Strong association of physical job demands with functional limitations among active people: a population-based study in North-eastern France

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Abstract

Purpose

To assess the association of physical job demands (PJD) with physical/cognitive functional limitations, and the role of adverse health behaviors, obesity, and socio-demographic factors as confounders for those associations.

Methods

The sample included 3,368 active subjects aged 18–64 years, randomly selected from North-eastern France. Subjects completed a post-mailed questionnaire. PJD score was defined as the product of years of employment with the cumulative number of a wide range of high job demands. Data were analyzed through the logistic regression models.

Results

The physical and cognitive functional limitations affected 16.9% and 28.6% of subjects respectively. A strong relationship was found between PJD and physical functional limitation: significant OR adjusted for all the factors studied 1.41 for PJD1-29, 1.72 for PJD30-99, and 2.57 for PJD≥100, vs. PJD0; and between PJD and cognitive functional limitation: OR 1.28 for PJD1-29, 1.60 for PJD30-99, and 2.00 for PJD≥100, vs. PJD0. Adverse health behaviors, obesity and job category were modest confounders of those associations.

Conclusions

This study identified a wide range of job demands and individual characteristics related to physical/cognitive functional limitations. Prevention should aim at improving working conditions and adverse health behaviors.

MESH Keywords Activities of Daily Living ; Adolescent ; Adult ; Aged ; Alcoholism ; epidemiology ; Cognition Disorders ; epidemiology ; psychology ; Disability Evaluation ; Employment ; statistics & numerical data ; Female ; France ; epidemiology ; Humans ; Male ; Mental Processes ; physiology ; Middle Aged ; Obesity ; Occupational Diseases ; epidemiology ; physiopathology ; psychology ; Odds Ratio ; Questionnaires ; Self Assessment (Psychology) ; Socioeconomic Factors ; Workload ; statistics & numerical data ; Young Adult

Author Keywords Functional limitations ; Physical job demands ; Obesity ; Alcohol abuse ; Educational level ; Living alone

Introduction

Chronic illness and functional limitations are highly prevalent conditions in the European Union, and their incidence continues to rise due to an ageing population (Congdon et al. 2004 ; Barbotte et al. 2001). In 2003, the European Union for the Improvement of Living and Working Conditions estimated that one in six of the working age population had a chronic illness or functional limitation, and a work-limiting one for one in eight (European Foundation for the Improvement of Living and Working Conditions 2003). Most functional limitations arise during the working years, and progressively impact on the workers' capacity to do their job, leading to recurrent absenteism, and in the extreme to dismissal and exclusion from the labour market. Within the context of the European Year of People with Disabilities 2003 (European Foundation for the Improvement of Living and Working Conditions 2003), there was a growing interest in supporting the participation of people with illnesses and functional limitations in working life, both in order to promote social inclusion and to meet the demand for labour (European Foundation for the Improvement of Living and Working Conditions 2004). For this purpose, there is an urgent need to identify the factors which elevate the risk of developing functional limitations, and design preventive interventions targetted at the ones which are modifiable.

Although chronic diseases are prominent among the causes of functional limitations, it is likely that working conditions play a significant role. A wide range of job demands such as awkward posture, heat, cold, work in adverse climate, working on a production line, vibrating platform or vibrating hand tools daily affect a number of categories of workers (manual workers, craftsmen, farmers, tradesmen, and clerks, etc.) (Chau et al. 2007 ; CNAMTS 2002 ; Lapeyre-Mestre et al. 2004 ; Smith and Veazie 1998) and can have a high impact on physical and mental health and functional limitations. Those occupational adversities have been found to favor smoking, occupational injury, fatigue, sleep disorders, anxiety, cardiovascular disease, and premature mortality (Bourgkard et al. 2008 ; Chau et al. 2008a ; Chau et al. 2008b ; Chau et al. 2008c ; Lorhandicap group 2004), and can thus alter living conditions and quality of life. Their impact on health

and functional limitations is bound to increase in the next few years, because of a longer duration of work exposure in relation with the lengthening of working life driven by the rise of life expectancy (INSEE 2001).

