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# 1. Context of the Study

## 1.1 Occupational Driving on Public Roads : Occupations Requiring Use of Light Vehicles

- 1 Driving a motor vehicle for occupational purposes is a complex activity that differs significantly from driving carried out for personal reasons (Pécot & Van Belleghem, 2012). Occupational driving is only one element in a broader framework, itself governed by its own constraints and functioning in its own particular dynamic environment.
- 2 In France, the number of wage-earners using public roads to drive for occupational purposes totalled just over 4 million in 2010, some 26.5 % of all French workers (Arnaudo & al., 2012). This percentage includes drivers both of heavy vehicles (vehicles weighing over 3.5 tons, used for the transport of merchandise or of people) and of light(-duty) vehicles or LDVs<sup>1</sup>.
- 3 The versatility of use of light vehicles makes them particularly suitable for addressing newly-developing commercial needs and responding to both low-volume and urgent needs, particularly for courier or delivery services. It is precisely for this reason that light-vehicle transport is becoming an increasingly important factor in transportation activities and in the economy in general (Giret, 2013). In 2011, figures compiled by France's *Service de l'observation et des statistiques* (SOeS) (Eng : Observation and Statistics Service) show that 5.8 million light vehicles were in use in the country that year, a figure 10 times higher than the number in the entire heavy-duty vehicle fleet (Jlassi, 2012). Over that same period, the relative number of people using LDVs also rose among retail and service employees and among administrative and factory workers (Arnaudo & al., 2012). Even as early as 2007 (Chardon & Estrade, 2007), the French public service directorate Dares<sup>2</sup> had begun to draw attention to the increasingly significant development of high mobility sectors and the expansion of the tertiary sector, thereby suggesting the probability of a growing and lasting increase in the number of people driving on public roads. The fact is that, above and beyond the socio-professional group composed of people who drive professionally, our society is seeing a growing number of wage-earners for whom driving constitutes only one part of their working day (construction sector managers, sales representatives, craftspeople or maintenance technicians, for example). And a significant amount of this work-related driving, using light vehicles, is carried out by people for whom the driving is integral to their work, but is nonetheless not their primary occupation.
- 4 In February 2012, some 91 % of interviewees questioned by IFOP<sup>3</sup> had made at least one online purchase and chosen home delivery to receive it (Ducret, 2012). Clearly, the parcel delivery sector is experiencing the impact of changing consumer practices and the resulting demands for delivery they generate. As a critical part of the chain of distribution, specializing in the transport and delivery of merchandise to end customers, courier and delivery services use primarily road-based transport to handle parcels weighing less than 3 tons, based on a system of parcel pickup, bundling and unbundling and delivery (Dupeyron, 2000).
- 5 The final links in this delivery chain that is one part of the broader road-based freight transport system are the couriers and driver-deliverers or transport professionals who, to a significant extent, rely on light vehicles. Studer (2002), refers to them as

“professionals *on* the road” ; their occupational culture is different from that of heavy vehicle drivers because driving is not their primary function, even though it represents a significant part of their workday. These drivers are regularly faced with what can often be difficult conditions arising from traffic situations, client behaviours and time constraints. Their delivery schedules require frequent stops to leave their vehicles and to handle and carry parcels in a range of different weights. Problems most typically associated with courier services arise from the physical loads couriers carry, time pressure and client relations (Annecy Santé au Travail, 2009).

- 6 Using activity-centered analysis, other studies instead consider the impact of this occupational activity on wage-earners in different sectors. In an ethnographic-type study, Cholez (2002) stresses the fact that, when questioned about their duties, driver-deliverers chose not to emphasize their driver function and spontaneously focused instead on their role in *delivering* goods, an activity that can seem entirely self-evident. Although different follow-up strategies enabled researchers to obtain more details about the process, they failed to identify specific knowledge or skill sets drawn on by driver-deliverers. Depincé (2004) laments the fact that, in the collective consciousness of these professionals, driving seemed only to constitute

“... an act of liaison between two tasks identified by their organization : you pick up a parcel from Mr X and you deliver it to business Y”

and was not seen as a distinct activity in its own right. Similarly, in the construction sector, Forrierre & Six (2010) showed that for site supervisors, driving was viewed basically as

“... an activity to enable a person to move onto a site in order to carry out another activity”,

even though the driving taking place on site may well be for different purposes. Pécot & Van Belleghem (2012), in their study of what contributes to a social and collaborative economy found in the seeming banality of the drive between one place and another a major source of motivation for working drivers. Employees apparently see their driving as an important resource that contributes to the effective performance of their duties. As a result, work-related constraints affecting their driving are identified and integrated with other requirements that impact on the performance of their work.

## 1.2 Occupational Driving and Related Health Risks

- 7 Occupational driving, where vehicles constitute the work tools used on a daily basis, represents in itself an occupational hazard. In 2012, deaths in work-related road accidents (excluding accidents while commuting to or from the workplace) accounted for 21 % of the deaths of French wage-earners (CNAM DRP, 2013). The goal of reducing the number of occupation-related road accidents and deaths has for many years led to a major focus being put upon reducing or preventing injuries or deaths resulting from road accidents. Clearly, society finds it difficult to accept that a person can be injured or lose their life at the wheel while performing work-related tasks. But in fact, above and beyond the question of road accidents, drivers performing their normal duties can also run the risk of being exposed to factors affecting their health. Even today, in the current context of an increasingly demanding work environment due to advances in internet technologies and the explosive growth of e-commerce, the issue of the impact of occupational driving on drivers' health still remains under-analyzed and limited to only a few professions (Guinchard & al., 2008). A literature review carried out in 2008

(Thierry & al., 2008) looked at the knowledge base available on the question of the relation that might be established between occupational driving and workplace health and compared the effects of different physical and postural constraints, chemical risks and even psychosocial risks on driver health and well-being. The vast majority of the studies reviewed focused on professional drivers : drivers of heavy-duty trucks or buses, taxi drivers and police drivers. Truck drivers, for example, are particularly subject to load handling accidents, unhealthy lifestyle habits arising from their schedules, a worsening of certain medical conditions (diabetes, high blood pressure), driver fatigue (Fournier et al., 2007) and stress.

- 8 Whatever the vehicle driven, the most frequently reported medical problems were musculoskeletal disorders (MSDs), defined as a range of periarticular conditions affecting the soft tissues of the limbs and back (muscles, tendons, nerves, blood vessels, cartilage), experienced primarily as pain or discomfort (Roquelaure et al., 2005). MSDs are individual- and occupation-specific (age, sex, diabetes, obesity) multifactorial disorders. Two types of occupational factors play a role in the occurrence of MSDs : biomechanical factors (physically demanding movements or static effort, extreme postures, repetitive movements, vibrations from tools or machines, etc.) and psychosocial or organizational constraints or stressors (high levels of psychological demands, poor social support, limited decision-making latitude, few or no work breaks, work pace pressures) (Brière et al., 2015).
- 9 In the case of professional drivers, the primary risk factors identified were physical constraints (sitting position, handling of heavy loads, exposure to vibrations), organizational factors (time spent driving, traffic situations, possibility of work breaks) and also psychosocial factors (psychological pressures, poor management support, low decision latitude, perceived stresses) (Magnusson & al., 1996 ; Aptel & al., 2007). Driving of light vehicles for specific occupations (travelling salespeople, taxi drivers, craftspeople) is most frequently associated with low back pain, with the principal risk factors reported arising from the length of time spent driving each week, the distance travelled annually, the number of hours driven each day, trunk movement while driving, awkward postures adopted as a result of the limited size of the cab of the vehicle, and the low degree of autonomy drivers can exercise in their work.
- 10 However, it becomes extremely difficult to extrapolate the results of these earlier studies to newly booming areas of activity such as courier and delivery services. This is precisely why INRS found it important to undertake a research project designed to better understand the current occupational health situation of drivers who regularly carry out long hours of occupational driving in the courier and parcel delivery sector.

