Working conditions and risk exposure of employees whose occupations require driving on public roads - Factorial analysis and classification

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Contents lists available at ScienceDirect

Accident Analysis and Prevention

journal homepage: www.elsevier.com

Working conditions and risk exposure of employees whose occupations require driving on public roads – Factorial analysis and classification

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ARTICLE INFO

Keywords:
Driving exposure
Working conditions
Multiple correspondence analysis
Occupational road risk
Ascending hierarchical classification

ABSTRACT

Introduction: Several studies of the working conditions of drivers, and in particular on their pace of work, have enabled a better understanding of the risk factors for road accidents that occur during work. However, few studies are available on the risk exposure and working conditions of employees whose occupations involve driving. The purpose of this paper is to identify the different groups of employees occupationally exposed to road risk and to classify them according to working conditions.

Methodology: A Multiple Correspondence Analysis (MCA) was implemented on the 41,727 individuals from the SUMER 2010 survey (Medical Monitoring of Occupational Risk Exposure: *SUrveillance Médicale des Expositions aux Risques professionnels*) and for 45 variables about working conditions. The analysis used 5 categories of weekly driving exposure as a supplementary variable (variable which is not used to perform the MCA): Non-exposure; Exposed <2 h; Exposed 2–10 hours; Exposed 10–20 hours; and Exposed >20 h. The results of the MCA were used to construct an ascending hierarchical classification.

Results: The first factorial axis differentiates between conventional and unconventional work schedules. Axis 2 differentiates modalities corresponding to the working hours of the most recent working week. The third axis chiefly contrasts persons who have rules to follow with those who have none. An ascending hierarchical classification distinguishes 10 clusters of individuals according to working conditions. Four clusters of employees were excessively exposed to occupational driving. Clusters also have distinct demographic, occupational and psychosocial characteristics.

Conclusion: Analysis of data from the SUMER survey confirms that employees exposed to road risk are particularly affected by atypical work time characteristics, but can be found in all activity sectors and in all types of job.

1 What is already known about this subject?

About a quarter of employees are exposed to occupational road driving. Employees exposed to road risk have been very little studied so far. A limited number of published studies examined the linkage between working conditions and work-related road exposure.

2 What are the new findings?

We distinguished 10 clusters of individuals according to working conditions. These clusters also differ from one another in driving exposure.

There are several clusters of employees who are exposed to road risk at work and who have various organizational constraints, in terms of work time contraints, work rhythms, autonomy, collective work, standards and evaluation, and public contact.

Pressures related to the pace of work are mostly observed in employees not exposed to driving, except for demands from outside that require an immediate response. Job strain is also more prevalent in the clusters with low driving exposure.

3 How might it impact on clinical practice in the foreseeable future?

The prevention provided by the occupational physician should be directed towards employees who have occupational driving exposure and who are not professional drivers.

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https://doi.org/10.1016/j.aap.2019.07.001
Received 28 June 2018; Received in revised form 4 July 2019; Accepted 5 July 2019
Available online xxx
0001-4575/

1. Introduction

In France, employees are increasingly exposed to road risk. The National Institute of Statistics and Economic Studies (*Institut National de la Statistique et des Etudes Economiques*: INSEE) reported an increase in the number of employees driving on duty between 1981 and 1993 (Cragues, 2003). Occupational driving is increasing more rapidly among women (from 9% in 1994 to 15% in 2003) than men (from 34% in 1994 to 36% in 2003) (Coutrot et al., 2006). Very few studies have been done on employees exposed to occupational road risk. The few publications available showed that certain occupational pressures were liable to be risk factors for work-related accidents (Charbotel et al., 2001; Fort et al., 2010; Robb et al., 2008).

A descriptive analysis of data from the SUMER 2010 survey (Medical Monitoring of Occupational Risk Exposure: *SUrveillance Médicale des Expositions aux Risques professionnels*) (Fort et al., 2016) gave a clear picture of employees' occupational exposure to driving and stress. More than one quarter (26.4%) were exposed to driving. This analysis confirmed that employees exposed to occupational driving were particularly subject to organizational pressures. Their weekly working hours were greater in magnitude and range. They often worked evenings, nights, weekends or public holidays. Employees exposed to occupational driving worked on average 38.2 h a week compared to 35.1 h a week for employees who did not drive as part of their occupation. Analysis of driving exposure showed a diversity of occupations. Among employees exposed to driving, « Professional drivers » is the third socio-occupational category (SOC) in terms of frequency (11%), behind skilled workers (17%) and business executives (14%). Professional drivers (PCS 2-digits: 64; truck, transit vehicle or light truck drivers) nevertheless accounted for almost half of employees exposed to occupational driving during 20 h or more per week. Psychosocial pressures, on the other hand, seemed to be less pronounced among occupational drivers. In general, the decision latitude of employees exposed to driving appeared to be significantly greater, and individuals exposed to driving had a better feeling of job reward than those who were not exposed (Fort et al., 2014).

The main objective of this study was to extend the earlier analyses in order to provide a typology of the individuals in the SUMER 2010 data based upon their responses across multiple working conditions variables. Another objective was to characterize the different types of clusters thereby identified. Thus, the study will show if there is one or several clusters of employees with specific work conditions who were exposed to on duty road risk and study them.

2. Material and methods

2.1. Study population

The study population comprised the 41,727 individuals from the SUMER 2010 survey. The SUMER survey *(Surveillance Médicale des Expositions aux Risques Professionnels*: medical survey of occupational risk exposure) is a tool for evaluating the organizational demands and physical, psychological, biological and chemical occupational exposures to which employees are subject (Lesuffleur et al., 2014). The project was overseen by the General Directorate of Labor *(Direction générale du travail,* DGT) and the Directorate for Research, Studies and Statistics *(Direction de l'animation de la recherche,* DARES) within the Ministry of Labor, Employment, Vocational Training and Labor Relations *(Ministère du Travail, de l'Emploi, de la Formation Professionnelle et du Dialogue Social)*. The sampling from the population of French employees is a cluster sampling: recruitment of occupational physicians on a voluntary basis, followed by a random sampling among employees followed by each doctor from the employees seen during periodic visits, according to a defined procedure. The survey covered almost 92% of French employees, or about 22 million workers.

2.2. Study data

A questionnaire completed by the occupational health physicians contained variables on the employee's characteristics (gender, age, nationality, job status, seniority, socio-occupationnal category), characteristics of the employing establishment (number of employees per site, number of employees per company, activity sector) and organizational and relational work constraints.

These constraints can be divided into 6 groups of variables:

- Work time characteristics variables (daily work hour [AMPLITUDE], On-call [ASTREINTE], Choice of type of work time [CHOIX TEMPS], work on Sunday or public holiday [DIMFER], Work in team [EQUIP], Full-time work [FULL TIME], number of hour worked last week [HH], variable work schedule [HORVAR], sleep away from home [LOIN], Knowledge of schedules one month in advance [MONTH], Work at night [NIGHT], Actual work more than scheduled [RAB], More than 48 h's rest in a row [REPOS48], saturday work [SAT], Knowledge of schedules one week in advance [SEM], evening work |SOIR], Knowledge of schedules three months in advance [TRIM]);
- Work rhythm (Frequent need to interrupt task to perform another, unforeseen [DEBORD], Possibility to change deadlines [DELAI], Haste needed to perform work [DEPECH], Possibility of momentary work interruption when one wishes [INTERUPT], Hold different posts or positions [POLY], Work pace determined by close reliance on colleagues' work [RWCOLEG], Work pace determined by external demand [RWDEM], Work pace determined by monitoring or computer tracking [RWINFOR], Work pace determined by production standards. or deadlines to be met in 1 h at most [RWNORMH], Work pace determined by production standards. or deadlines to be met in one day at most [RWNORMJ], Work pace determined by daily or continuous managerial checks or monitoring [RWSURV], Work pace determined by other technical constraints [RWTEC]);
- Autonomy and scope for initiative [ORD];
- Collective work group (Number of colleagues or collaborators enough [CORCO], Adequate and suitable training [CORFORM], Clear and adequate information [CORINF], Suitable and adequate material resources [CORMOY], Personnel under their orders [CHEF]);
- Standards and evaluations (Follow strict quality procedures [CERTISO], Have at least one individual assessment interview per year [EVA], Must achieve exact numerical targets [OBJ], Risk to product or service quality in case of error [RISQUAL], Financial risk in case of error [RISFINA], Risk of danger in case of error [RISDANG], Risk to employment in case of error [RISEMPL]);
- Public contact [PUB].

A self-administered questionnaire was provided to participating employees by occupational health physicians. It contained 70 questions about work perception and the connection between work and health, enabled assessment of psychosocial risk on Karasek's questionnaire, and the extent of reward and recognition on Siegrists's 'Effort/Reward Imbalance' model (Siegrist et al., 2004). The Karasek model assesses decision latitude, social support and psychological demands (Karasek, 1979; Siegrist et al., 2004); a combination of strong psychological demand and weak decision latitude leads to job-strain. 'Isostrain' combines job-strain and social isolation. As far as the Siegrist model was concerned, employees with a reward score lower than the population median taken from the SUMER 2010 survey considered themselves as well rewarded, and employees who had a recognition score higher than the median considered that their work was well recognized (Niedhammer et al., 2000).

Exposure to occupational driving was defined by two variables: a binary variable determined whether the employee drives on a public

road as part of his or her job (by car, truck or van, coach, public bus, etc.), and a variable for the exposure duration in the week prior, divided into 4 classes: <2 h, 2–10 hours, 10–20 hours, and ≥20 h. A global variable for exposure to occupational driving was created from these two variables and resulted in a variable that divided weekly exposure into five categories: Not exposed, Exposed less than 2 h, Exposed 2–10 hours, Exposed 10–20 hours, and Exposed ≥20 h.