The pathways leading from adverse working conditions to functional limitations may be quite diverse. First, stress and the physical demands of the job may elevate the risk of occupational injuries, smoking, fatigue, sleep disorders, anxiety, certain diseases (musculoskeletal disorders, cardiovascular disease, for example), physical, sensorial and intellectual impairments and especially the ensuing physical and cognitive functional limitations (Chau et al. 2005a ; Chau et al. 2005b ; Chau et al. 2008a ; Chau et al. 2008b ; Chau et al. 2008c ; CNAMTS 2002 ; Lorhandicap group 2004). Second, work strain favours using psychotropic medication (Lapeyre-Mestre et al. 2004 ; Lorhandicap group 2004) that is associated with injuries in the workplace, alters health status, increases the risk of cancer, injury, and obesity, and deteriorates quality of life (Baumann et al. 2007 ; Bhattacherjee et al. 2007 ; Chau et al. 2008b ; Khlat et al. 2008). Third, strenuous work is associated with harmful health behaviors (initiating smoking, smoking more intensively) and obesity (Chau et al. 2008c ; Lalluka et al. 2008), which in the short term may elevate the risk of injuries (Chau et al. 2002 ; Chau et al. 2004 ; Chau et al. 2005a ; Chau et al. 2008b ; Gauchard et al. 2003 ; Khlat et al. 2008), and in the long term are major determinants of chronic diseases and functional limitations (Baumann et al. 2007 ; Bourgkard et al. 2008 ; Caille et al. 2003 ; Dahlgren and Whitehead 2006 ; Diderichsen et al. 1997 ; Flegal et al. 2005 ; Zhang and Reisin 2000). Fourth, adverse working conditions may directly entail the deterioration of a worker's functional ability (Chau et al. 2005a ; European Foundation for the Improvement of Living and Working Conditions 2003).

When investigating the relation of working conditions to functional limitations, one aspect which deserves proper attention is the role of socioeconomic position. Indeed, people with physically demanding jobs were also lower socioeconomic positions and at the same time have harder living conditions and poorer health (Baumann et al. 2007 ; Dahlgren and Whitehead 2006). Socioeconomic position may therefore confound the association between functional limitations and working conditions, and has to be accounted for in order to explore the intrinsic influence of working conditions on functional limitations.

To our knowledge, no investigation has been conducted to date in the economically active population on the respective roles of physical job demands and adverse health behaviours in functional limitations. The purpose of the present study is to assess among the economically active population aged 18–64 years from north-eastern France: (1) the association of cumulated physical job demands during the working life with physical and cognitive functional limitations and (2) the potential mediating role of obesity, smoking, heavy alcohol consumption and socioeconomic position in those associations. This work is an original study because it focused on physical and cognitive functional limitations, and that functional limitations are a stage after disease occurring, which favours occupational injury, leads to altered living conditions and quality of life, and death.

Materials and Methods

Study design

The initial sample consisted of everyone aged 15 years or more living in 8,000 randomly selected households in the Lorraine region of north-eastern France (2.3 million inhabitants). Only households with a telephone were eligible.

Before the initial survey, a 3-month media campaign (television, print, and radio) was conducted in order to raise awareness. The investigation was approved by the Commission Nationale d'Informatique et Libertés , and written informed consent was obtained from respondents.

The study protocol included: (a) request of participation by means of a questionnaire to ascertain the number of people in the household, then (b) three sendings out standardized auto-questionnaires with a covering letter and a pre-paid envelope to reply at one-month interval. When the number of individuals was unknown, two questionnaires were sent first, and a complementary one was sent later. The standardized auto-questionnaires were completed by the subjects themselves.

Measures

The questionnaire included: birth date, sex, height, weight, educational level, occupation (coded according to the Insee classification, Paris, 1983), smoking habit, alcohol abuse, living alone, years of employment during the working life, physical job demands, and reported-functional limitations (according to the WHO international classification (Organisation Mondiale de la Santé 1988).