### 1.3 Use of Light Vehicles for Delivery of Mail and Parcels : the Example of the La Poste Group in France

- 11 Similarities have been identified between operations for delivery of mail and parcels using light vehicles and activities performed in sectors such as messaging services and parcel drop-off by driver delivers, especially as regards terminal mail sorting practices and loading and delivery of mail and parcels (Mykolenko & Ropital, 2004 ; Ducret, 2012).
- 12 As part of its prevention responsibilities, *La Poste's* occupational health service is required to find the best possible solutions to problems identified and ensure that workplace requirements or constraints for postal occupational groups are suitably

taken into account (*Accord cadre* (Eng. : Framework Agreement), 2013) for the courier and parcel delivery sector with its intensive use of light vehicles. In fact, for the *La Poste* group in France, MSDs represent a major workplace health issue and primarily affect courier and parcel delivery workers (approximately 90 % of responses to medical questionnaires), with one third of the employees affected ultimately needing some form of job reassignment (Hocine & al., 2013). MSDs of the upper limbs constitute over 90 % of occupational illnesses and are increasing all the time (Arnaudo & Morel, 2007), especially in the case of courier and parcel delivery workers who use light vehicles for their deliveries. This group is at three times greater risk than administrative personnel or those working at front desks of organizations.

- 13 In light of these observations, the INRS and the *La Poste* group decided to carry out an ergonomic study focusing on an analysis of the work activities actually performed by courier and parcel delivery agents using light vehicles in different reference situations. This exploratory study was carried out between 2011 and 2012 under the guidance of a joint INRS-*La Poste* Steering Committee comprised of representatives from *La Poste* (*Direction Prévention Santé Sécurité Travail*: (Eng. : Occupational Prevention, Health and Safety Directorate), volunteer physicians from the *Services de Santé au Travail* (Eng. : Occupational Health Services) and workplace safety officers from *Courrier & Colis* (Eng. : the Mail and Parcels group), with input also provided by representatives from a range of disciplines at the INRS.
- 14 The purpose of the study was to examine, in real work situations, the different steps taken by *La Poste* employees in the courier and parcel delivery process. Using a multidisciplinary approach combining observation of the activity, a structured interview in the course of the activity and administration of a medical questionnaire after the activity, this exploratory study provided the initial knowledge base from which a subsequent epidemiological study could then be developed to analyze specific driving-related risk factors in the delivery process.

## 2. Methodology

### 2.1 Study Population

- 15 The study steering committee chose a sample group of 22 postal workers, including 14 agents from the *Courier* section and 8 handlers from the *Packages*<sup>4</sup> section, all of whom used four-wheeled motor vehicles extensively and made frequent stops with them. The 22 members of the sample group were recruited on a volunteer basis from 12 postal centres working in 4 departments in France.
- 16 Typologies reflecting standard constraints experienced by these two occupations were identified :
- horizontal (individual homes) or vertical (multiple-user buildings) delivery process ;
  - urban/suburban (multiple-user buildings, private homes, stores, businesses) or rural (mainly private homes, commercial and/or industrial areas) delivery process ;
  - The 22 postal workers participating in the study were almost equally distributed between the sexes (10 women/12 men) and were on average 38.4 years old ( $\pm 9.2$ ). There were more women recruited in the Courier agent group (8 compared to 6) and more men in the Package handler group (6 compared to 2).

## 2.2 Materials and Methods

- 17 For this exploratory study based on only a small study population, we developed a combination of different approaches and drew on a variety of different sources of information :
- observed data focusing on actions taken by mail carriers in performing their work activities,
  - qualitative data emerging from structured interviews carried out with these mail carriers during their work activities,
  - data obtained using standardized medical questionnaires administered outside the carriers' work activities.
- 18 Our ergonomic analysis involved observation of the actions carried out by these mail carriers from the start of their workday until their return from their delivery routes at the conclusion of those workdays, between November 2011 and April 2012. The study protocol provided for the installation of observation cameras in certain vehicles and the use of the passenger seats of delivery vehicles or presence in accompanying vehicles of observers for the study during the delivery process, as well as verbal exchanges based on semi-structured questionnaires. This data was collected by a multi-disciplinary team from the INRS (one psycho-ergonomist, one physician, and one technician). The study was conducted so as not to interfere with the regular work of the mail-carriers.
- 19 In the course of a subsequent follow-up medical appointment, a 15- to 20-minute questionnaire was administered to the mail carriers by an occupational physician from their postal centre. The intervention protocol was presented by these workplace medical officers to the Occupational Hygiene, Safety and Workplace Environment committees of the organizations concerned. Each volunteer participant received individualized information as to how the study would be conducted ; their agreement or refusal to accept proposed different steps to be taken was carefully noted, as was an explicit authorization in the case of any employees to be filmed. All the information collected was to remain anonymous and confidential and its analysis would be comprehensive and collective.

## 2.3 Ergonomic Analyses

- 20 To best reflect the range of activities involved in the mail delivery process (initial sorting of mail and parcels, planning of the delivery, loading of the vehicle, tallying of payments received, handling of undistributed parcels or recommended mail items, etc.), observation of the different activities carried out by the mail carriers began at the start of their work day and continued until their return to the mail centre at the end of their work shift. In this way, we were able to re-situate letter and parcel distribution as significant elements in the overall mail delivery process taking place, before then trying to pinpoint the variations in these delivery activities which might be explained by differences in the driving environment. In our analysis of all the data collected, we drew primarily on the observations we found to be most enlightening.
- 21 Documentation describing work processes was also collected from and reviewed with the directors of the different mail centres involved.

### 2.3.1 Tracking and Observation of Drivers during the Delivery Process

22 To carry out tracking and observation of drivers along their delivery routes, it was agreed that a representative of the multidisciplinary INRS study team could occupy the passenger seat to the right of the drivers. Observers used an observation checklist which allowed them to note the number of times any particular action was performed in the course of 15-minute time periods during the delivery (e.g., climbing out of the vehicle, opening the doors, reversing the vehicle, climbing into the loading area, etc.). All the vehicles tracked in this study were standard commercially available vehicles that had not been modified in any way. They were all either light trucks or vans, of different makes or models, and all had manual transmissions.

### 2.3.2 Video Recordings of Drivers during the Delivery Process

23 Camera observations of the delivery process were made using continuous video recordings of the different actions carried out by vehicle operators while seated in their driver's seat. Eight drivers were observed in this way (5 courier agents and 3 parcel handlers). Vehicles were equipped with a small camera attached to the windshield and facing the driver, who was videoed in profile (Figure 1). Three other cameras were mounted in each vehicle, two of which covered the loading area and the other the road environment to the front of the vehicle.

Figure 1. Mounted video camera filming actions taken by the mail carrier while seated in the driver's seat



An observer in a second vehicle followed the delivery route taken by the camera-equipped vehicle. To identify in detail the sequence of operations carried out in driving the vehicle, the video recordings made were analyzed using the data analysis and synchronisation software program, Captiv<sup>®</sup>. Those operations were subsequently grouped together in broad categories such as driving activities, stops, manoeuvres, etc. To avoid needing to spend over-much time analyzing the video recordings, only one hour of recorded observations per employee was analyzed for each of the 8 drivers



whose vehicle had been fitted with cameras. The hour was selected so it would fall midway along the delivery route, and would also leave some distance between the different loading and unloading phases, to make it as representative as possible of the steps followed in courier and parcel delivery.

### 2.3.3 Interview Guide

- 24 In tracking the delivery process, observer interviewers used a semi-structured interview guide, based on a list of questions that allowed them to solicit from interviewees responses centering in particular on a number of previously-determined subjects and themes. The themes focussed on specific points that might affect the mail carriers' work, such as their personal characteristics, a description of the tasks they performed and their work environment or the physical layout of their vehicles, and also explored how their work was organized and any perceived psychosocial or physical constraints encountered. The observers addressed these different subjects with the driver-operators while recognizing that the order of their questions and how they were phrased, as well as the degree of detail to be asked for in the responses, could obviously vary, depending on the context.