2.3. Statistical analysis

A multiple correspondence analysis (MCA) (Benzécri, 1979; Lebart et al., 2006; Neudecker et al., 2010) was undertaken in order to study the relationships between the different variables that characterized working conditions. It is a tool especially relevant for the exploratory analysis of data with many variables and without preliminary hypotheses. The main objectives of MCA could be defined as follows: 1) to provide a typology of the individuals that-is-to-say to study the similarities between the individuals from a multidimensional perspective; 2) to assess the relationships between the variables and study the associations between the categories; 3) to link together the study of individuals and that of variables in order to characterize the individuals using the variables. The relationship between the categories of rows (employees) and columns (variables) of the data could be represented using MCA. A graphical representation of the relationships between the row and column categories in the same space is also produced using correspondence analysis. The method starts from the initial cloud, of which the total size was equal to the number of modalities (total sum of modalities, or response options, across variables) minus the number of variables. The number of axes to analyze is chosen through the study of the actual values. The MCA explains these factorial axes in terms of the variables actively relevant to working conditions, making the greatest contribution (on 10) to the MCA axes. Study of the first three axes identified the different modality groupings. Other variables were introduced in the analysis as supplementary variables: seventeen sociodemographic and psychosocial characteristics and driving exposure. These supplementary elements were used to take into account all information that might be of help in understanding or interpreting the typology resulting from the active elements. The supplementary variables were all derived from the employees' self-completed questionnaires and the main MCA variables were all from the occupational physicians' questionnaires. A supplementary modality was considered significant on a given axis if its test-value was greater, in absolute value, than the value of the statistic of standard normal distribution with alpha equal to 5% i.e. 1.96.

The MCA results were used to construct an ascending hierarchical classification (AHC). This method aims at grouping individuals into clusters. The algorithmic principle consists in pairing, step by step, those individuals most similar to each other. Ward's method was used to aggregate individuals (Ward, 1963). This grouped together clusters in order to maximize the interclass inertia and minimize the intraclass inertia (distinguishing homogenous classes, with maximum dissimilarity).

SAS 9.3 software was used in all the statistical analysis. The SAS macros employed for the analysis were *aideacm*, *cahnum*, *partnum* and *desqual,* developed by Michel Isnard and Olivier Sautory (Isnard and Sautory, 1994). In particular, they enabled calculation of test values for the supplementary variables and yielded the results Tables used for analysis.

3. Results

3.1. Multiple correspondence analysis

The first three factorial axes explained 25% of the total inertia and almost 90% of the total inertia when corrected by the Benzekri method (Benzécri, 1979). Axis 1 showed the contrast between conventional (negative) and unconventional working schedules (positive). On the positive side of the axis, the modalities were: working at nights, evenings, Saturdays, Sundays and public holidays. Schedules were not known in advance. The work was in team and an error on employee's part might incur penalties from the employer or put employee's personal safety at risk. On the negative side there were modalities related to the conventional working schedule. Schedules were known at least 3 months in advance. Axis 2 differentiated modalities corresponding to the working rhythms of the most recent working week. On the positive side, we found working less than 40 h a week, and spending less than 10 h per day away from home, while in the negative side, there were: work exceeds 40 h a week or more work than scheduled with no compensation. The third axis contrasted "having quality standards to meet during the day" on the negative side and "not having quality standards to meet" on the positive side.

Fig. 1 represents active modalities together with the most important contributions and supplementary variables of the factorial plane (axis1, axis 2). Table 1 summarizes all of the inputs. The supplementary vari-

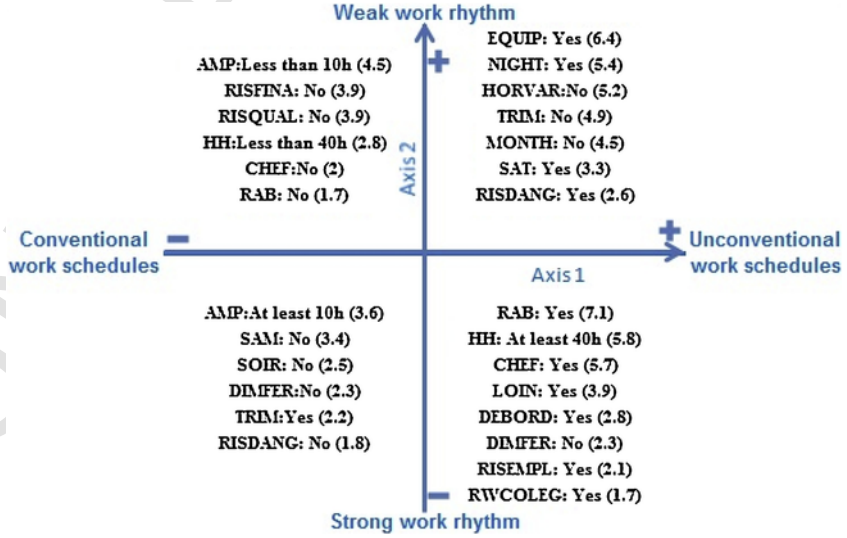

Fig. 1. Active representative modalities and their contributions (in brackets) on the factorial plane (axis 1, axis 2).

Table 1
Contributions and coordinates on the three factorial axes and quality of representation in the plane (1. 2. 3) for the modalities of the actives variables[1].
Source: Dares-DGT-DGAFP. 2010 Sumer Survey.

Variables	Modality	Meaning	Contribution (axis 1)	Coordinate (axis 1)	Contribution (axis 2)	Coordinate (axis 2)	Contribution (axis 3)	Coordinate (axis 3)	Quality of representation (%) factorial plane (1.2.3)
AMPLITUDE	AMP:At least 10h	Work hours: at least 10 hours	0	0	3.6	−0.44	0.2	0.11	26.0
	AMP:Less than 10h	Work hours: less than 10 hours	0	0	4.5	0.56	0.3	−0.13	26.0
ASTREINTE	ASTR:Yes	On-call: Yes	1.3	0.75	0.8	−0.48	1.2	0.54	13.6
	ASTR:No	On-call: No	0.2	−0.09	0.1	0.06	0.2	−0.07	13.6
CERTISO	CERTISO:No	Follow strict quality procedures: No	1.5	−0.39	0.5	0.17	1.7	0.31	25.7
	CERTISO:Yes	Follow strict quality procedures: Yes	1.4	0.36	0.4	−0.16	1.6	−0.29	25.7
CHEF	CHEF:No	Personnel under their orders: Yes	0.2	−0.11	1.8	0.28	0.2	−0.09	26.8
	CHEF:Yes	Personnel under their orders: No	0.5	0.3	5.2	−0.78	0.6	0.25	26.8
CHOIX TEMPS	CHOITPS: No	Choice of type of work time: Yes	0	0	1.6	0.57	0	0.04	5.6
	CHOITPS: Yes	Choice of type of work time: No	0	0	0.3	−0.1	0	−0.01	5.6
CORCO	CORCO: No	Number of colleagues or collaborators enough: No	0.2	0.19	0.1	−0.08	0	0.03	1.7
	CORCO: Yes	Number of colleagues or collaborators enough: Yes	0.1	−0.08	0	0.03	0	−0.01	1.7
CORFORM	CORFORM:No	Adequate and suitable training: No	0.2	0.24	0	0.04	0.5	−0.3	2.8
	CORFORM:Yes	Adequate and suitable training: Yes	0	−0.05	0	−0.01	0.1	0.06	2.8
CORINF	CORINF:No	Clear and adequate information: No	0.3	0.32	0.4	−0.26	0.4	−0.25	4.4
	CORINF:Yes	Clear and adequate information: Yes	0.1	−0.06	0.1	0.05	0.1	0.05	4.4
CORMOY	CORMOY:No	Suitable and adequate material resources: No	0.9	0.51	0.1	0.11	0.5	−0.27	7.2
	CORMOY:Yes	Suitable and adequate material resources: Yes	0.2	−0.11	0	−0.02	0.1	0.06	7.2
DEBORD	DEBORD:No	Frequent need to interrupt task to perform another, unforeseen: No	0.1	−0.11	3.7	0.51	0	0.03	20.7
	DEBORD:Yes	Frequent need to interrupt task to perform another, unforeseen:Yes	0.1	0.09	2.7	−0.38	0	−0.02	20.7
DELAI	DELAI:No	Possibility to change deadlines: No	0.6	0.27	0.6	0.22	1.9	−0.38	14.9
	DELAI:Yes	Possibility to change deadlines: Yes	0.1	−0.08	2.8	−0.44	0.1	0.08	16.3
	DELAI : N/A	Not applicable: no deadlines	0.4	−0.32	2.3	0.6	2	0.52	17.6
DEPECH	DEPECH:No	Haste needed to perform work: No	0.6	−0.22	0.5	0.16	0.3	0.11	14.5
	DEPECH:Yes	Haste needed to perform work: Yes	1.1	0.37	0.9	−0.27	0.5	−0.2	14.5
DIMFER	DIMFER:Yes	Work on Sunday or public holidays: Yes	3.9	0.73	0.5	0.2	3.9	0.55	46.6
	DIMFER:No	Work on Sunday or public holidays: No	2.1	−0.39	0.2	−0.11	2.1	−0.29	46.6
EQUIP	EQUIP: No	Work in team: No	0.8	−0.22	0.6	−0.15	0.1	0.05	32.8
	EQUIP: Yes	Work in team: Yes	3.8	0.99	2.6	0.66	0.4	−0.23	32.8

Table 1 (*Continued*)