Concerning the physical job demands, 12 items were selected, with the following question “Please indicate the high job demands for your work”: hammer, vibrating platform, pneumatic tools, other vibrating hand tools, handling objects, awkward posture, machine tools, pace of working, working on a production line, standing about and walking, heat, and cold (Yes/No) (Bourgkard et al. 2008 ; Chau et al. 2005a ; Chau et al. 2008b ; Lorhandicap group 2004). Those physical job demands showed satisfactory unidimensionality. Indeed, the principal component analysis showed that those job demands are unidimensional: the first eigenvalue (2.19) is much higher than the 2nd and the 3rd eigenvalues (0.56 and 0.30). The summary scale, called cumulated physical job demands (PJD) was defined as the product of years of employment during the working life with the cumulative number of high physical job demands (range 0 to 12).

The following categories of functional limitations were considered:

- Physical with 20 items: Self-care (2 items: dress yourself, including typing shoelaces and doing buttons; shampoo your hair), arising (2 items: stand up from a straight chair; get in out of bed), Eating (3 items: cut your meat; lift a full cup or glass to your mouth; open a new milk carton), walking (2 items: walk outdoors on flat ground; climb up five steps), hygiene (3 items: wash and dry your body; take a tub bath; get on and off the toilet), reach (2 items: reach and get down a 2.5 kg object from just above your head; bend down to pick up clothing from the floor), grip (3 items: open car doors; open jars which have been previously opened; turn faucets on and off), and activities (3 items: run errands and shop; get in and out of a car; do chores such as vacuuming or yardwork); and
- Cognitive functional limitations with 4 items: concentration/attention, orientation, problem-solving, and memory.

The subjects were asked the following: 'Indicate the response which corresponds to your abilities during the 8 last days for the following activities'. The response was: 'without difficulty'/'with some difficulty'/'with much difficulties'/'unable to do'. For each category of functional limitation (physical or cognitive) a subject was considered with a functional limitation when he/she had responded 'with some difficulty', 'with much difficulties' or 'unable to do' for at least one of the items concerned.

Seven occupational categories were considered: upper professionals (intellectual professionals, upper managerial staff and administrators, medical doctors, independent professionals, engineers), intermediary professionals (managerial staff, school teachers, skilled technicians, foremen, medical and social workers), manual workers (skilled manual workers, farm workers, semi-skilled manual workers and unskilled manual workers), clerks, farmers (farm managers), craftsmen/tradesmen (independent shop or business owners), and other employed people and unknown (Bhattacherjee et al. 2007 ; Bourgkard et al. 2008 ; INSEE 2001). Unemployed were categorized according to their last job, considered as the best reflection of their current situation. Educational level was categorized into "primary school only" versus "secondary or above".

Obesity was defined as body mass index ≥30 kg/m^2 . Alcohol abuse was determined using the DETA questionnaire (at least two positive responses to four items: (i) consumption considered excessive by the subject; (ii) consumption considered excessive by people around the subject, (iii) subject wishes to reduce consumption, and (iv) consumption on waking) (Bourgkard et al. 2008 ; Guilbert et al. 2001 ; Khlat et al. 2008).

Sample

Of the 8,000 households included in the sample, mailings to 193 (2%) were lost (due to addressing error or death). Of 7,807 households contacted, 3,460 (44.3%) participated (all eligible members of the family took part in 86% of those). In total, 6,234 subjects completed a questionnaire; 18 were of unknown sex or age, leaving 6,216 subjects. The distributions of the sample gathered according to age and sex are close with those of the Lorraine population (INSEE 1993) (Table 1). The present study focused on the subpopulation of 3,368 economically active (either employed or looking for work) subjects aged between 18 and 64 years.

Statistical analysis

The outcome variables were physical and cognitive functional limitations. This study examined the associations between those dependent variables with physical job demands, and its change when adjusting for the risk factors: age, sex, obesity, smoking, alcohol abuse, low educational level, living alone, and job category. The age was categorized into 5 groups: 18–29, 30–39, 40–49, 50–59, and ≥60. For the job category, 7 groups were considered: upper professionals; intermediate professionals; manual workers; clerks; farmers; craftsmen and tradesmen; and other professionals and unknown category. First, the associations between each factor and each type of functional limitation was assessed via crude odds ratios (OR) and 95% confidence intervals (95% CI). For the job demands, the PJD score was divided into four categories: 0, 1–29, 30–99, and ≥100. Two rounds of logistic regression analyses were carried out: We first examined the association between PJD and each type of functional limitation, adjusting for age and sex (model 1). Next, we added in the logistic model obesity, smoking, alcohol abuse, low educational level, living alone, and job category (model 2). The extent of the difference between the estimates arising from the two analyses was interpreted as reflecting the role of those factors in explaining the relationship between the functional limitation and PJD.