### 2.3.4 Simplified "Nordic" Questionnaire

- 25 A simplified series of questions based on the "Nordic" questionnaire on musculoskeletal symptoms developed by Kuorinka & al., and translated into French (1994), were asked of the drivers every 90 minutes during their delivery route. This data base was collected from a sample group of 22 mail carriers (14 courier agents, 8 package handlers).
- 26 The questionnaire was used to explore with the mail carriers the problems they experienced (discomfort or pain) during their delivery routes, without attempting to differentiate between the particular types of problems encountered. The questionnaire used a rear view diagram of the human body showing the different parts of the body and asked respondents to rate the degree of intensity of the symptom or symptoms experienced in each area shown, on a labelled scale ranging from 0 to 10.
- 27 For the purposes of our study, interview questions were not focussed on work-related health problems, but rather on identifying the parts of the body affected by the work carried out by the mail carriers (Vézina & al., 2009). This is precisely why the body diagram shown to mail carriers at the start of their deliveries was shown again to them every 90 minutes so they could identify exactly where in their body they experienced the pain or discomfort and could use the corresponding intensity scale to show the level of symptoms experienced. It was this process which enabled us to correctly identify the areas of the mail carriers' bodies affected by their work. Symptoms reported by any mail carriers or package handlers who identified at least one problem during the delivery operation, in any of the parts of the body under consideration, were included in the sum total of work-related musculoskeletal symptoms for the purposes of our study.

## 2.4 Medical Questionnaire

- 28 In order to identify the various elements associated with individual characteristics, working conditions (occupational and psychosocial factors) and the health situation of each mail carrier in the study and to cross-reference this information with the activity analysis data, the INRS, in collaboration with the *La Poste* occupational physicians

involved, prepared a questionnaire based on previously validated instruments : the Everest 2011 questionnaire (Leroyer, 2011), jointly designed by occupational physicians and researchers to enable comprehensive assessments to be made in day-to-day medical practice of the work-related health problems of the postal employees in question ; the statistical indicators of work-related psychosocial risks developed by the Dares group (Dares Analyses, 2010) and the full Nordic questionnaire. This unabridged version of the questionnaire is used in epidemiological studies and includes a range of questions bearing on the nature of musculoskeletal symptoms experienced, their frequency, their duration and the degree of intensity of the problems identified (Kuorinka & al., 1994). It is widely used in the occupational health field and is a tool which enables comparisons to be made between results obtained in a given study and those of other studies. The questions in the Nordic questionnaire give researchers detailed information on the musculoskeletal symptoms experienced by respondents but do not provide answers as to which particular aspects of the job situation lead to the emergence of those problems.

- 29 The medical questionnaire used for our study asked for information in reference to :
- the personal characteristics of each worker (socio-demographic profile, lifestyle and commuting habits, education level, job in the organization, total time spent in jobs requiring driving on a regular basis, etc.) ;
  - the physical demands of the position held (driving, maintaining awkward postures, carrying loads, repetitive gestures, etc.) ;
  - the person's current health situation (self-reported health problems, MSDs) ;
  - the person's experiences in their workplace and, in particular, any perceived psychosocial pressures (time pressures, need for autonomy or support, ethical issues, need for better recognition, job security, etc.).
- 30 The medical questionnaire was completed by 21 mail carriers.

Table 1 shows a breakdown, by type of analysis applied and by sex, of the two mail carrier occupations studied for this project.

**Table 1. Breakdown of postal employees showing type of analysis used, their occupational group and sex**

Mail Carriers		Courier Agents N = 14 (6/8)		Package Handlers N = 8 (6/2)		Total N = 22
(M/F)		Males	Females	Males	Females	
Data Sources						
Ergonomic Analyses	Tracking and observation of drivers during delivery process	N = 4	N = 5	N = 2	N = 2	N = 13
	Video recordings made during delivery process	N = 2	N = 3	N = 3	/	N = 8
	Semi-structured interviews	N = 3	N = 6	N = 4	N = 2	N = 15

	Simplified Questionnaire	Nordic	N = 6	N = 8	N = 6	N = 2	N = 22
Medical questionnaire			N = 6	N = 8	N = 5	N = 2	N = 21

### 3. Results

- 31 Two kinds of results are given. The first section is based on field data collected using ergonomic methods combining on-site observation, interviews and a simplified Nordic questionnaire. The second section shows medical information collected by means of a medical questionnaire.

## 3.1 Ergonomic Analyses

### 3.1.1 Observation of the Work Process

- 32 The normal workday begins at 6 a.m. Postal workers have approximately one hour, first to hand sort incoming deliveries by sector, then to sort by street name and address number the mail and parcels they will be delivering. All mail must be ready for delivery by approximately 8 a.m.
- 33 In theory, mail carriers can use their sorting time slot as they need to prepare the delivery process. In fact, our tracking indicates that the speed of repetitive sorting movements seems to gradually increase over time. At all times, the separation and sorting process involves repetitive movements of the upper limbs, particularly the shoulders, the elbows and the right wrist.
- 34 One factor that seems to explain this increase in speed is a work environment that allows employees to work on a “fini-parti” (*‘done and gone’ - our translation*) basis, where they have the right to end their workday once deliveries have been completed (Cuvelier & Caroly, 2011).
- 35 The mail organization and sorting process is a key factor in subsequent operations (Cholez, 2008). It enables mail carriers to plan their delivery routes in advance and sort the mail to be delivered on that basis. It also means they are able to allow for a range of factors that can impact on the delivery process : traffic conditions, depending on the day and time of the delivery, operating hours or opening times of businesses or stores, weather conditions, road work, etc.
- 36 Loading of the vehicle is the other important step taking place before the delivery process can begin. Letters and registered mail, arranged in bundles inside special bins, and parcels for delivery, are moved to the delivery vehicle on mobile shelving units (Figure 2). In this phase of the process, each parcel or mail bundle postal workers will be delivering is handled at least four times before the vehicle is loaded, demanding additional physical effort before the delivery process in fact begins. Solely to have a rough idea of the weight and size of packages handled, we were able to obtain information about parcel dimensions from the *ColiPoste* mail centre where two of the package handlers in our study worked. In theory, parcels should weigh a maximum of 30 kg and their maximum measurements are 150 cm by 100 cm. It is calculated that each package handler delivers on average between 360 kg and 400 kg of parcels daily.

Figure 2. Letters and parcels being moved to the postal delivery vehicle in a rural area



- 37 As a general rule, loading of delivery vehicles takes place in the same order as the delivery route taken, but mail carriers are free to make changes to the loading order, depending on the weight and size of parcels to be delivered.
- 38 Before the vehicle leaves, any needed delivery documents or forms (tracking slips for registered mail or parcels, delivery notification forms, etc.) are placed within easy reach in the driver's compartment. Many drivers have devised their own mounting systems for keeping these documents in place and organized.
- 39 When they return to the mail centre, mail carriers carry out their various return-to-base operations : logging of payments received, return of remittance vouchers, updating of client logs, as well as applying standard procedures for undelivered mail and parcels (sorting of this mail for later pickup, forwarding or returns to senders of mail or packages, etc).
- 40 These workday processes – almost identical for the two mail carrier occupations – involve the following steps : a) sorting and preparation of the delivery. b) loading and organization of mail and packages in the vehicle, c) a work break in advance of the demands of the delivery itself, d) the delivery operation *per se* which can involve 2 or even 3 separate phases, followed by e) a return to the mail centre with a less physically demanding period when administrative tasks can be carried out, then finally, completion of the delivery process with the undelivered mail and packages unloaded and stored for later follow-up and the vehicle readied for the following day's activities.
- ### 3.1.2 Mail and Parcel Delivery by Light Vehicle
- 41 The operations analyses show (Fig. 3) that the mail carrier drivers in both occupational groups remain in the driver's compartment for more than half of the time (56 %) spent on their delivery route, with 45 % of that time used for driving-related activities

(driving and manoeuvring the vehicle). The remaining time (11 %) is spent when the vehicle is stationary, with the parking brake applied.

Figure 3. Average percentage of time spent per operation, with type of delivery and occupational groups combined

- 42 These latter stops are used for different tasks that can be carried out in the driver's compartment (filling in of forms, checking of lists, etc.) (Fig. 4) and for reorganizing mail and parcels still to be delivered.

Figure 4. Office-type tasks carried out in the driver's compartment - Camera shots from inside the vehicle



- 43 All this constant reorganization of deliveries is the result of contingencies that can occur in the course of the delivery process : mail addressees are absent, the mail carrier has problems accessing a building, traffic is re-routed because of road work or accidents, etc. and drivers need to make changes to the delivery circuit that had initially been planned that morning.