Variables	Modality	Meaning	Contribution (axis 1)	Coordinate (axis 1)	Contribution (axis 2)	Coordinate (axis 2)	Contribution (axis 3)	Coordinate (axis 3)	Quality of representation (%) factorial plane (1.2.3)
EVA	EVA:No	Have at least one individual assessment interview per year: No	0.2	−0.14	1.9	0.39	0.3	0.13	11.5
	EVA:Yes	Have at least one individual assessment interview per year: Yes	0.1	0.09	1.1	−0.24	0.2	−0.08	11.5
HH	HH:At least 40H	At least 40 hours worked in week preceding survey	0.6	0.31	5.2	−0.71	1.7	0.38	34.6
	HH:Less than 40 h	Less than 40 hours worked in week preceding survey	0.3	−0.14	2.5	0.33	0.8	−0.18	34.6
HORVAR	HORVAR:Yes	Variable work schedules: Yes	1.1	−0.26	0.4	−0.13	0.7	−0.15	37.4
	HORVAR:No	Variable work schedules: No	3.8	0.9	1.4	0.43	2.3	0.53	37.4
INTERUPT	INTERUPT:Yes	Possibility of momentary work interruption when one wishes: Yes	0.3	−0.13	0.5	−0.14	0	0.03	20.3
	INTERUPT:No	Possibility of momentary work interruption when one wishes: No	1.6	0.71	3	0.78	0.1	−0.15	20.3
LOIN	LOIN:Yes	Sleep away from home: Yes	0.8	0.49	3.1	−0.79	2.9	0.73	24.4
	LOIN:No	Sleep away from home: No	0.1	−0.09	0.5	0.14	0.5	−0.13	24.4
MONTH	MONTH:Yes	Knowledge of schedules one month in advance: Yes	1	−0.25	0.2	−0.08	1.2	−0.21	41.6
	MONTH: No	Knowledge of schedules one month in advance: No	3.8	0.93	0.7	0.31	4.7	0.78	41.6
NIGHT	NIGHT:Yes	Work at night: Yes	5.2	1.17	0.2	0.17	1.1	0.4	34.4
	NIGHT:No	Work at night: No	1.1	−0.26	0	−0.04	0.2	−0.09	34.4
OBJ	OBJ:No	Must achieve exact numerical targets: No	0.4	−0.17	1.3	0.26	0.6	0.16	19.5
	OBJ:Yes	Must achieve exact numerical targets: Yes	0.6	0.27	2.2	−0.42	1	−0.27	19.5
ORD	ORD:No	Possibility of changing task order: No	0.3	0.25	5.1	0.87	0.4	−0.22	22.1
	ORD:Yes depending on task	Possibility of changing task order: Depending on task	0.1	0.11	0	−0.01	0.3	−0.14	2.6
	ORD:Yes all the time	Possibility of changing task order: Yes	0.6	−0.3	2.7	−0.49	1.2	0.31	22.4
POLY	POLY: No	Hold different posts or positions: No	0.6	−0.22	0	−0.05	0.5	0.16	9.4
	POLY: Yes	Hold different posts or positions: Oui	0.7	0.28	0.1	0.06	0.6	−0.2	9.4
PUB	PUB: No	Contact with the public: Yes	0	0.07	0.5	0.22	1.6	−0.39	8.1
	PUB: Yes	Contact with the public: No	0	−0.03	0.2	−0.09	0.6	0.15	8.1
RAB	RAB: No	Actual work more than scheduled, no compensation: No	0.1	−0.07	1.6	0.24	0.3	−0.09	31.4
	RAB: Yes	Actual work more than scheduled, no compensation: Yes	0.3	0.29	6.8	−1.06	1.2	0.41	31.4

Table 1 (*Continued*)

Variables	Modality	Meaning	Contribution (axis 1)	Coordinate (axis 1)	Contribution (axis 2)	Coordinate (axis 2)	Contribution (axis 3)	Coordinate (axis 3)	Quality of representation (%) factorial plane (1.2.3)
REGL	Call another person	In case of difficulty: call another person	0	0.03	3.2	0.67	0.6	−0.27	14.5
	Handle personally in special cases	In case of problem: In special cases, handle personally	0.3	0.27	0.2	0.15	0.4	−0.23	3.8
	Handle personally	In case of problem: Handle personally	0.1	−0.11	1.8	−0.31	0.7	0.18	19.0
REPOS	REPOS48:Yes	More than 48 hours's rest in a row: Yes	0.1	−0.09	0.2	−0.09	0.2	−0.08	13.1
	REPOS48: No	More than 48 hours' rest in a row: No	0.8	0.54	1.3	0.54	1.2	0.49	13.1
RISDANG	RISDANG: No	Risk of danger in case of error: No	1.8	−0.39	0	−0.05	0	0.05	21.2
	RISDANG: Yes	Risk of danger in case of error: Yes	2.5	0.53	0.1	0.07	0.1	−0.06	21.2
RISEMPL	RISEMPL: No	Risk to employment in case of error: No	2.1	−0.45	0.1	0.09	0.2	0.11	21.6
	RISEMPL: Yes	Risk to employment in case of error: Yes	2.0	0.44	0.1	−0.08	0.2	−0.11	21.6
RISFINA	RISFINA: No	Financial risk in case of error: No	1.9	−0.48	2.0	0.38	0.8	0.23	29.2
	RISFINA: Yes	Financial risk in case of error: Yes	1.3	0.33	1.3	−0.26	0.6	−0.16	29.2
RISQUAL	RISQUAL: No	Risk to product or service quality in case of error: No	2.6	−0.63	1.3	0.35	1.1	0.31	27.7
	RISQUAL: Yes	Risk to product or service quality in case of error: Yes	1.1	0.28	0.6	−0.16	0.5	−0.14	27.7
RWCOLEG	RWCOLEG: Yes	Work pace determined by close reliance on colleagues' work: Yes	1.7	0.53	0	−0.05	3.3	−0.55	24.2
	RWCOLEG: No	Work pace determined by close reliance on colleagues' work: No	0.7	−0.22	0	0.02	1.3	0.23	24.2
RWDEM	RWDEM: Yes	Work pace determined by external demand: Yes	0.5	0.21	1.2	−0.25	0	−0.04	14.3
	RWDEM: No	Work pace determined by external demand: No	0.7	−0.27	1.6	0.33	0	0.05	14.3
RWINFOR	RWINFOR: Yes	Work pace determined by monitoring or computer tracking: Yes	1.1	0.4	0.3	−0.17	3.3	−0.53	21.8
	RWINFOR: No	Work pace determined by monitoring or computer tracking: No	0.5	−0.19	0.1	0.08	1.5	0.25	21.8
RWNORMH	RWNORMH: Yes	Work pace determined by production standards. or deadlines to be met in 1 hour at most: Yes	3.1	0.83	0.2	0.15	4.6	−0.76	35.1
	RWNORMH: No	Work pace determined by production standards. or deadlines to be met in 1 hour at most: No	0.8	−0.23	0	−0.04	1.3	0.21	35.1

Table 1 (*Continued*)

Variables	Modality	Meaning	Contribution (axis 1)	Coordinate (axis 1)	Contribution (axis 2)	Coordinate (axis 2)	Contribution (axis 3)	Coordinate (axis 3)	Quality of representation (%) factorial plane (1.2.3)
RWNORMJ	RWNORMJ: Yes	Work pace determined by production standards. or deadlines to be met in one day at most: Yes	1.5	0.4	0	−0.06	4.6	−0.54	34.4
	RWNORMJ: No	Work pace determined by production standards. or deadlines to be met in one day at most: No	1.1	−0.31	0	0.04	3.5	0.41	34.4
RWSURV	RWSURV:Yes	Work pace determined by daily or continuous managerial checks or monitoring: Yes	1.9	0.59	0.3	0.17	3.7	−0.62	27.1
	RWSURV: No	Work pace determined by daily or continuous managerial checks or monitoring: No	0.7	−0.21	0.1	−0.06	1.3	0.22	27.1
RWTEC	RWTEC: Yes	Work pace determined by other technical constraints : Yes	2.4	0.83	0.1	0.11	2.7	−0.66	22.5
	RWTEC: No	Work pace determined by other technical constraints: No	0.5	−0.17	0	−0.02	0.5	0.13	22.5
SAT	SAT: Yes	Saturday work: Yes	2.7	0.5	0.6	0.19	1.9	0.32	40.7
	SAT: No	Saturday work: No	2.8	−0.53	0.6	−0.2	2	−0.33	40.7
SEM	SEM:Yes	Knowledge of schedules one week in advance: Yes	0.3	−0.12	0	−0.01	0.5	−0.12	26.4
	SEM: No	Knowledge of schedules one week in advance: No	2.4	1.06	0	0.12	4.5	1.1	26.4
SOIR	SOIR: Yes	Evening work: Yes	4.9	0.83	0	−0.01	2.3	0.43	44.9
	SOIR: No	Evening work: No	2.5	−0.43	0	0	1.2	−0.22	44.9
TEMPS	FULL TIME : Yes	Full-time work	0.1	0.06	0.5	−0.13	0	−0.02	13.0
	FULL TIME : No	Part-time work	0.5	−0.39	2.9	0.8	0.1	0.12	13.0
TRIM	TRIM:Yes	Knowledge of schedules three months in advance: Yes	1.7	−0.35	0.5	−0.14	1.6	−0.25	45.8
	TRIM: No	Knowledge of schedules three months in advance: No	3.9	0.78	1.0	0.32	3.7	0.57	45.8

Field: employees in Metropolitan France.

[1] Modalities with the most input for each axis are marked in bold.

ables also participated in the description of these axes. In the north-east quadrant, one found different occupations, such as professional drivers, restaurant workers and car mechanics. The north-west quadrant mainly comprised administrative employees, customer service staff, public sector workers or teaching professionals. In the south-west quadrant, one found employees in intermediate professions and executives in the fields of science, finance and real estate. These salaried workers had strong decision latitude. Finally, in the south-east quadrant one found employees of regulated companies, with active jobs. Exposure to driving was found in the quadrants furthest to the east.

3.2. Ascending hierarchical classification

Individuals were classified according to the results on the first three MCA axes.