Results

The characteristics of the study sample are in Table 2 . The sample included 3,368 subjects (1,799 men and 1,569 women), who belonged to the following groups: upper professionals 13.4%, intermediary professionals 9.4%, manual workers 26.5%, clerks 34.8%, farmers 1.8%, craftsmen and tradesmen 2.1%, and others or unknown 12.0%. The people with low educational level (primary school) represented 18.4%, the obese subjects 6.4%, the current smokers 34.2%, the subjects having reported alcohol abuse 9.0%, and those living alone 9.0%.

The subjects suffering from physical functional limitation represented 16.9% and those suffering from cognitive functional limitation 28.6%; 6.6% had physical disability only, 18.4% had cognitive disability only, and 10.2% had both physical and cognitive disabilities. Cumulating several functional limitations were also common: 5.3%, 3.0% and 6.4% of subjects had 1, 2, and 3 or over physical functional limitations, respectively; and 13.0%, 8.1% and 7.6% of subjects had 1, 2, and 3 or over cognitive functional limitations, respectively.

Expectedly all three types of functional limitations were strongly related to age. Men suffered less than women from all those functional limitations. Obesity was associated with physical functional limitation. Alcohol abuse and low educational level were associated with both physical and cognitive functional limitations. Living alone was linked with cognitive functional limitation only. Compared to upper professionals, a higher frequency for both physical and cognitive functional limitations was found for all categories of workers except for physical functional limitation among intermediate professionals. Every job demand considered affected between 1.5% and 27.3 % of subjects. Nearly all job demands were related to cognitive functional limitation (crude ORs between 1.21 and 2.74). Only using vibrating hand tools, handling objects, cold environment, awkward posture, working on a production line, and standing about and walking were significantly related to physical functional limitation (crude ORs between 1.35 and 1.94). The results obtained with the principal component analysis shows that these job demands are unidimensional and thus validate the calculation of cumulated job demands (PJD). Note that 33.1% of subjects had PJD1-29, 14.7% PJD30-99, and 3.3% PJD≥100.

The results of two rounds of analyses are presented in Table 3 . The first round estimated age and sex-adjusted odds-ratios for various PJD levels, using the PJD0 as the reference, and the second round provided odds ratios adjusted for the same variables, with in addition obesity, smoking, alcohol consumption, educational level, living alone and job category as covariates, in order to investigate the role of those factors in explaining the associations between PJD and each category of functional limitation. We found a dose-response association of PJD with physical functional limitation (ORa adjusted for age and sex 1.39, 1.80 and 2.98 for PJD1-29, PJD30-99, and PJD≥100, respectively, vs. PJD0) as well as with cognitive functional limitation (ORa adjusted for age and sex 1.32, 1.82 and 2.55 for PJD1-29, PJD30-99, and PJD≥100, respectively, vs. PJD0). We failed to find the individual factors studied in mediating those associations. Among the covariates obesity had significant ORa for physical functional limitation only whereas alcohol abuse and low educational level had significant ORa for both physical and cognitive functional limitations. Living alone had a significant ORa for cognitive functional limitation only. Regarding job category, the ORa were markedly lower than the crude ORs when controlling for all covariates, especially for manual workers, farmers, craftsmen and tradesmen, and also but less for clerks.

The relationships between PJD and those functional limitations were clearly stronger when we considered cumulating several functional limitations. The ORa adjusted for all factors studied for PJD≥100, vs. PJD0, was 3.34 for 3 or more physical functional limitations and 2.93 for 3 or more cognitive functional limitations (Table 4).

Discussion

The present study demonstrates that the physical and cognitive functional limitations were common and that they were strongly related to cumulated physical job demands during the working life. Smoking, alcohol abuse and obesity were included in the analysis to assess their potential mediating role in the association, and education, living alone and job category were included as potential confounders. We found a strong relationships between the cumulated job demands and both physical and cognitive functional limitations, and those were not or very slightly mediated by individual factors such as age, sex, obesity, smoking, alcohol abuse, and neither were they confounded by low educational level, living alone and job category.