“If things get overwhelming, I need to re-sort, reorganize and re-stack my stuff ...”

#### a. Delivery strategies

- 44 In order to focus in particular on occupational demands or constraints that might be associated with the type of delivery area served (urban/suburban area, rural area), we began by distinguishing and analyzing the observed data relating to driver-operators exiting their vehicles and to the stops where they remained in the driver's compartment. Basically, they exited their vehicles for their delivery activities and stopped the vehicles to reorganize the mail and parcels.
- 45 In the case of rural mail routes, mail carriers exited the driver's compartment of their vehicle for only 39 % of their overall delivery time, while for urban or suburban routes, they exited the driver's compartment of their vehicle half of the delivery time (50 %).

This same trend was observed in the average time spent away from their vehicle (Table 2) : less than one minute in rural areas (0.5 min.), compared to over 3 minutes for urban or suburban delivery routes (3.19 min.). The total time spent on stops where drivers remained in the driver's compartment was proportionally greater on rural routes than on urban/suburban delivery routes (15 % cf. 6 %).

Table 2. Individual data results for the 8 mail carriers filmed during their deliveries. Results are based on a one-hour video recording per mail carrier

Mail carrier	1	2	3	4	5	6	7	8
Type of delivery route	Urban	Urban	Urban	Rural	Rural	Rural	Rural	Rural
Occupational Group	Courier Agent	Package Handler	Package Handler	Package Handler	Courier Agent	Courier Agent	Courier Agent	Courier Agent
Absence from driver's compartment (%age of total delivery time spent away)	49 %	57 %	44 %	39 %	36 %	54 %	31 %	37 %
Number of times driver exited vehicle	6	16	19	22	44	62	23	47
Average duration of each exit from vehicle (mins : secs)	04 :52	02 :09	01 :22	01 :05	00 :30	00 :32	00 :47	00 :29

46 The different time breakdowns shown can be explained at least in part by the limits and physical constraints specific to the corresponding delivery area.

47 In rural areas, the areas covered by mail delivery services are significant and distances considerable, hence the amount of time drivers spend behind the wheel. At the same time, because of the lower housing density than in towns and cities or suburban areas, mail carriers have lower mail drop-off rates and are less subject to some of the time pressures created by other road users.

“rural delivery ... calm environment, no traffic pressures, no stress”...

48 In rural areas, it is also easier for mail carriers to develop their own awareness of the habits or preferences of local residents. One technique in particular, allowing mail carriers to avoid always having to leave their vehicle, was observed : with the driver's window down, mail or small packages were placed directly in addressees' mailboxes (Fig. 5) or handed in person to people standing on their own doorsteps. As a result, the relative time taken for vehicle manoeuvres was twice as long in rural areas as in urban or suburban areas (12 % vs. 6 %).

Figure 5. Mail delivered directly through the open window of the delivery vehicle – Camera shots from inside the vehicle



- 49 The time saved by using this approach, and the existence of fewer parking constraints, also explain the longer mail stops made by the driver-operators ; these stops give them more time to reorganize mail or parcels and deal with postal paperwork (delivery notices, registered mail slips, etc.).
- 50 In the urban and suburban context, however, time pressures are of an entirely different nature and demands or constraints on mail carriers are amplified : road traffic is heavier and urban development more dense, traffic conditions lead to more frequent periodic stops (8 % vs. 2 % in rural areas), mail drop-off points are closer together, parking spaces harder to find, etc. As a result, delivery situations are more complex and pose problems in areas such as delivery safety, shared use of the road and traffic congestion.

“The next mailbox is a really dangerous one. I actually need to park the vehicle across the sidewalk to avoid traffic problems.”

Strategies used can vary and observers were able to see :

- mail carrier-drivers hunting for the “best” parking space, based on their familiarity with the location (parking spaces reserved for delivery vehicles being all-too-often taken), so parking becomes a somewhat chancy operation, as can be seen in Figure 6 ;
- mail carriers spending longer times on deliveries carried out away from the delivery vehicle, because of the use of pre-sorted mail and parcel bundles for buildings on the same street, served by multiple mail boxes or using internal mail delivery systems run by a building superintendant ;
- alternatively, mail carriers spending the shortest possible time on deliveries, as a way to avoid creating any major traffic disruptions.

Figure 6. Mail delivery vehicle parked on the concrete island between vehicle traffic and the bus and taxi lane



- 51 Parking in an urban area also regularly requires carrying out backing manœuvres (3 per hour on average during our observations) while facing tight time constraints, as well as pressures from other road users. Mail carriers also need to climb out of their vehicles to make their deliveries (10 times per hour on average), open the back doors (6 times/hour) and/or the side door (2 operations/hour), and climb up into the loading area (3 times/hour) to handle mail sacks and parcels.
- 52 Wherever deliveries were being made, we observed that the mail carriers regularly used the passenger seats in their vehicles to organize the next series of mail or packages for delivery, after transferring this mail in bundles or parcels from the rear section of the van (see Figure 7). Passenger seats were not the only place used for pre-delivery mail placement ; mail could also be placed in the area between the two front seats, on the floor of the passenger compartment, or even on the dashboard.

“When there are small parcels, I put them up front. Not exactly what you might call the most legit of choices...”

“I normally put the box of mail and parcels on the passenger seat ... and mail for upcoming deliveries on the dash, within easy reach.”



Figure 7. Mail stacked on the passenger seat – Camera shots from inside the vehicle



- 53 This kind of make-do organization means that mail-carriers can access their soon-to-be delivered mail without leaving their seats, so reducing the amount of energy they expend on those tasks. It is a widely used approach, with the added advantage that it also allows them to mentally plan for upcoming delivery stops.
- 54 One final point to be made regarding mail delivery is that seat belts are very rarely used. Tracking shows that they are attached less than once an hour, a far lower figure than the average number of times per hour that drivers actually leave their vehicles. For the most part, they attach their seat belts at the beginning (start-up manoeuvres) and the end of the delivery process (for the return to the mail centre). The frequent stops they make, hard-to-find seat belt clips, tacit tolerance of failure to respect this rule of the road code are some of the reasons given for mail carriers' non-use of seat belts.
- 55 The different strategies adopted by mail carriers during the initial mail sorting and organization phase and then in adapting the planned delivery process to the constraints specific to their particular delivery areas illustrate the crucial importance of their having the fullest possible understanding of their entire delivery operation. They are involved in situations where they need to use creativity and initiative, and to be able to interact with a variety of other players (clients, other drivers, etc.) and with the environment in which they are working (Pulakos & al., 2002), in other words, to be capable of adapting to a range of diverse situations. They build up for themselves what might be described as operational leeway (Coutarel & al., 2015) which allows them to conduct their mail-carrying activities in a highly dynamic environment.
- 56 Table 3 provides a synthesis of major strategies and constraints observed in urban/suburban and rural mail delivery operations.

Table 3. Comparison of the strategies and constraints particular to urban/suburban and rural mail delivery operations

		Urban/Suburban Delivery	Rural Delivery
<b>Delivery Strategies</b>	Parking	Mail carriers constantly hunting for parking spots	Few constraints affecting available parking
	Delivery Method	Deliveries carried out using previously sorted bundles	Individual door-to-door delivery
<b>Organizational Constraints</b>	Time Constraints	Rapid delivery processes used so as to free up parking spaces occupied by mail carriers	Few time constraints, thereby freeing up mail carriers for sorting and re-organizing mail
	Environment	Constant changes, so requiring constant adaptation to the situation of the moment	Generally stable, requiring above all a good grasp of the challenges posed by the distances involved