The classification tree showed an interesting segmentation into 10 clusters. Fig. 2 represented the classification on the 3 first axes where the 10 clusters were particularly well discriminated. Driving exposure, which concerned 26.4% of employees, was overrepresented in four of the clusters and under-represented in another four. Clusters numbered 2, 6, 8 and 9 were the clusters with overrepresentation of driving expo-

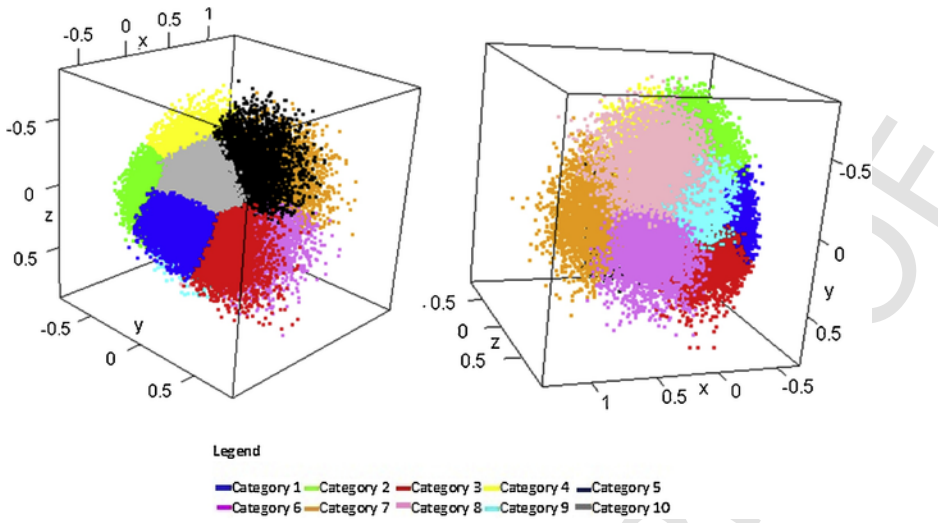

Fig. 2. Classification in 10 categories according to the first 3 dimensions (1,2,3).

sure. Tables 2 and 3 showed the distribution of active variables and supplementary variables by cluster.

Cluster 6 ("Employees invested with important working times characteristics (week-end, evening, holidays, +40 h), decision-making latitude, imposed rhythms") comprised 3330 individuals (8%). The majority were under atypical working time characteristics: they worked evenings, nights and weekends and did not know their schedules beforehand. Their work pace was dictated by quality standards, deadlines, colleagues, computer surveillance and technical constraints. An error on their part posed a risk to the company, whether financial or in terms of quality of service, or might jeopardize their job, incur financial penalties, or endanger their own personal safety or that of others. They had worked at least 40 h in the week preceding the survey and at least 10 h a day. 27% were exposed to driving between 2 and 10 h, 12% less than 2 h, 12% from 10 to 20 h and 8% more than 20 h. 80% of this cluster were men holding positions of responsibility, 39% being company executives (compared to 11% in other clusters). Their jobs were in the audiovisual, telecommunications, computing, engineering, science and technology sectors. 75% enjoyed strong decision latitude. This class had the greatest incidence of driving exposure (60%).

Cluster 2 ("Permanent contract, responsibilities, significant time constraints, no risk and no imposed rhythms", n = 4,948, 12%) had similar characteristics to cluster 6. On the other hand, employees in this cluster did not face atypical working time characteristics and their psychological pressures were higher. 40% of employees in this cluster were driving-exposed and these were men holding responsible positions.

Cluster 9 ("Time constraints, invested without risk, decision-making power, public", n = 3,844, 9%) had here employees facing atypical working time characteristics (80% of employees in this cluster worked on Saturdays and 60% on Sundays and public holidays). This cluster showed an overrepresentation of driving-exposed employees (42%). Men were overrepresented.

Finally, **cluster 8 (**"Regular hours, risks, less than 40 h"**)** comprised 3417 individuals (8%). The occupational characteristics of this cluster were quite different from the 3 other clusters descrived above. The employees almost all (85%) worked on Saturday, less than 40 h per week. The cluster has a balanced sex-ratio. Decision latitude was weak, as was social support. These employees felt that they received scant recognition for their work. There were 3 different employee profiles within this cluster: sales persons, public sector workers, and professional drivers in the transportation and warehousing (French occupational nomenclature (NAF H), automobile and motorcycle sale and repair (NAF G), and health and social work (NAF Q) sectors. Fixed-term work contract were most frequent. It was not exposure in general but driving exposure of more than 20 h in the week prior that was over-represented in this cluster (about 8%). (Table 4).

The four clusters (1, 3, 5 and 10) that group subjects less exposed to driving showed a variety of occupational characteristics. These 4 clusters comprised 19,543 individuals, of whom 16,556 (84.7%) were not at all exposed to driving (5.7% exposed less than 2 h, 5.9% between 2 and 10 h, and 3% more than 10 h). In these 4 clusters, the number of hours worked in the week prior to the survey was more often less than 40 h and atypical working time characteristics was not a factor. Cluster 5 (n = 3,567, 9%) was the cluster with the least driving exposure (91% of employees are non-exposed) and where there was a significant degree of job-strain (33%, compared to 19% in the other clusters); The rhythm of the work was imposed by standards to be followed, an error at work might jeopardize safety of self and others and the work schedules were normal. Prevalence of isostrain was rather high (43%, compared to 24%). Most of the employees were industrial workers. Employees of cluster 10 (n = 6,149, 15%) felt that their work was little recognized or rewarded. They were also subject to managerial checks or computerized tracking. Two of these 4 clusters (1 and 3) were majority female; cluster 1 (n = 6,323, 15%) was formed by public sector intermediate profession employees and cluster 3 (n = 3,482, 8%) by workers with more insecure positions, such as employees on fixed-term contracts or temporary placements.

The last 2 clusters where driving exposure was not significantly different from the general population were clusters 4 and 7. Cluster 4 (n = 3,482, 8%) comprised more middle managers, subject to time constraints and under pressure but not exposed to driving. They worked overtime and had to hurry to complete their work. They worked at least 40 h a week and an error on their part might cause financial loss, might impair the quality of the products or services being provided, or might incur a penalty. Employees in cluster 7 (n = 3,042, 7%) worked less than 40 h per week, did not know their schedules in advance, and their work pattern was restricted by quality standards, deadlines and the work of other colleagues. Different employment profiles characterized this cluster: public sector employees, 93% of whom worked in education or in state administration or regulated companies such as National society of French railways and Electricity of France, and workers in the transport (70%) and industrial sectors (30%).

Table 2
Coordinates and test values of the modalities of the supplementary variables in the MCA.

Variables	Modalities	Axis 1	Axis 2		Axis 3		
		Coordinates	Test value	Coordinates	Test value	Coordinates	Test value t
Age	35 years and under	0.13	19.03	0.11	16.53	0.01	1.10
	Between 35 and 50 years	0.01	1.54	−0.06	−10.94	0.00	0.59
	More than 50 years	−0.20	−23.12	−0.05	−5.99	−0.02	−1.92
Gender	Female	−0.24	−41.86	0.19	33.74	−0.02	−3.36
	Male	0.18	41.86	−0.14	−33.74	0.01	3.36
Nationality	NAT: French	0.00	0.80	−0.01	−13.99	−0.00	−2.37
	NAT: foreign	−0.02	−0.80	0.38	13.99	0.06	2.37
Status	Regulated company employees	0.45	23.88	−0.27	−14.38	−0.18	−9.54
	Apprentice	−0.42	−10.34	0.69	16.96	−0.17	−4.07
	Fixed-term contract	0.00	0.17	0.57	28.27	0.28	14.11
	Permanent	−0.04	−12.49	−0.07	−21.05	−0.01	−4.02
	Public sector	0.00	0.15	0.04	3.00	0.09	7.06
	Temporary	0.25	7.18	0.88	24.94	−0.26	−7.36
	Trainee	−0.12	−0.84	0.50	3.59	−0.01	−0.10
Seniority	SNR: Less than 1 years	−0.05	−3.08	0.47	31.19	0.12	8.17
	SNR: From 1 to 2 years	0.03	3.28	0.08	7.96	0.07	6.91
	SNR: From 3 to 10 years	0.05	6.46	−0.02	−3.45	0.04	5.20
	SNR: More than 10 years	−0.04	−7.12	−0.13	−21.60	−0.09	−15.14
Socio-occupational category (SOC)	31 Professional and associated services	−0.30	−3.51	−0.40	−4.66	0.40	4.67
	32 Public sector executives	−0.06	−2.12	−0.70	−25.77	0.58	21.42
	36 Company executives	−0.06	−5.21	−1.17	−94.38	0.38	30.95
	41 Intermediate education, health, public sector and associated professionals	0.02	1.08	0.11	6.33	0.13	7.72
	46 Company middle managers	−0.25	−16.73	−0.43	−28.66	−0.02	−1.42
	47 Technicians	−0.04	−1.78	−0.40	−19.03	−0.21	−10.16
	48 Foremen. supervisors	0.46	18.16	−0.56	−22.50	−0.17	−6.65
	51 Public-sector employees	0.11	7.32	0.52	36.35	0.15	10.41
	54 Clerical employees of companies	−0.58	−37.04	0.05	3.42	−0.27	−17.33
	55 Sales employees	0.02	0.67	0.79	35.48	0.46	20.33
	56 Customer service staff	−0.02	−0.71	0.91	35.96	0.42	16.73
	61 Skilled workers	0.27	24.02	0.22	19.93	−0.40	−35.27
	64 Professional drivers	0.51	17.90	0.55	19.51	0.26	9.05
	66 Unskilled workers	0.06	3.64	0.73	47.14	−0.49	−31.39
	69 Agricultural workers	−0.15	−4.22	0.57	15.78	0.56	15.43
Number of employees per site	SITE: 1 to 9	−0.32	−30.33	0.14	12.73	0.30	27.82
	SITE: 10 to 49	−0.10	−11.54	0.00	0.51	0.05	6.23
	SITE: 50 to 199	0.08	8.38	0.05	5.45	−0.09	−8.52
	SITE: 200 to 499	0.20	15.51	0.05	3.85	−0.17	−13.33
	SITE: 500 or more	0.15	18.06	−0.15	−19.14	−0.10	−12.30
Number of employees per company	C°:1 to 9	−0.37	−16.41	0.29	12.79	0.40	17.57
	C°: 10 to 49	−0.17	−8.35	0.00	0.15	0.15	7.36
	C°: 50 to 499	0.01	0.69	−0.04	−2.76	−0.02	−1.52
	C°: 500 to 9998	0.06	5.65	−0.24	−23.14	−0.13	−12.51
	C°: 9999 or more	0.27	23.54	−0.15	−12.92	−0.20	−17.29
Activity sector	NAF: Administrative and support services	0.05	2.67	0.48	23.81	0.00	0.21
	NAF: Household activities	−0.83	−4.41	0.81	4.29	0.65	3.46
	NAF: Extra-territorial activities	−0.44	−1.09	0.13	0.31	−0.06	−0.15
	NAF: Financial and insurance activities	−0.32	−14.59	−0.67	−29.97	−0.25	−11.05
	NAF : Real estate activities	−0.55	−12.41	−0.21	−4.61	0.19	4.29
	NAF: Public administration	−0.21	−14.67	−0.08	−5.63	0.07	4.77
	NAF: Agriculture, forestry and fisheries	−0.12	−3.25	0.45	12.52	0.60	16.74
	NAF: Arts, entertainment and recreation	0.16	3.13	0.34	6.86	0.87	17.27
	NAF: Audiovisual, telecommunication, computing	−0.09	−3.33	−0.60	−22.02	0.14	5.25
	NAF: Other service activities	−0.42	−12.90	0.19	5.82	0.25	7.73
	NAF: Sale and repair of autumobiles and motorcycles	−0.12	−9.46	0.08	6.07	0.22	17.07
	NAF: Construction	0.17	3.23	−0.00	−0.01	0.07	1.30
	NAF: Education	−0.61	−14.24	0.12	2.72	0.36	8.26
	NAF: Accommodation and restaurants	0.30	10.06	0.50	16.97	0.28	9.31
	NAF: Manufacturing	0.17	15.94	−0.02	−1.69	−0.43	−41.33
	NAF: Extractive industries	0.03	0.20	0.23	1.77	−0.40	−3.11
	NAF: Engineering,. science and technology	−0.27	−14.41	−0.59	−30.79	0.11	5.97
	NAF : Water, waste and decontamination	−0.30	−13.81	−0.20	−9.12	−0.07	−3.03
	NAF: Production and distribution of electricity, gas, steam, air	0.11	4.21	−0.56	−21.65	−0.09	−3.61
	NAF : Human health and social work	0.15	10.51	0.44	32.05	0.19	13.89