The selection bias of the sample would be small. Indeed, the households possessing a telephone represented 96%, and those having confidential addresses represented only 16%. According to our discussions before the survey with several associations for persons with disability, this list is not likely to be related to health status or life conditions. The proportion of subjects who participated among those contacted was similar with that reached for surveys with mailed questionnaire in France (Alonso et al. 2004 ; Lorhandicap group 2000). The distributions according to age and sex of the sample are close with those of the Lorraine population. The quality of the filling in of the questionnaire was very good (non-responses for various items <4%). Although this study was conducted on a large sample, the interpretation of the results needs some caution due to the presence of a possible selection bias and the use of an auto-questionnaire. However, self-administered occupational health history questionnaire is reliable and valid (Lewis et al. 2002). The majority of studies rely on self-report as a measure of disability (Newman and Brach 2001). The non-response bias in mailed health surveys is small (Etter and Pernejer 1997 ; Kant et al. 2003). The use of a self-administered questionnaire based on self-reported responses would be appropriate for assessing functional limitations as consequences of diseases or ageing (OMS 1988). As previously mentioned, all factors studied were validated and used in other studies (Bourgkard et al. 2008 ; Chau et al. 2005a ; Chau et al. 2008b ; Guilbert et al. 2006; Guilbert et al. 2001 ; Khlat et al. 2008). The physical job demands were those reported as highly demanding by the subjects, and have been used elsewhere (Bourgkard et al. 2008 ; Chau et al. 2005a ; Chau et al. 2008b ; Lorhandicap group 2004). The calculation of the score PJD was valid because the physical job demands considered were unidimensional The occupational exposure was therefore underestimated because moderate occupational hazards were excluded. Furthermore, many hazards, for example chemical hazards, dust, etc. were not considered (

Teschke et al. 2002). It should be noted that most subjects generally have one main job during their working life, so they should be aware of their job demands. Given the large number of statistical tests carried out, type I error may be a concern, but it has to be pointed out that most tests were significant at the 1% level, with very large odds ratios estimates.

We found that the ORa adjusted for PJD and other factors were markedly lower than the crude ORs for various job groups (except for intermediate professionals), especially for manual workers, for both physical and cognitive functional limitations. The same pattern was found for educational level and, to a lesser extent for living alone for cognitive functional limitation. This finding was expected because the PJD concerned most jobs, but more particularly manual workers and the least educated. It should be noted that people with lower levels of occupational standing, and particularly manual workers, are less educated and have fewer material resources, and that this profile is associated with poorer health due to the co-occurrence of many factors: unfavourable health behaviors, poor nutrition, occupational hazards, altered living conditions, low income, low educational level, lack of physical activity, barriers to health care (Baumann et al. 2007 ; Dahlgren and Whitehead 2006 ; Lochner et al. 2001 ; Marchand et al. 2003 ; Mejer 2004). In this sense, our findings illustrate the role of lifestyle factors and adverse working conditions in explaining social inequalities in health (Huisman et al. 2008 ; Sekine et al. 2006 ; Warren et al. 2004).