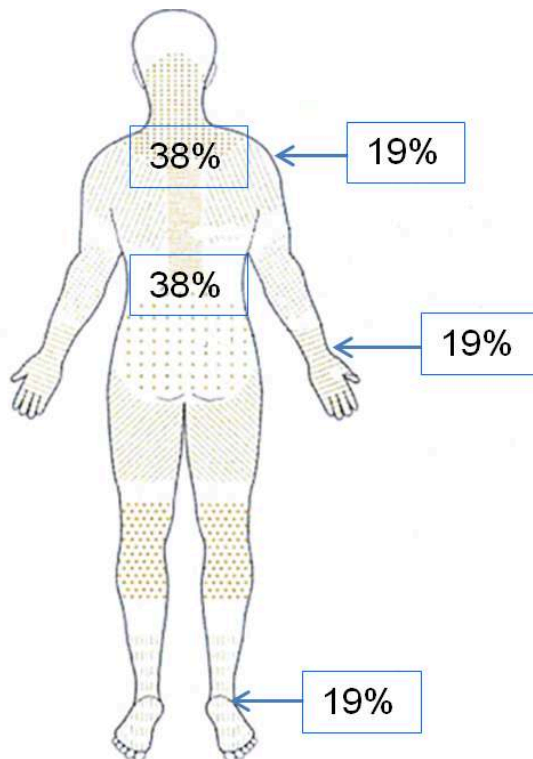
## b. Answers to the Simplified Nordic Questionnaire

- 57 The question sheet based on the simplified Nordic questionnaire gave mail carriers the opportunity to describe musculoskeletal symptoms they experienced, both on their delivery routes and in pre-delivery sorting. We found, however, that the problems identified did not have any precise pattern corresponding to stages of the delivery process. Some mail carriers might experience no pain at the beginning of their shifts, but might find that the pain symptoms would occur at different moments in the course of a delivery, and would sometimes disappear entirely. It is precisely for this reason that we chose to centre our analysis on the parts of the body where symptoms were experienced, rather than on what may have caused the carriers' experience of those symptoms to evolve. This analysis enabled us to calculate the total number of pain issues identified for each part of the body, by adding up the number of times problems were reported, either by the same, or by different, mail carriers. Readers will find it of interest to learn that seven of our 21 mail carrier respondents answered that they had experienced no pain or discomfort during the delivery process, so were not included in the analyses for this study. Consequently, given the limited number of respondents (14 mail carriers, comprised of 6 package handlers and 8 courier agents), these results should be interpreted with caution.
- 58 In qualitative terms, musculoskeletal problems were most frequently identified in the upper and lower back and on the right side of the body (Table 4). These were issues experienced by mail carriers from both occupational groups. Even after we apply all the careful nuances called for in what still remains a qualitative evaluation, the results nonetheless suggest that pain symptoms identified by mail carriers who use light vehicles for mail delivery affect exactly the same areas of the body.

Table 4. Total number of most frequent sites of pain or discomfort identified by body area for 14 mail carriers, with both occupational groups taken together


- 59 Respondents also identified problems in the neck area, in knees, elbows, arms, thighs and feet, but less often. This type of pain was experienced as being more moderate and mail carriers did not associate it with any specific body movements or situations. Figure 8 shows the frequency of pain or discomfort in the upper and lower back and in limbs on the right side of the body for the 14 mail carriers who identified them as a work-related issue.
- 60 In terms of the perceived intensity of the pain or discomfort experienced, the upper and lower back received similar minimum and maximum ratings, ranging from low (0.5) to medium intensity (a rating of 5 for the lower back and of 4 for the upper back). Mail carriers usually associated back pain with exiting, loading and driving their vehicles.
- 61 Two of the postal employees who identified high intensity pain (rated between 5 and 8) in their right wrists were males in the package handlers occupational group. In one case, the pain was already present at the start of his work shift and increased over the delivery period. The other mail carrier reported that the pain appeared and increased when he carried packages during the delivery period.

Figure 8. Frequency and sites of musculoskeletal problems identified by 14 mail carriers, with both occupational groups taken together



c. Semi-structured interviews

- 62 In the course of the delivery process, our use of the interview guide brought to light a number of issues of particular concern to mail carriers, and their potential impact on driver health.
- 63 Mail carriers sometimes expressed concerns about the overall reduction in mail delivery activities and its impact on the future of their profession. They found this particularly disquieting as regards the mail sorting process.
- “... less mail sorting is being done overall and fewer packages are being handled, compared with what used to happen.”
- “Mail volumes are dropping. And they cut back on too many employees. When people retire, they’re not even replaced. Anyway, that’s our take on what’s happening.”
- 64 Employees in the package handler group preferred to focus in particular on the way the demands of their work tended to fluctuate, depending on the day of the week or on the season (the end-of-year holiday season, for example). For them, seasonal peaks in activity, changes to their delivery routes, traffic jams, in fact anything that changed the pace of the delivery process represented a source of stress. For the mail carriers, stress can be created as much by pressures to meet higher productivity goals as by the self-imposed pressures they put on themselves to continually work faster.
- “When you have 110 parcels to deliver, it’s you who puts pressure on yourself. No-one is telling you that you have to rush.”
- “You need to be on time so as to make as many deliveries as possible. This is a pressure I put on myself, ‘cos I want to be able to get my deliveries done and do my job well”.
- 65 Different positive aspects of mail carrying were described by drivers during the interviews that took place as they drove. Acts of cooperation and support between colleagues during the mail sorting process were particularly often cited as examples. Social support from colleagues and supervisors were considered good ways to reduce stress.
- “There are days when you have less work. But when things get really busy, the mail carriers will spread the work around among themselves and people will add extra parcels to their delivery routine. I myself sometimes take just a small part of other carriers’ mail packages. Mutual support within the group is a given in our world.”
- 66 Similarly, maintaining good relations with clients seems to be the rule, with training sessions offered by the postal service on how to deal with particularly difficult situations.
- 67 The actual mail delivery process was seen as being a time that allows mail carriers considerable autonomy and where they have real leeway in, for example, their choices for the order of deliveries to be made or for managing the pace they want to adopt in making those deliveries.
- “We have a lot of autonomy. No-one checks up on us during the delivery process. It’s only before and afterwards that there are checks on items we carry with us. And there is no set order we have to use for the delivery route.”
- “It’s entirely up to us how we manage the delivery process. I can play it cool, if I want to. We really do feel free to manage our time as we think best.”
- 68 These sentiments jibe convincingly with the results of our observations of the delivery process, demonstrating how mail carriers adapted their delivery strategies to the type of delivery made, and particularly how they used dynamic, operational leeway for the urban delivery process.

- 69 Opinions expressed by the mail carriers on the issue of recognition of their work were somewhat divergent. Some people complained about the low status they seemed to hold in the organization ; many of the opinions expressed centred on concerns about a potential further decline in this status that would result from changes expected to occur at *La Poste*. Other employees complained about a lack of recognition coming from within their own family circle or from clients. Even so, their reflections on the issue of recognition led the majority of those mail carriers to acknowledge that their work was in fact a source of satisfaction for them.
- 70 On an entirely different level, mail carriers spontaneously made many observations on the question of their physical needs : access to toilets, to drinking water and to food ; this was clearly an issue about which they felt really strongly and their thoughts on the subject were always at the forefront of their concerns. Nevertheless, these employees recognized that they did find ways to “manage”.

### 3.2 Medical analysis of the activity

- 71 The quantitative data obtained from the medical questionnaire completed by the mail carriers at the occupational health centre included the personal characteristics of each individual respondent, the occupational driving they carried out, the health situation of each of them and the psychosocial constraints they faced in the workplace. The 21 mail carriers who answered the questionnaire were all working full-time. They had an average seniority level of 4.8 years in the position they held at the time of the study. Some 78 % of the mail carriers drove to work in their own vehicles. Only 3 % of the mail carriers, all of whom worked in Paris, used public transit. The average time mail carriers spent travelling between their place of residence and place of work was 40 minutes and 19 % of them found this travel time long and demanding.

#### 3.2.1 Occupational Driving

- 72 Across the two mail carrier groups observed (11 and 10 individuals respectively), the number of urban or rural mail delivery routes was evenly divided. Mail carriers estimated that they drive their vehicles for an average of 3.5 hours a day. Over half of those working on urban or peri-urban routes reported longer times than this.
- 73 Slightly more than half the mail workers interviewed stated that they covered in excess of 200 km per week for their mail deliveries. In most cases, these were rural delivery routes (see Figure 9). This would suggest that mail carriers reporting distances of less than 200 km would be more likely to be working urban or peri-urban routes (80 % vs. 20 %) and these results are consistent with our earlier data from our ergonomic analysis.
- 74 Work breaks declared as taken during deliveries lasted around 20 minutes on average.