Table 2 (*Continued*)

Variables	Modalities	Axis 1	Axis 2		Axis 3		
		Coordinates	Test value	Coordinates	Test value	Coordinates	Test value t
	NAF: Transportation and warehousing	0.55	35.41	0.13	8.26	−0.14	−8.75
Decision latitude	Weak decision latitude	0.05	9.17	0.32	64.80	−0.19	−38.15
	Strong decision latitude	−0.04	−8.58	−0.37	−70.88	0.20	39.14
Psychological demands	Weak demands	−0.24	−40.5	0.33	51.8	0.11	29.1
	Strong demands	0.18	39.8	−0.28	−56.5	−0.09	−29.4
Social support	Weak social support	0.06	15.26	−0.02	−5.85	−0.06	−14.49
	Strong social support	−0.11	−14.55	−0.03	−4.35	0.11	15.09
Job strain	Job strain: NO	−0.07	−21.99	−0.07	−20.06	0.11	31.35
	Job strain: YES	0.26	26.47	0.08	7.72	−0.35	−35.46
Isostrain	isostrain: NO	−0.09	−26.34	−0.07	−20.27	0.13	38.38
	isostrain: YES	0.24	28.77	0.10	11.87	−0.33	−40.47
Karasek quadrants	Active work	0.13	17.16	−0.63	−85.69	0.12	16.49
	Stress-free work	−0.29	−31.88	0.09	9.45	0.23	25.05
	Passive work	−0.17	−15.58	0.65	60.40	−0.03	−2.76
	Stressful work	0.26	27.94	0.19	20.08	−0.38	−40.41
Recognition	Recognition: below median (work not recognized)	0.02	7.91	−0.02	−7.06	−0.03	−12.40
	Recognition: above median (work recognized)	−0.06	−6.37	−0.01	−1.26	0.15	15.57
Reward	Reward: below median (work rewarded)	−0.12	−24.87	−0.01	−2.69	0.14	29.18
	Reward: above median (work not rewarded)	0.17	28.62	−0.05	−8.31	−0.18	−30.12
Exposure to occupational driving	Not exposed	−0.06	−20.41	0.10	33.89	−0.11	−37.18
	EXPO: < 2 hours	−0.08	−4.57	−0.27	−16.48	0.13	7.88
	EXPO: from 2 to 10 hours	0.15	10.68	−0.33	−23.29	0.32	22.93
	EXPO: from 10 to 20 hours	0.33	13.12	−0.44	−17.46	0.47	18.39
	EXPO: 20 hours or more	0.59	23.08	0.08	3.05	0.48	18.60

4. Discussion

4.1. Main results

The MCA disclosed associations between working condition variables such as work duration, pace of work, and individual or team work. The ascending hierarchical classification was based on the results of the MCA and the typology obtained consisted of 10 clusters of organizational and relational work constraints. A link between exposure to occupational driving and these working conditions profiles was observed.

In this study, 11,442 employees were exposed to driving: i.e., almost 25% of the population. In 3 clusters (2, 6 and 9), driving-exposed employees were overrepresented: 45% (5481 out of 12,122). Cluster 8 represented overexposure to driving more than 20 h a week. These 4 clusters (2, 6, 8 and 9) corresponded to groups in which 58% of employees were driving-exposed. Exposure to occupational driving was therefore not found in only one cluster: several employee clusters were exposed to driving. Noticeable in these clusters was the large majority of men (between 65% and 80%). These results were consistent with published data in which 75% of persons exposed to occupational driving were men (Charbotel et al., 2001) and, when they made a trip, they traveled further than women (Salminen, 2000). Numerous studies have shown that male gender was a risk factor for road accidents (Charbotel et al., 2001; Salminen, 2000).

The clusters 2 and 6 could be compared for the intensity of work: employees more often worked more than 40 h a week, working days were longer (more than 10 h), and business trips were frequent (between 30% and 55%). What differentiated the two clusters were the work schedules: while employees in cluster 2 had conventional schedules, employees in cluster 6 worked more frequently evenings, nights, Saturdays, Sundays and on public holidays. Employees in the cluster 6 might be at heightened risk for fatigue crashes compared to cluster 2 because of their relatively high exposure to driving plus their work intensity, schedules and work time characteristics. Corporate and public sector executives were represented more frequently in these clusters. The prevalence of exposure to psychosocial risks was low, since the majority of these employees were active workers according to Karasek's model. Epidemiological studies previously showed that driving after a night shift was linked to an increase in drowsiness (Scott et al., 2007), a higher probability of crossing the white line in the center of the road (Di Milia et al., 2012) and an increased risk of road accident, regardless of the type of journey undertaken (Connor et al., 2002; Stutts et al., 2003). Long working hours, night or shift work were occupational factors for heightened risk of accident (Dembe et al., 2006; Wagstaff and Sigstad Lie, 2011). Driving-exposed employees were reported to have jobs with responsibility and strong decision latitude, and worked a large number of hours per week. Within these clusters, however, different jobs were found, such as corporate and public sector executives, intermediate professional employees in education, health, the public sector or similar, and foremen. The under-representation of isostrain jobs in clusters 6, 2 and 9 and their overrepresentation in clusters 5 and 4 (where 90% and 70% respectively of employees were not exposed to driving) suggested that driving-exposed employees were less subject to psychosocial risks at work.

Driving-exposed employees were also more exposed to significant atypical work time characteristics at work. Employees in cluster 6, of whom about 60% are exposed to driving, have unconventional work schedules and more frequently work at nights, weekends or public holidays. A greater risk of road accident at work was previously identified in employees who worked at nights and weekends, or lacking two consecutive days of rest (INRS, 2014). Night work and working days longer than 8 h impacted the risk of accidents. This risk quickly rose: the risk of having an accident after 12 h of consecutive work was double that after 8 h (Wagstaff and Sigstad Lie, 2011). A study on medical interns and road accidents during the home-to-work commute confirmed these conclusions: there were twice as many accidents and 5 times more near-accidents after prolonged hospital shifts (Barger et al., 2005). However, among the general population, not all driving-exposed subjects face atypical working time characteristics: persons in cluster 2 did not suffer from atypical work time characteristics, al-

Table 3
Distribution of the modalities of the supplementary variables by cluster.
Source: Dares-DGT-DGAFP. 2010 Sumer Survey.

