https://doi.org/10.1016/J.TRANPOL.2014.01.002>