Figure 9. Mail carriers' estimates of weekly occupational driving distances

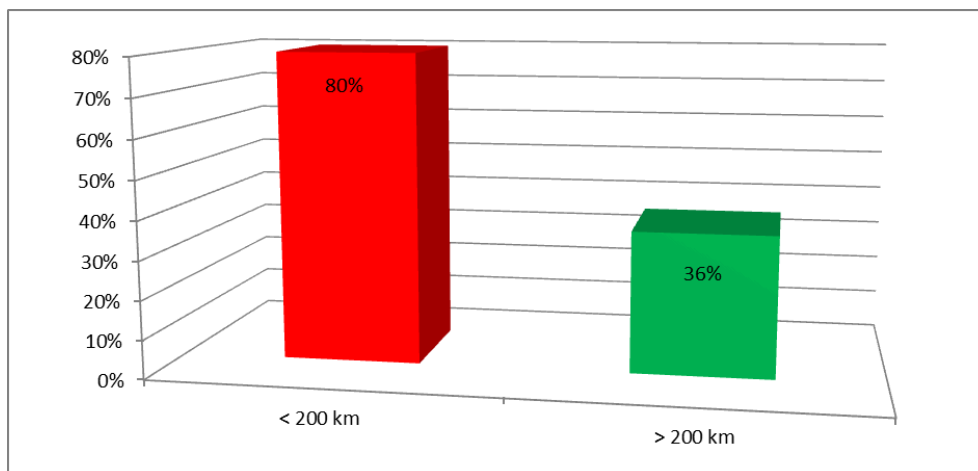
#### 3.2.2 Musculoskeletal pain or discomfort and its relation to driving

- 75 Use of the Nordic questionnaire enabled us to explore with the mail carriers the musculoskeletal problems they had experienced in the past 12 months. Among the 21 mail carriers interviewed during their medical follow-up, 17 reported experiencing musculoskeletal problems or disorders (MSDs). By order of frequency of occurrence, the anatomical sites most often identified were : the upper body, including the upper

limbs (13 mail carriers), the low back (12 mail carriers) and the lower limbs (7 mail carriers). Courier agents reported more musculoskeletal problems than package handlers, but, given the low number of package handler subjects and the preponderance of courier agents in the study sample (14 courier agents, cf. 8 package handlers), this result should be interpreted with caution.

- 76 Mail carriers with a declared length of daily occupational driving times of over 3.5 hours more frequently reported MSD problems than those declaring shorter driving times (64 % vs. 50 %). Among the mail carriers reporting at least two MSD problems, two thirds of the individuals affected drove their vehicles for more than 3.5 hours every day.
- 77 Our analysis of the relation between the frequency of MSD problems and distances driven showed that courier drivers driving shorter distances (less than 200 km per week) reported a higher number of MSD problems than those who drove the longest distances (see Figure 10).

Figure 10. Percentage of mail carriers reporting MSDs in relation to delivery distances



### 3.2.3 Perceived psycho-social constraints

- 78 In the questionnaire administered by the occupational physicians, psychosocial constraints were explored through questions around issues such as time pressures, the amount of work required, work-related expectations and emotional demands, mail carrier autonomy and operational leeway, socioeconomic insecurity, value conflicts, recognition and social support. A further dimension needing to be added to these various workplace based considerations was the issue of outside pressures (verbal and physical attacks, fears experienced in the course of the work day and pressures arising from relations with the public). Study data indicate that time pressures and pressures stemming from the amount of work required are identified more often by mail carriers carrying out urban/suburban deliveries (91 % of those drivers) than by the ones making rural deliveries (50 % of those drivers), with a similar result appearing as regards external violence (82 % vs. 50 %). More than two thirds of the mail carriers who declared that they were exposed to external pollution and psychological pressures were involved in urban/suburban mail deliveries.
- 79 When the issue of distances driven was examined, our analysis rapidly revealed that all postal employees who drove less than 200 km/week (the urban and suburban delivery

routes) said they were constantly under time pressures and 90 % experienced outside pressures, whereas only 45 % of those driving the longer distances reported experiencing this kind of constraint or pressure.

80 Furthermore, over 70 % of mail carriers who reported experiencing at least one MSD problem also declared that they were often subject to time pressures, had to do unreasonable amounts of work and needed to deal with heavy emotional demands and socio-economic uncertainty. To illustrate how they coped with the problem of time pressure, two thirds of the mail carriers used the example of skipping or rushing meals and often depending on assistance from fellow colleagues -- all of which can further add to existing pressures.

81 All the mail carriers in the study saw their work as being valuable, although 20 % of them felt that its value was not always recognized by key players in their professional environment. Most mail carriers reported that they had operational autonomy and social support. Even so, more than half of the group could not see themselves continuing in the same job until their retirement, mainly because of the physical demands their work placed on their bodies.

#### 4. Discussion

82 To distinguish between the activities planned and carried out on a daily basis by the courier drivers and package handlers, recognize the sources of variations in their routines and understand the potential work-related problems and impacts arising from those variations, we decided to use a pluridisciplinary analytical strategy that would draw on ergonomics on the one hand and occupational medicine on the other.

83 The analysis and cross-analysis of the data collected demonstrate the extent to which the work day is broken down into a series of successive steps which are exactly the same for both mail carrier occupational groups. While the overall physical demands of the work performed may appear to be relatively moderate when the work day is taken as a whole, even the initial mail separation and sorting phase creates physical demands on mail carriers before the delivery process actually begins.

84 This mail delivery process is itself composed of repeated series of actions (driving and manoeuvring the vehicle, short or long stops, exiting the driver's compartment. Choices made as to the order of the actions performed will vary, depending on the nature of the delivery area : driving short distances for urban/suburban deliveries, with exits from the driver's compartment half the time ; driving longer distances and remaining behind the wheel for longer periods, in the case of rural deliveries.

### 4.1 Driving of the mail delivery vehicle : a key structural component in the delivery process

85 A striking characteristic of the transformation of the workplace in the past years has been the intensification of work, particularly the increases in the speed with which activities are carried out : speed becomes the driving factor and leads, among other things, to lower quality work performance (Davezies, 2007). Urban parcel delivery, considered by Ducret (2012) to be a major economic issue for cities in particular, has not escaped this trend to speed. The rise of the Internet, accompanied by corresponding rapid and significant reductions in mail volume but by an explosion in E-commerce, has further added to demands for speed in express courier and parcel

delivery services, in today's highly competitive environments. This present study shows that urban or suburban courier and parcel delivery processes provide a particularly telling example of the different constraints experienced while driving vehicles for mail delivery.

- 86 Clot & al. (2000) compared the courier and parcel delivery process to a moment of “liberation” after the initial indoor mail sorting phase. In fact, the delivery process was even described by certain other authors as a guarantee of independence and freedom (Dubar & al., 2001). Our study tempers the rhetoric of these comparisons and shows that deliveries carried out using mail vehicles are highly demanding activities. Demands may be physical in nature : carrying packages to the addresses where they are to be delivered and maintaining uncomfortable positions inside the vehicle cab due to space constraints, after having previously performed daily mail organization and sorting tasks with the constant repetitive movements these tasks require of the upper limbs. Or the demands may instead be at the mental level : adapting planned routes and delivery stops to traffic conditions, hunting for places to park the delivery vehicle on crowded urban streets, remaining cautiously vigilant toward other users of the same urban environment, choosing the best ways to place delivery loads in order to avoid potential problems, etc.
- 87 Our data also revealed that mail carriers show foresight and prepare for problem situations at all stages of the delivery process and, as a result, are able to deal with a wide variety of contingencies. Cholez (2002) even goes so far as to argue that the constraints particular to the urban delivery process can be seen as resources that enable mail delivery drivers to demonstrate the kind of knowledge and skill sets they draw on to handle those constraints. The ergonomic analysis of the work situation carried out for this study enabled us to identify some of the compromises and strategies employed by the mail carriers in response to the pressures encountered in performing their tasks. One example is how, by placing a bundle of mail or parcels on the passenger seat, they reduce physical demands on themselves by cutting back on the number of times they have to exit the driver's compartment and open the back door.
- 88 The possibility for mail carriers to influence their work situations through the choices they make individually about the work methods to use can be assimilated both to adaptive performance (Pulakos & al., 2002) and to the concept of operational leeway, as defined by Coutarel (Coutarel & al., 2015). This viewpoint is also conveyed through the arguments about “constructive ergonomics” put forward by Barcellini & al. (2013) who suggest that definitions of workplace situations need to recognize for those concerned the choices they can make to “*enhance their activities*”, not only in performing simulations but also in real-life work situations. The knowledge and skill sets letter carriers are able to draw on to address the different pressures and changing demands of their work environment are major factors that contribute both to their experience and to enhancing the work activities they carry out. The all-too-rarely recognized efforts they need to make to meet daily productivity targets, while ensuring that they themselves are sufficiently protected at the same time, could potentially be drawn on and developed within the *La Poste* group to serve as indicators and assessment criteria in the area of adaptive performance.