Variables	Modalities	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	Cluster 9	Cluster 10	Total
		n = 6,323	n = 4,948	n = 3,482	n = 3,623	n = 3,567	n = 3,330	n = 3,042	n = 3,419	n = 3,844	n = 6,149	N = 41,727
		15.1%	12%	8.3%	8.7%	8.5%	8%	7.3%	8.2%	9.2%	14.7%	100%
Age	35 years and younger	28.8	29.2	40.2	35.3	38.7	33.2	45.0	45.1	36.3	34.0	35.6
	Between 35 and 50 years	40.4	43.5	36.3	41.9	39.8	46.2	38.6	37.0	41.9	39.7	40.6
	More than 50 years	30.9	27.3	23.5	22.9	21.5	20.6	15.4	17.8	21.9	26.3	23.8
Gender	Female	59.5	35.0	62.4	35.3	41.1	19.3	29.0	44.0	36.1	49.3	42.8
	Male	40.5	65.0	37.7	64.8	58.9	80.7	71.0	56.0	63.9	50.7	57.2
Nationality	French	97.1	98.3	94.1	97.7	96.4	98.0	97.1	95.8	96.5	96.9	96.9
	Foreign	2.9	1.7	5.9	2.4	3.6	2.0	2.9	4.2	3.5	3.1	3.1
Status	Regulated company employees	4.1	7.9	1.0	8.2	4.2	8.7	18.8	6.0	4.4	4.8	6.4
	Apprentice	2.0	0.2	4.0	0.6	1.6	0.1	0.5	1.1	0.7	2.5	1.4
	Fixed-term contract	5.1	2.1	14.1	2.4	5.8	4.2	4.3	10.6	5.5	4.5	5.6
	Permanent	71.7	79.5	65.8	77.3	73.4	74.3	58.0	62.1	71.7	72.2	71.3
	Public sector	15.9	10.1	10.7	10.7	9.7	12.1	15.6	16.7	16.6	13.7	13.3
	Temporary	1.0	0.1	4.2	0.6	5.3	0.3	2.5	3.4	1.1	2.0	1.9
	Trainee	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0	0.2	0.1
Seniority	SEN: Less than 1 year	9.2	5.5	19.8	5.6	10.7	5.7	7.5	14.6	9.1	8.7	9.4
	SEN: From 1 to 3 years	16.8	16.7	22.4	16.9	16.9	18.3	19.4	21.6	20.6	18.2	18.6
	SEN: From 3 to 10 years	29.7	32.1	29.4	32.3	29.4	34.5	33.2	33.7	33.2	29.4	31.5
	SEN: More than 10 years	44.2	45.6	28.3	44.9	42.2	41.3	39.6	30.0	37.0	43.5	40.5
Socio-occupational categories (SOC)	31 Professional and associated services	0.5	0.6	0.2	0.2	0.0	0.7	0.0	0.0	0.4	0.2	0.3
	32 Public sector executives	2.8	7.0	1.2	3.3	0.3	7.9	0.8	1.6	5.3	1.2	3.1
	36 Company executives	8.9	44.2	0.7	18.9	0.4	38.6	3.2	0.9	12.0	5.4	13.6
	41 Intermediate education, health, public sector and associated professionals	9.2	4.7	8.0	6.3	5.7	5.3	10.1	9.5	10.3	7.2	7.6
	46 Company middle managers	12.3	13.8	2.4	14.7	3.1	11.4	4.4	3.6	11.0	11.8	9.5
	47 Technicians	4.7	6.7	0.8	9.9	2.7	7.4	4.7	1.9	5.4	7.3	5.3
	48 Foremen. supervisors	1.6	4.6	0.2	8.2	2.1	7.3	7.4	1.9	3.8	2.4	3.7
	51 Public-sector employees	10.8	1.8	16.5	4.0	11.2	5.4	12.1	24.0	10.5	10.4	10.3
	54 Clerical employees of companies	20.1	5.6	5.9	10.2	4.3	1.3	3.7	3.5	4.0	16.2	8.9
	55 Sales employees	3.1	1.1	16.5	1.4	4.4	0.7	3.4	11.2	5.5	2.4	4.6
	56 Customer service staff	2.8	0.5	13.3	0.8	3.7	0.8	3.0	8.7	4.0	2.0	3.6
	61 Skilled workers	12.0	7.0	9.5	16.9	31.8	8.3	30.4	14.2	14.7	19.6	15.9
	64 Professional drivers	1.4	0.7	3.5	1.7	2.6	2.8	5.4	8.3	4.2	1.8	2.9
	66 Unskilled workers	7.9	1.4	16.4	3.3	26.9	1.0	10.8	7.6	5.4	11.2	8.9
	69 Agricultural workers	2.0	0.5	4.9	0.5	1.1	1.1	0.7	3.1	3.5	1.1	1.8
Number of employees per site	SITE:1 to 9 employees	25.4	15.2	31.7	12.2	7.1	15.2	4.8	13.5	24.7	17.0	17.4
	SITE:10 to 49 employees	25.4	24.0	27.5	25.8	18.9	26.0	13.8	22.5	25.7	26.1	24.0
	SITE:50 to 199 employees	15.5	17.5	8.5	21.5	24.0	18.6	20.7	21.2	18.1	20.0	18.4
	SITE:200 to 499 employees	9.3	12.4	20.3	11.7	20.3	11.2	19.4	14.8	9.3	11.8	13.4
	SITE:500 and more employees	24.4	30.8	12.0	28.8	29.8	29.1	41.2	27.9	22.2	25.1	26.8
Number of employees per company	C°:1 to 9 employees	6.8	2.8	9.5	2.0	1.5	3.0	0.8	4.3	7.7	4.0	4.4
	C°:10 to 49 employees	6.5	5.5	6.5	4.8	5.5	6.7	2.3	4.1	6.2	5.5	5.5
	C°:50 to 499 employees	9.7	11.2	10.0	11.3	10.4	12.3	9.6	10.3	10.3	10.8	10.5
	C°:500 to 9,998 employees	15.5	23.5	9.5	24.1	20.0	22.1	19.0	14.6	14.1	18.0	18.0
	C°:9,999 and more employees	10.2	17.5	6.6	18.6	19.1	15.0	29.6	14.7	10.8	13.9	15.0
	Missing data	51.4	39.5	57.9	39.3	45.4	41.1	38.6	52.0	51.1	47.8	46.6
Activity sector	NAF: Administrative and support services	5.1	3.1	10.7	3.2	8.5	3.9	5.5	8.3	4.3	4.8	5.5
	NAF: Household	0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1
	NAF: Extra-territorial	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	NAF: Financial and insurance	5.5	9.2	0.6	10.3	1.6	4.7	0.6	0.4	2.6	6.4	4.6

Table 3 (*Continued*)

Variables	Modalities	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	Cluster 9	Cluster 10	Total
	NAF: Real estate	2.2	1.9	1.4	1.0	0.1	1.3	0.2	0.2	1.0	1.3	1.2
	NAF: Public administration	14.3	8.8	8.1	10.3	5.1	11.7	4.7	9.0	14.1	11.8	10.3
	NAF: Agriculture, forestry and fisheries	2.3	0.6	4.7	0.6	0.8	1.7	0.8	3.0	3.7	0.9	1.8
	NAF: Arts, entertainment and recreation	0.7	0.5	1.8	0.2	0.3	1.4	0.5	2.7	1.7	0.5	1.0
	NAF: Audiovisual, telecommunications, computing	3.0	5.9	0.8	4.0	1.8	6.4	1.5	1.1	2.8	3.1	3.1
	NAF: Other services	3.8	2.2	4.4	1.2	1.3	1.8	0.6	1.6	2.5	2.0	2.3
	NAF: Sales and repair of automobiles and motorcycles	13.4	11.6	19.7	11.1	8.9	13.3	5.8	13.9	16.8	12.5	12.8
	NAF: Construction	0.8	0.7	0.6	0.6	0.7	1.0	1.2	0.9	1.3	0.6	0.8
	NAF: Education	2.7	1.2	2.3	0.7	0.3	0.8	0.0	0.5	1.9	1.2	1.3
	NAF: Accommodation and restaurants	1.3	0.6	5.5	1.9	2.9	1.9	3.9	5.8	3.9	1.6	2.6
	NAF: Manufacturing	12.4	18.3	9.6	19.8	40.5	14.3	25.4	10.4	10.2	20.2	17.8
	NAF: Extractive industries	0.1	0.1	0.1	0.2	0.3	0.1	0.2	0.1	0.0	0.2	0.1
	NAF: Engineering, science and technology	7.4	12.4	1.8	8.6	1.9	9.5	1.3	1.0	6.8	6.9	6.2
	NAF: Water, waste and decontamination	7.1	6.6	2.5	6.3	2.2	5.4	1.7	1.4	5.1	6.6	4.9
	NAF: Production and distribution of gas, electricity, steam, air	2.9	5.9	0.3	4.4	1.3	6.2	6.1	1.5	3.1	3.1	3.5
	NAF: Human health and social work	10.8	4.4	19.8	5.9	10.0	5.1	16.7	24.0	11.9	8.7	11.1
	NAF: Transportation and warehousing	4.1	6.1	5.2	9.7	12.0	9.6	23.5	14.4	6.4	7.5	9.0
Decision latitude	Weak decision latitude	48.7	23.9	63.2	44.3	73.8	23.1	63.0	62.9	37.7	59.3	49.4
	Strong decision latitude	47.6	74.0	30.1	52.9	21.0	74.9	33.4	32.4	59.1	36.6	46.8
	Missing data	3.7	2.1	6.7	2.8	5.2	2.1	3.6	4.7	3.3	4.2	3.8
Social support	Weak social support	55.9	59.9	53.2	66.0	21.0	61.8	69.5	60.9	56.8	61.3	56.8
	Strong social support	34.9	34.7	33.6	26.7	24.3	31.5	23.1	29.3	34.7	30.0	30.8
	Missing data	9.2	5.3	13.2	7.3	54.8	6.7	7.4	9.8	8.5	8.7	12.4
Psychological demands	Weak demand	61.6	25.2	64.7	18.5	38.8	75.1	66.0	43.8	46.4	5.9	42.2
	Strong demand	33.2	70.4	27.7	77.1	54.8	20.6	28.1	49.2	47.7	43.6	45.6
	Missing data	5.2	4.4	7.9	4.4	6.4	4.3	5.8	7.0	5.9	50.5	12.2
Job strain	Job strain: NO	75.5	78.7	68.8	61.8	52.1	76.7	54.3	64.0	74.3	63.7	67.9
	Job strain: YES	12.4	13.4	14.0	28.3	33.3	13.9	34.1	21.7	14.0	23.7	20.1
	Missing data	12.1	7.9	17.2	10.0	14.6	9.4	11.6	14.3	11.7	12.6	12.0
Isostrain	Isostrain: NO	75.9	77.5	69.7	58.1	47.4	77.2	49.4	61.1	73.8	59.7	65.9
	Isostrain: YES	16.5	16.7	18.7	35.7	42.8	17.2	42.3	29.2	18.2	31.6	26.0
	Missing data	7.6	5.8	11.6	6.2	9.8	5.6	8.3	9.7	8.1	8.8	8.1
Quadrant	Active work	18.9	58.6	9.8	48.0	13.9	62.3	27.0	17.3	31.4	22.0	30.5
	Stress-free work	36.2	20.6	26.8	13.4	13.1	16.6	12.0	21.4	33.6	21.8	22.7
	Passive work	23.9	4.1	35.2	4.5	24.2	3.6	15.4	26.4	12.8	20.4	17.3
	Stressful work	13.5	10.9	16.6	27.9	39.1	11.9	37.3	25.2	14.1	27.0	21.5
	Missing data	7.6	5.8	11.6	6.2	9.8	5.7	8.3	9.7	8.1	8.8	8.1
Recognition	RECOGNITION: below median	73.2	76.2	68.3	79.4	77.0	76.3	79.3	75.7	71.8	77.0	75.3
	RECOGNITION: above median	21.2	21.2	23.6	17.2	15.8	20.7	16.0	19.2	24.3	17.8	19.8
	Missing data	5.6	2.6	8.1	3.5	7.3	3.0	4.7	5.1	4.0	5.2	4.9
Reward	REWARD: below median	58.9	58.7	56.7	39.4	37.8	51.9	36.6	50.0	55.7	47.3	50.3
	REWARD : above median	30.8	35.1	27.8	54.0	51.1	41.9	55.1	39.9	35.2	43.5	40.5
	Missing data	10.4	6.2	15.5	6.6	11.1	6.2	8.3	10.1	9.1	9.1	9.2
Exposure to driving	Not exposed	81.1	62.1	83.5	70.9	91.4	40.1	77.5	71.9	58.1	85.6	73.3
	EXPO: < 2 hours	8.1	16.1	5.9	11.0	2.2	11.7	4.6	5.9	11.1	5.1	8.3
	EXPO: from 2 to 10 hours	7.5	2.6	6.1	10.9	3.2	26.4	8.3	9.9	17.6	5.8	9.2
	EXPO: from 10 to 20 hours	1.5	4.9	2.0	3.9	0.9	11.7	3.1	3.3	6.3	1.3	3.6
	EXPO:20 hours or more	1.1	13.0	2.0	1.9	1.9	8.2	5.6	8.3	5.8	1.7	4.7
	Missing data	0.7	1.3	0.5	1.4	0.4	2.0	0.9	0.7	1.2	0.6	0.9