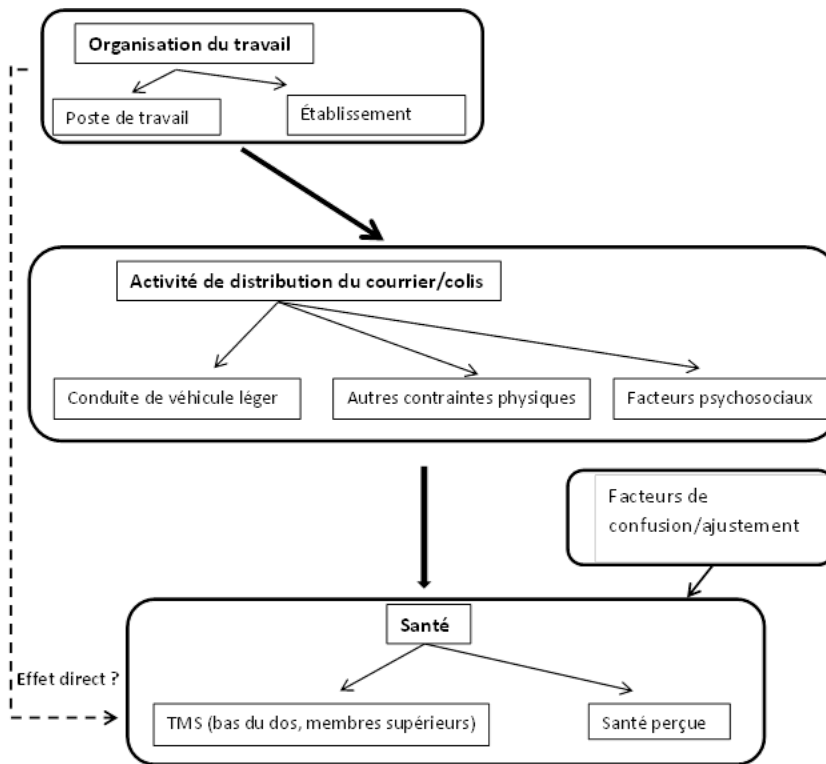


## 4.2 Are there specific risks of MSDs to be associated with driving mail delivery vehicles ?

- 89 Our study revealed that, during the work activity investigated, the majority of the mail carriers studied reported that they experienced pain problems, particularly in the upper limbs and in the lower back. In addition, the medical questionnaire looking into the question of musculoskeletal problems over the previous 12 months confirmed high frequencies of pain complaints which, somewhat surprisingly, were reported by the mail carrier drivers working over the shortest distances (less than 200 km a week). These same mail carriers were also the ones who reported experiencing time pressures and expectations of unreasonable amounts of work, all of which could be understood in the more complex context of urban/suburban delivery requirements we previously discussed. The existence of more demanding postural constraints (with constantly fragmented driving situations, frequent exits from behind the wheel, climbing up to take mail from the loading area, heavy loads to carry and considerable distances to walk), as well as greater psychological pressures (such as heavier traffic, staying attentive to the needs of other users of the road, parking problems, time pressures for freeing up the roadway, limited down-time) are all probably factors explaining the frequency of mail carrier reports of experiencing MSDs.
- 90 The higher number of reports of musculoskeletal problems among the mail carriers driving shorter, primarily urban, delivery routes raise questions about the relation that could potentially be established between the risk of MSDs and urban-type occupational driving. However, in the case of our study, the low number of mail carriers involved and the self-declaratory nature of the MSD problems identified, and of the distances driven, demand caution in any interpretation of the results. This risk needs to be validated across larger sample populations in specifically targeted studies. Clearly, quantifying specific risks to be associated with driving light vehicles calls for the presence of a control group exposed to other recognized MSD risk factors such as carrying heavy loads and walking considerable distances, etc.
- 91 There is a distinct paucity of specialized scientific health-centered literature focusing on postal activities. International epidemiological studies carried out on mail carriers as a whole, with no distinction between specific occupational groups, indicate that musculoskeletal disorders (MSDs) are the principal health problem experienced in this sector. MSDs of the upper limbs and low back MSDs were also associated with carrying loads (Welles & al., 1983 ; Harcombe & al., 2009). In a study among retired English mail workers, it was reported that MSDs resulting from exposure to occupational factors persisted even after the exposure ended. The study of this post-retirement group also showed associations between MSDs and carrying loads, awkward postures and occupational driving for periods of more than 4 hours (Sobti & al., 1997). Finally, in a study on the multifactorial determinants behind sick leaves taken by Swedish mail carriers, the strongest relation was found to exist with anxiety about workplace reorganization, while the second strongest was with carrying heavy loads (Voss & al., 2011). In a New Zealand study of a population of mail carriers, nurses and office workers, MSDs of the lower back, shoulders and wrists/hands were associated primarily with work-related physical demands, the demanding nature of the jobs performed and dissatisfaction with the job itself (Harcombe & al., 2010).

- 92 Two doctoral studies (Theurel, 2008 ; Sendeki, 1999), which analyzed the mail delivery process in terms both of the physical and the physiological demands it makes on mail carriers, found that mechanization of mail sorting had resulted in less time being allowed for the work involved in preparing mail deliveries and in more time being spent on the deliveries themselves. The delivery process still remains difficult to automate even though technological developments are producing changes of all kinds in the field, and still requires the performance of repetitive physical tasks, whether non-motorized (walking or cycling) or using motorized transport (bicycles or vehicles). Comparing the arduous nature of non-motorized and motorized mail deliveries, by analyzing the cardiac strain generated and using ergonomic observations, Sendeki (1999) showed that the levels of cardiac strain experienced are deemed acceptable for both forms of mail delivery, even though non-motorized delivery is more demanding. The demonstration of differences in cardiac strain during the different stages of the work process is another fascinating aspect of his study. The sorting phase which precedes delivery of parcels by motor vehicle in fact generates more cardiac strain than the deliveries themselves. On the other hand, Sendeki found that, when deliveries are non-motorized or “mixed-type” (both letters and parcels), they make fewer demands on the heart.
- 93 The ergonomic analysis of the overall delivery process and the answers given to the medical questionnaire added to our understanding of the situation and enabled us to formulate a hypothesis on the association between MSDs and occupational driving. This association, which seems a somewhat complex one, suggests that there could well be a risk of MSDs specific to occupational driving for mail deliveries. An analysis of this risk, associated with the delivery of postal mail and parcels, is currently under way in the form of an epidemiological study of the workplace organization and different elements comprising the delivery process, all of which draw on information collected for this present study. To this end, data on the operations performed (characteristics of the vehicle and type of delivery, time spent on the different steps in the delivery process, the duration/frequency/intensity of effort required for maintaining awkward postures, for deliveries on foot and for handling loads, as well as psychosocial factors), in addition to health data focusing on low back and upper limb MSDs, and on perceived health status, will be collected from a group of mail carriers who drive light vehicles and others in a control group who perform manual handling of loads. Workplace organization and structures will be analyzed at two levels: at the level of the employee’s job situation (job title, length of time in the workplace, employee’s polyvalence, work schedules, work breaks, training, etc.) and at the level of the mail centre (type of mail centre, number of employees, performance indicators, work schedules, newly created structures, monitoring of activities of mail carrier drivers). Individual variables that may constitute factors of confusion/adjustment will also be collected: age, sex, weight, height, smoking habits, leisure activities, past workplace exposure to a risk of MSDs, medical history). The data collected will be analyzed using the conceptual model shown in Figure 11.

Figure 11. Causal conceptual model underlying the epidemiological study



### 4.3 Bringing ergonomics and epidemiology together to explore issues around work-related MSDs : using different tools to examine a question of mutual interest

- 94 By drawing on tools used both in occupational medicine and in ergonomics, we were able to demonstrate that the use of light vehicles for the mail and parcel delivery process can be associated with a range of biomechanical, organizational and psychosocial risk factors related to this activity. Occupational health researchers agree on the multifactorial nature of musculoskeletal disorders, medical conditions with an occupational component, considered as being at once the result of work-related activities and a health problem that can be modelled using a cross-disciplinary approach: epidemiology, ergonomics, physiology, biomechanics, psychology, etc. (Aptel & Vézina, 2008). Clearly, when researchers take on the challenge of better understanding complex problems like MSDs and developing a solid knowledge base on the subject, working solely along disciplinary lines is not a sufficiently satisfactory basis on which to develop comprehensive prevention strategies. Consequently, these researchers argue for an interdisciplinary approach not only for the research field, but also for corresponding workplace interventions because they require dialogue, the sharing of knowledge, analyses and methods between at least two disciplines, and interactions, mutually enriching exchanges between specialists in different fields.
- 95 Research in epidemiology is helping to increase our understanding of the role of different risk factors in the etiology of these disorders. In conjunction with this epidemiological approach, ergonomics would suggest the use of an approach based on the relation between the work activity and the risk of the appearance of MSDs, where

an adequate knowledge of the work carried out can serve as the basis for better understanding and transforming work situations. Aptel & Vézina (2008) argue that

“this context of interdisciplinary cooperation, where the work carried out is seen as essential to the whole, so in itself a subject worthy of scientific attention, is an instrument through which to generate socially acceptable explanations of the risk of being affected by occupational MSDs” (our translation).

- 96 Clearly, to properly understand MSDs and establish strategies for their prevention means integrating different disciplinary perspectives on these issues, while at the same time recognizing that this kind of integration is never a given and depends on the readiness of each person involved to collectively build up and create a synergy of their different areas of knowledge and professional practices. It is an integration which, while drawing on disciplines that each respect their own specific disciplinary perspectives, have their own particular constraints and must even meet their own professional requirements, must also have as its overall goal to develop a shared understanding of the issues to be addressed. Although epidemiologists and ergonomists have differing professional objectives and may use different analytical tools, compatibility between those different tools is essential to respond to our common need for better understanding and preventing MSDs (Vézina & al., 2009). While ergonomists will describe the strategies the mail carriers adopt to protect their health and well-being, and the far from passive solutions they apply to meet the demands of their different work situations, epidemiologists will use questionnaires administered to a broader population sample to identify and quantify the determinants of the associations to be made between the work situation and individuals' health issues.
- 97 So it is that an interdisciplinary approach of this kind, through the conjunctive use of quantitative data and comprehensive analyses, makes it possible to take into consideration variations both in people's working conditions and in the choices they themselves make to maintain a balance between their own health and their productivity, to ensure that their personal health situation is not affected (Vézina, 2008). The fundamental challenge then becomes to identify the complementary approaches and anchor points that make it possible to express these disciplinary outlooks in concrete terms and situations, drawing on the tools to be found at the vanguard of the various source disciplines (Marsot & Atain Kouadio, 2017).

#### 5. Conclusion

- 98 This present exploratory study, based on a range of different analyses, has evident limitations, due to the low study sample. Observation of the mail carriers did however enable researchers to make a qualitative identification of their exposure to physical constraints associated with MSDs, such as their need, in certain situations, to adopt awkward postures and carry heavy loads. Analysis and quantification of the risk of MSDs that can be specifically associated with mail deliveries carried out using light commercial vehicles is now the goal of an epidemiological study currently under way ; results obtained will enable researchers to better define the biomechanical, psychosocial and organizational determinants of MSD risks.
- 99 The methodology adopted for this study with its ergonomic approach to the delivery process, together with a medical analysis, made it possible to reconcile the ergonomists' need to understand the complexity of this activity in order to intervene effectively and the epidemiologists' need to identify the particular variables that would allow them to establish associations between employees' work situations and their

health. Understanding the activities carried out, through ergonomic observation, led to the formulation of a related hypothesis and the subsequent design of the research protocol and data collection tools needed to generate the quantitative data for the upcoming epidemiological study that will help further our awareness of the risk of MSDs that can be associated with driving light delivery vehicles.

- 100 Further improvements to the equipment design process for mail delivery vehicles will also require specific studies involving both ergonomists and mechanical design engineers.

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## NOTES

1. Light(-duty) vehicle : a vehicle designed and built to transport merchandise weighing no more than 3.5 tons.
2. Dares : *Direction de l'animation de la recherche, des études et des statistiques* (Eng. : Directorate for Research, Studies and Statistics).
3. IFOP - Institut Français d'Opinion Publique (Eng. : French Public Opinion Institute).
4. *Courier agents* are employees of a mail business with responsibility for sorting and delivering both personal and business correspondence. In a rural or semi-rural context, they may also deliver parcels. *Package handlers* sort and deliver parcels, on urban and semi-urban mail routes, and always use motor vehicles.

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## ABSTRACTS

A complex activity different from personal driving, professional light vehicle driving is becoming increasingly important in the delivery/messaging sector faced with new consumption patterns. Sparsely studied, health risks other than road accidents were approached in an exploratory multidisciplinary study conducted in collaboration with the La Poste group. Its objective was to explore, in work situation, the different components of the mail/parcel delivery activity, and particularly the driving activity as a structuring part of the distribution activity. The methodological approach combining ergonomic analyses and a medical approach has revealed postural and psychological constraints as well as complaints mainly related to the characteristics of the distribution rounds. These findings contributed to the construction of an epidemiological study aimed to analyze risk factors related to driving light vehicles for postal delivery activities.

Activité complexe différente de la conduite personnelle, la conduite professionnelle de véhicule léger prend une importance croissante dans le secteur de la livraison/messagerie confronté aux nouveaux modes de consommation. Peu étudiés, les risques pour la santé autres que les accidents de la route ont été approchés dans une étude exploratoire multidisciplinaire menée en collaboration avec le groupe La Poste. Son objectif a été d'explorer, en situation de travail, les différentes composantes de l'activité de distribution de courrier/colis, et particulièrement l'activité de conduite comme partie structurante de l'activité de distribution. La démarche méthodologique alliant des analyses ergonomiques et une approche médicale a mis en évidence des contraintes ainsi que des plaintes en relation principalement avec les caractéristiques des tournées de distribution. Ces résultats ont permis d'orienter la construction d'une étude épidémiologique visant à analyser les facteurs de risque spécifiques à la conduite de véhicule léger dans les activités de distribution.



Actividad compleja diferente del manejo de un vehículo personal, la conducción profesional de vehículos ligeros es cada vez más importante en el sector de entrega/mensajería frente a nuevos patrones de consumo. Poco estudiados, los riesgos para la salud diferentes a los accidentes de tráfico se abordaron en un estudio exploratorio multidisciplinario realizado en colaboración con el grupo de servicios postales La Poste. El objetivo fue explorar, en situación de trabajo, los diferentes componentes de la actividad de entrega de correo/paquetería, y particularmente la actividad de conducción como una parte estructuradora de la actividad de distribución. El enfoque metodológico que combina el análisis ergonómico y un enfoque médico pusieron en evidencia las dificultades y las quejas relacionadas principalmente con las características de las rondas de distribución. Estos resultados permitieron orientar la construcción de un estudio epidemiológico destinado a analizar los factores de riesgo específicos en el manejo de vehículos livianos en actividades de distribución.

## INDEX

**Keywords:** occupational driving, postal workers, analysis of activity, medical approach, musculoskeletal disorders

**Palabras claves:** conducción profesional, trabajadores postales, análisis de la actividad, medicina del trabajo, trastornos musculoesqueléticos

**Mots-clés:** conduite professionnelle, postiers, analyse de l'activité, médecine du travail, troubles musculosquelettiques

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