Field: employees in Metropolitan France.

Table 4
Distribution of the modalities of the active variables by cluster.
Source: Dares-DGT-DGAFP. 2010 Sumer Survey.

Variables	Label	Modalities	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	Cluster 9	Cluster 10	Total
			n = 6,323	n = 4,948	n = 3,482	n = 3,623	n = 3,567	n = 3330	n = 3,042	n = 3,419	n = 3,844	n = 6,149	N = 4,1727
			15.1%	12%	8.3%	8.7%	8.5%	8%	7.3%	8.2%	9.2%	14.7%	100%
AMPLITUDE	Hours away from home in a working day	AMP_At_least_10H	51%	88%	21%	76%	28%	89%	45%	37%	64%	50%	55.6%
		AMP_Less_than_10H	49%	12%	79%	24%	72%	11%	55%	63%	36%	50%	44.4%
ASTREINTE	On-call for work	ASTR_no	98%	90%	97%	88%	96%	61%	79%	86%	80%	98%	87.4%
		ASTR_Yes	2%	10%	3%	12%	4%	39%	21%	14%	20%	2%	12.6%
CERTISO	Strict quality control procedures (ISO certification, accreditation. EAQF, etc.)	CERTISO_No	80%	48%	80%	19%	23%	37%	12%	48%	61%	46%	71.3%
		CERTISO_Yes	20%	52%	20%	81%	77%	63%	88%	52%	39%	54%	28.7%
CHEF	In charge of one or more employees	CHEF_No	89%	46%	95%	58%	90%	35%	68%	85%	70%	89%	14.8%
		CHEF_Yes	11%	54%	5%	42%	10%	65%	32%	15%	30%	11%	85.2%
CHOIX TEMPS	Choice of type of work time	CHOITPS_no	14%	6%	34%	8%	19%	9%	15%	21%	12%	14%	14.8%
		CHOITPS_yes	86%	94%	66%	92%	81%	91%	85%	79%	88%	86%	85.2%
CORCO	Conditions to ensure the job is well done: possibility of cooperation	CORCO_no	23%	28%	28%	36%	27%	38%	39%	31%	29%	23%	30.1%
		CORCO_yes	77%	72%	72%	64%	73%	62%	61%	69%	71%	77%	69.9%
CORFORM	Conditions to ensure the job is well done: sufficient and suitable training	CORFORM_No	10%	10%	14%	24%	23%	16%	23%	16%	13%	19%	15.7%
		CORFORM_Yes	90%	90%	86%	76%	77%	84%	77%	84%	87%	81%	84.3%
CORINF	Conditions to ensure the job is well done: sufficient and clear information	CORINF_No	8%	15%	6%	29%	18%	22%	25%	13%	12%	17%	15.6%
		CORINF_Yes	92%	85%	94%	71%	82%	78%	75%	87%	88%	83%	84.4%
CORMOY	Conditions to ensure the job is well done: sufficient and suitable material resources	CORMOY_No	7%	8%	13%	23%	29%	19%	37%	23%	14%	16%	17.5%
		CORMOY_Yes	93%	92%	87%	77%	71%	81%	63%	77%	86%	84%	82.5%
DEBORD	Frequently having to interrupt one task for another unforeseen task	DEBORD_No	54%	18%	75%	14%	58%	20%	38%	59%	43%	45%	42.1%
		DEBORD_Yes	46%	82%	25%	86%	42%	80%	62%	41%	57%	55%	57.9%
DELAI	Possibility of changing deadlines	DELAI_No	21%	19%	30%	42%	70%	26%	58%	39%	25%	46%	34.4%
		DELAI_Yes	48%	72%	17%	55%	21%	66%	35%	25%	50%	43%	44.9%
		Not_applicable_no-deadline	32%	9%	52%	3%	9%	8%	7%	37%	25%	12%	20.8%
DEPECH	Need to hurry to complete job	DEPECH_No	88%	56%	81%	37%	50%	44%	43%	66%	73%	67%	62.2%
		DEPECH_Yes	12%	44%	19%	63%	50%	56%	57%	34%	27%	33%	37.8%
DIMFER	Sunday and public holiday work, even if occasional (any time)	DIMFER_no	95%	88%	55%	84%	74%	28%	17%	14%	40%	95%	60.2%
		DIMFER_Yes	5%	12%	45%	16%	26%	72%	83%	86%	60%	5%	39.8%
EQUIP	Team work	EQUIP_no	98%	99%	84%	92%	52%	91%	30%	50%	91%	93%	79.7%
		EQUIP_yes	2%	1%	16%	8%	48%	9%	70%	50%	9%	7%	20.3%
EVA	At least 1 individual assessment interview per year	EVA_No	48%	22%	70%	21%	40%	26%	27%	46%	42%	38%	38.3%
		EVA_Yes	52%	78%	30%	79%	60%	74%	73%	54%	58%	62%	61.7%
HH	Number of hours worked in the previous working week	HH_At_least_40H	13%	68%	7%	42%	11%	82%	36%	26%	41%	11%	35.5%
		HH_Less_than_40H	87%	32%	93%	58%	89%	18%	64%	74%	59%	89%	64.5%
HORVAR	Stable daily schedule	HORVAR_no	3%	4%	28%	6%	21%	45%	67%	71%	24%	4%	25.9%
		HORVAR_Yes	97%	96%	72%	94%	79%	55%	33%	29%	76%	96%	74.1%
INTERUPT	Possibility of interrupting work a moment if wished	INTERUPT_no	3%	1%	26%	8%	33%	6%	44%	38%	9%	9%	16.3%
		INTERUPT_Yes	97%	99%	74%	92%	67%	94%	56%	62%	91%	91%	83.7%
LOIN	Sleeping away from home	LOIN_no	96%	70%	98%	87%	98%	45%	81%	85%	80%	97%	83%
		LOIN_Yes	4%	30%	2%	13%	2%	55%	19%	15%	20%	3%	17%

MONTH	Knowing schedule for the coming month	MONTH_no	1%	2%	24%	5%	17%	59%	48%	63%	33%	2%	24.3%

Table 4 (*Continued*)

Variables	Label	Modalities	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	Cluster 9	Cluster 10	Total
		MONTH_Yes	99%	98%	76%	95%	83%	41%	52%	37%	67%	98%	75.7%
NIGHT	Night work (midnight to 5am), even occasionally	NIGHT_no	99%	98%	93%	93%	84%	55%	30%	53%	75%	99%	79.1%
		NIGHT_Yes	1%	2%	7%	7%	16%	45%	70%	47%	25%	1%	20.9%
OBJ	Precise quantitative targets	OBJ_No	85%	46%	89%	33%	48%	41%	48%	79%	71%	65%	61.6%
		OBJ_Yes	15%	54%	11%	67%	52%	59%	52%	21%	29%	35%	38.4%
ORD	Possibility of changing task order	ORD_No	12%	3%	45%	6%	48%	4%	32%	39%	10%	19%	20.3%
		ORD_Yes_according_tosk	39%	32%	36%	59%	45%	45%	57%	46%	45%	55%	43.8%
		ORD_Yes_always	50%	66%	19%	34%	7%	51%	11%	15%	45%	26%	36.1%
POLY	Performing different jobs or functions (polyvalence)	POLY_no	72%	72%	64%	44%	33%	56%	31%	52%	61%	55%	56.3%
		POLY_yes	28%	28%	36%	56%	67%	44%	69%	48%	39%	45%	43.7%
PUB	Public contact (users, patients, passengers, clients, etc.)	PUB_No	26%	21%	26%	23%	58%	14%	43%	21%	18%	35%	27.2%
		PUB_Yes	74%	79%	74%	77%	42%	86%	57%	79%	82%	65%	72.8%
RAB	Extra work without compensation	RAB_No	95%	52%	97%	67%	97%	39%	87%	92%	81%	96%	78.8%
		RAB_Yes	5%	48%	3%	33%	3%	61%	13%	8%	19%	4%	21.2%
REGL	Action in case of incident	act_personally	66%	85%	42%	65%	30%	78%	38%	40%	70%	48%	59.2%
		Sometimes_act_personally	15%	11%	16%	24%	28%	16%	37%	27%	17%	23%	20.1%
		Call_someone	19%	5%	42%	11%	42%	6%	25%	32%	13%	29%	20.7%
REPOS	Generally at least 48 hours off in a row in the week	REPOS48_no	4%	3%	30%	5%	15%	17%	24%	37%	18%	5%	15.2%
		REPOS48_Yes	96%	97%	70%	95%	85%	83%	76%	63%	82%	95%	84.8%
RISDANG	Error at work may jeopardize safety of self and others	RISDANG_No	86%	73%	71%	51%	43%	45%	14%	33%	54%	67%	56.3%
		RISDANG_Yes	14%	27%	29%	49%	57%	55%	86%	67%	46%	33%	43.7%
RISEMPL	Error at work may lead to penalties	RISEMPL_No	83%	54%	70%	29%	34%	31%	13%	32%	53%	57%	48.3%
		RISEMPL_Yes	17%	46%	30%	71%	66%	69%	87%	68%	47%	43%	51.7%
RISFINA	Error at work may incur high costs for company	RISFINA_No	76%	27%	80%	11%	26%	14%	11%	45%	45%	43%	40.3%
		RISFINA_Yes	24%	73%	20%	89%	74%	86%	89%	55%	55%	57%	59.7%
RISQUAL	Error at work may severely impact quality of products or service	RISQUAL_No	67%	25%	66%	7%	13%	11%	4%	26%	32%	28%	31.2%
		RISQUAL_Yes	33%	75%	34%	93%	87%	89%	96%	74%	68%	72%	68.8%
RWCOLEG	Work pace determined by colleagues' work	RWCOLEG_no	92%	84%	90%	44%	41%	70%	31%	77%	86%	68%	71.3%
		RWCOLEG_Yes	8%	16%	10%	56%	59%	30%	69%	23%	14%	32%	28.7%
RWDEM	Work pace determined by automatic movement of product or part	RWDEM_no	65%	33%	67%	15%	51%	19%	28%	45%	45%	46%	42.7%
		RWDEM_Yes	35%	67%	33%	85%	49%	81%	72%	55%	55%	54%	57.3%
RWINFOR	Work pace determined by checks or computer monitoring	RWINFOR_no	89%	75%	91%	35%	47%	67%	39%	77%	81%	62%	69.2%
		RWINFOR_Yes	11%	25%	9%	65%	53%	33%	61%	23%	19%	38%	30.8%
RWNORMH	Work pace determined by production or time targets to be met within the hour	RWNORMH_no	99%	97%	92%	56%	39%	82%	30%	82%	94%	82%	78%
		RWNORMH_Yes	1%	3%	8%	44%	61%	18%	70%	18%	6%	18%	22%
RWNORMJ	Work pace determined by production or time targets to be met within the day	RWNORMJ_no	86%	74%	82%	19%	18%	54%	19%	70%	76%	45%	59%
		RWNORMJ_Yes	14%	26%	18%	81%	82%	46%	81%	30%	24%	55%	41%
RWSURV	Work pace determined by daily or continuous managerial checks or monitoring	RWSURV_no	95%	92%	86%	54%	38%	80%	35%	71%	89%	71%	74.3%
		RWSURV_Yes	5%	8%	14%	46%	62%	20%	65%	29%	11%	29%	25.7%

Table 4 (*Continued*)

Variables	Label	Modalities	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	Cluster 9	Cluster 10	Total
RWTEC	Work pace determined by other technical factors	RWTEC_no	98%	96%	94%	70%	58%	83%	44%	86%	93%	87%	82.8%
		RWTEC_Yes	2%	4%	6%	30%	42%	17%	56%	14%	7%	13%	17.2%
SAT	Working Saturdays (any time) even occasionally	SAT_no	83%	73%	29%	64%	42%	18%	8%	6%	24%	78%	44%
		SAT_Yes	17%	27%	71%	36%	58%	82%	92%	94%	76%	22%	56%
SEM	Knowing next week's schedule	SEM_no	0%	0%	8%	1%	4%	42%	21%	30%	17%	0%	11.7%
		SEM_Yes	100%	100%	92%	99%	96%	58%	79%	70%	83%	100%	88.3%
SOIR	Evening work (8 pm to midnight), even occasionally	SOIR_no	97%	78%	80%	79%	66%	19%	13%	25%	50%	95%	61.3%
		SOIR_Yes	3%	22%	20%	21%	34%	81%	87%	75%	50%	5%	38.7%
TEMPS	Type of work time	Full_time	78%	96%	56%	96%	88%	98%	93%	81%	92%	86%	86.1%
		Part_time	22%	4%	44%	4%	12%	2%	7%	19%	8%	14%	13.9%
TRIM	Knowing schedule for the next 3 months	TRIM_no	4%	6%	41%	12%	32%	70%	67%	82%	47%	7%	35.2%
		TRIM_Yes	96%	94%	59%	88%	68%	30%	33%	18%	53%	93%	64.8%

Field: employees in Metropolitan France.

though driving-exposed subjects are also overrepresented in this cluster. Moreover, exposure to occupational driving also concerned employees with strong decision latitude: executives, supervisors or foremen, or public sector executives and workers. They often had to sleep away from home for work and worked more than 40 h in the week prior to the survey (clusters 2, 6 and 9).

The description of cluster 8 showed that the occupational categories most exposed to driving more than 20 h a week were, on the one hand, professional drivers (PCS 64) and sales staff (PCS 55) in the field of automobile sales and repair. Of the 1459 persons exposed to driving 20 h or more, 20% (282) were in cluster 8, in which professional drivers were overrepresented. Psychosocial risk was high for these employees: decision latitude, social support and feeling of recognition were all weak. Poor psychosocial working conditions (strong psychological demand and weak decision latitude) were associated with depression (Paterniti et al., 2002) and the various psychosocial factors could lead to sick leave or work accidents (Niedhammer et al., 2008). Furthermore, employees in cluster 8 did not know their schedules in advance, and it has been previously demonstrated that unpredictable work schedules might be a cause of job stress (Andrea et al., 2004; INRS, 2014). In other words, employees in cluster 8 have work characteristics that literature suggests might lead to higher crash risk. In the other 3 clusters where occupational driving exposure is overrepresented, psychosocial factors and stressful work were less frequent. A study in Turkey found that professional drivers were more quick to react stressfully and more subject to risky behavior while driving as part of their job than other motorists (Wagstaff and Sigstad Lie, 2011).

As far as work patterns are concerned, the results were diverse for the 4 clusters where employees exposed to occupational driving were overrepresented. Taken as a whole, employees exposed to driving were less subject to restrictive work patterns (Fort et al., 2014). Executives (PCS 32 or 36) or foremen had strong decision-making power but were bound by targets, deadlines and technical restrictions, their pace of work depended on their colleagues, and they were monitored while performing their tasks. In contrast, professional drivers (PCS 64), workers (PCS 61) and public employees who were exposed to driving did not depend on quality standards or colleagues to do their job.

In the three clusters 2, 6 and 9, more than two-thirds of employees were more than 35 years old, while in clusters 3, 7 and 8 the majority were not exposed to driving and more than 40% were less than 35 years of age. In a study of work-related road accidents, workers between 50 and 65 years of age had the highest accident frequency of work-related traffic accidents (Salminen, 2000). Young drivers for heavy vehicle, especially those who drove for their living, were recognized as being at greater risk of road accidents while at work (Duke et al., 2010), and their injuries were also more serious (Boufous and Williamson, 2009).

Those most overexposed to driving within the framework of this study were therefore executives (PCS 32 or 36). In the literature, some socio-occupational categories were more frequently victims of road accidents, such as professional drivers (Hours et al., 2011), sales personnel and business owners (Charbotel et al., 2001). Another study reported higher risk of work-related accidents for company sales representatives, clerical staff and public sector workers (Fort et al., 2010). Some clusters identified here included the same socio-occupational categories with strong occupational driving exposure, and which had been recognized as at risk of road accidents, such as public sector employees, professional drivers and sales representatives, but not executives (Fort et al., 2010).

MCA enabled investigation of the characteristics and work conditions of employees in the SUMER survey, so as to obtain an overall view. It highlighted relationships between working conditions and their links with occupational driving exposure. It was then possible to create a typology of employees. This analysis was interesting because it was carried out on a large sample, of more than 40,000 individuals (SUMER survey), which were representative of 92% of all salaried workers in France. Some of the clusters observed characteristics predict differences in accident risk, and this could be tested in future research.

4.2. Limitations of the study

Although the SUMER survey covers a large proportion of employees in France, some workers were not included in this study, such as employees of the Ministry of Justice, the Ministry of Social Affairs and National Education. These employees are not known to have a strong occupational driving exposure (Hours et al., 2011). Independent workers were not covered by this survey. These workers are known to have strong organizational and relational work constraints and may be concerned by an occupational driving exposure. Unfortunately, on-duty road accident history was not recorded in the Sumer survey. Anyway, it is not the most appropriate to have a report of a rare event such as a road accident in a cross-sectional survey representative of a population such as SUMER; even if this question was asked, only few employees could have been concerned.

5. Conclusion

This study of the characteristics of work in a large sample of the French workers showed that occupational driving workers did not form a homogenous group and that numerous variables linked to the pace of work and occupational constraints should be used to characterize the different groups. Four clusters accounted for almost 60% of those exposed to driving, the other 40% being distributed among the other 6 clusters in a heterogeneous fashion (between 5% and 10% per cluster). Thus, analysis confirmed that driving exposure was related to certain atypical work time characteristics, such as weekend working and not having foreknowledge of one's work schedule. Employees exposed to driving showed a diversity of other occupational characteristics. Pressures related to the pace of work were mostly observed in employees not exposed to driving, except for demands from outside that required an immediate response. Job strain was also more prevalent in the clusters with low driving exposure. This analysis nevertheless suggested perspectives for preventing road accidents at work, since it highlighted several characteristics of employees exposed to occupational driving. Professional drivers had been well identified in a cluster but other clusters had been shown to include other road exposed employees and concerned other professions. These clusters of employees should also be the target of road safety prevention.

Authors' contributions

EF managed the data and made statistics analysis. EG managed the data and made statistics analysis. EG, EF, BG, CP, MH and BC wrote and approved the final manuscript.

Declaration of Competing Interest

The authors declare that they have no competing interests.

Acknowledgments

The authors wish to thank DARES for permission to use data from the SUMER 2010 survey.

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