Our study found strong relationships between PJD and both physical and cognitive functional limitations, and those associations remained when controlling for sex, age, obesity, smoking, alcohol abuse, educational level, living alone and job category. The physical job demands considered were found to be related to premature mortality (Bourgkard et al. 2008) and also smoking, fatigue, sleep disorders, anxiety, occupational injury, certain diseases (musculoskeletal disorders, cardiovascular disease, for example), physical, sensorial and intellectual impairments (Chau et al. 2005a ; Chau et al. 2005b ; Chau et al. 2008b ; Chau et al. 2008c ; Lorhandicap group 2004), which may favour both physical and cognitive functional limitations. Kristal-Boneh et al. (2000) found a hazard ratio of 1.82 of all-cause mortality in workers with a high physical workload compared with the others. We found that the higher prevalence associated with PJD is slightly confounded by smoking, alcohol abuse, low educational level, and job category. These results are consistent with the findings of Diderichsen et al. (1997) who stated the high total burden of diseases of tobacco and alcohol in the European Union (respectively 9.0% and 8.4%; 3.6% for work environment). As already mentioned, job demands could favour drug use that has a great role in disease burden (Dahlgren and Whitehead 2006). In France, one-third of the working population smokes and uses medications or other legal psychoactive substances in order to cope with work-related difficulties, and such use is more common in manual workers (Chau et al. 2008c ; Lapeyre-Mestre et al. 2004). Intake of drugs is a leading cause of injuries (Chau et al. 2002 ; Chau et al. 2005a ; Chau et al. 2008b ; Gauchard et al. 2003), and smoking and alcohol abuse are common and alter physical and mental abilities of workers, increasing in this way risk of injuries due to job demands (Chau et al. 2002 ; Chau et al. 2004 ; Chau et al. 2005a ; Chau et al. 2008b ; Gauchard et al. 2003). In the present study, the associations found of pneumatic tool use and vibrating platform with cognitive functional limitation and not with physical functional limitation are un bit surprising. In fact, we found relationships of pneumatic tool use with sleep disorders (14.5% vs. 7.6%, p=0.028) and nervousness (18.4 vs. 11.9, p=0.083, close to significance), and also of vibrating platform exposure with chronic pain (15.6% vs. 79.1%, p=0.014) and fatigue (17.9% vs. 12.5%, p=0.078, close to significance) (yet not-published data). The associations between those job demands to cognitive disability may be partly explained by those disorders. The absence of association between these job demands and physical functional limitation may suggest that workers with physical disability would avoid such hazards.

It should be noted that PJD≥100 was strongly associated with cumulating several functional limitations. Indeed, the ORa (adjusted for all factors studied, vs. PJD 0), was 2.57 for at least one physical functional limitation and reached 3.34 for 3 or more physical functional limitations. It was 2.00 for at least one cognitive functional limitation and reached 2.93 for 3 or more cognitive functional limitations. The subjects with high PJD appeared thus to have a higher prevalence for various types of functional limitations.

The gender difference in functional limitations is well known. Indeed, women live longer than men, but men have fewer disabilities than do women (Newman and Brach 2001). A study in Spain showed that men lived more time free of disability than women (Gispert et al. 2007). Our study shows that the gender gap was for both physical and cognitive disabilities, and it was not confounded by the factors studied (when comparing crude and adjusted ORs). Some of the explanations for the disability gap have included reporting bias, higher rates of co-morbidity or chronic health problems, possible physiologic differences, and behavioral factors that could leave women more susceptible to disability than men are (Newman and Brach 2001). The prevalence of pain conditions is higher among women, women report more severe pain, and co-morbidity between pain conditions and psychosomatic problems is higher among women (Baumann et al. 2007 ; Bingefors and Isacson 2004). Depression is more common in women (Baumann et al. 2007), and sex moderates the relationship between depression and disability, in that when depression is high, women report greater disability than men (Keogh et al. 2006). But it should be noted that there is a higher premature mortality among men than among women which could result in less men surviving with functional limitations (Bourgkard et al. 2008 ; Newman and Brach 2001).

Our study sheds light on the strong associations between physical job demands and both physical and cognitive functional limitations in North-eastern France. We also provide evidence for the association of personal factors such as obesity, alcohol abuse, low educational level and living alone with an elevated prevalence of those functional limitations, and demonstrate that the contribution of those factors to the PJD disparities in functional limitations is quite limited. Our findings need to be confirmed by other studies on other populations. They

may however suggest that intervention policies to prevent functional limitations and limitations of daily living activities, especially at work, should focus on job demands, but proper attention to lifestyle factors should be included to prevent a whole range of physical and cognitive functional limitations.

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Footnotes:

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References:

- Alonso J , Angermeyer MC , Bernert S , Bruffaerts R , Brugha TS , Bryson H , de Girolamo G , Graaf R , Demyttenaere K , Gasquet I , Haro JM , Katz SJ , Kessler RC , Kovess V , Lépine JP , Ormel J , Polidori G , Russo LJ , Vilagut G , Almansa J , Arbabzadeh-Bouchez S , Autonell J , Bernal M , Buist-Bouwman MA , Codony M , Domingo-Salvany A , Ferrer M , Joo SS , Martínez-Alonso M , Matschinger H , Mazzi F , Morgan Z , Morosini P , Palacín C , Romera B , Taub N , Vollebergh WA . ESEMeD/MHEDEA . 2000 ; Investigators, European Study of the Epidemiology of Mental Disorders (ESEMeD) Project (2004) Psychotropic drug utilization in Europe: results from the European Study of the Epidemiology of Mental Disorders (ESEMeD) project . Acta Psychiatr Scand Suppl . 420 : 55 - 64
- Baumann M , Spitz E , Guillemin F , Ravaud JF , Choquet M , Falissard B , Chau N . Lorhandicap group . 2007 ; Associations of social and material deprivation with tobacco, alcohol, and psychotropic drug use, and gender differentials: A population-based study . Int J Health Geogr . 6 : 50 - 10.1186/1476-072X-6-50
- Barbotte E , Guillemin F , Chau N . 2001 ; Prevalence of impairments, disabilities, handicaps and quality of life in the general population: a review of recent literature . Bull WHO . 79 : 1047 - 1055
- Bhattacherjee A , Bertrand JP , Meyer JP , Benamghar L , Otero Sierra C , Michaely JP , Ghosh AK , d'Houtaud A , Mur JM , Chau N . Lorhandicap Group . 2007 ; Relationships of physical job tasks and living conditions with occupational injuries in coal miners . Ind Health . 45 : 352 - 358
- Bingefors K , Isacson D . 2004 ; Epidemiology, co-morbidity, and impact on health-related quality of life of self-reported headache and musculoskeletal pain – a gender perspective . Eur J Pain . 8 : 435 - 450
- Bourgkard E , Wild P , Massin N , Meyer JP , Otero Sierra C , Fontana JM , Benamghar L , Mur JM , Ravaud JF , Guillemin F , Chau N . Lorhandicap group . 2008 ; Association of physical job demands, smoking and alcohol abuse in subsequent premature mortality: A 9-year follow-up population-based study . J Occup Health . 50 : 31 - 40
- Caille EE , Rodriguez C , Walker-Thurmond K , Thun MJ . 2003 ; Overweight, obesity, and mortality from cancer in a prospectively studied cohort of U.S. adults . N Engl J Med . 348 : 1625 - 1638
- Caisse nationale de l'assurance maladie des travailleurs salariés (CNAMTS) . 2002 ; Statistiques financières et technologiques des accidents du travail - Années 1998, 1999, 2000 . Paris, France CNAMTS ;
- Chau N , Mur JM , Benamghar L , Siegfried C , Dangelzer JL , Français M , Jacquin R , Sourdot A . 2002 ; Relationships between some individual characteristics and occupational accidents in the construction industry. A case-control study on 880 victims of accidents occurred during a two-year period . J Occup Health . 44 : 131 - 139
- Chau N , Mur JM , Touron C , Benamghar L , Dehaene D . 2004 ; Correlates of Occupational Injuries for Various Jobs in Railway Workers: A Case-control Study . J Occup Health . 46 : 272 - 280
- Chau N , Bhattacherjee A , Bertrand JP , Meyer JP , Guillemin F , Ravaud JF , Ghosh AK , Mur JM . Lorhandicap group . Editor: Bhattacherjee A , Das SK , Karanam UMR . 2005a ; Associations of occupational hazards and individual characteristics with occupational injuries and disabilities in Lorraine coal miners . Advances in Mining Technology and Management . Indian Institute of Technology ; Kharagpur 543 - 552
- Chau N , Ravaud JF , Otero Sierra C , Legras B , Macho J , Guillemin F , Sanchez J , Mur JM . Groupe Lorhandicap . 2005b ; Prevalence of impairments and social inequalities: A community-based study in Lorraine . Rev Epidemiol Sante Publique . 53 : 614 - 628
- Chau N , Gauchard G , Dehaene D , Benamghar L , Touron C , Perrin P , Mur JM . 2007 ; Contributions of occupational hazards and human factors in occupational injuries and their associations with job, age and type of injuries in railway workers . Int Arch Occup Environ Health . 80 : 517 - 525
- Chau N , Baumann M , Ravaud JF , Choquet M , Falissard B . Lorhandicap group . 2008a ; Association of cardiovascular disease with high physical job demands among working people: A population-based study . The 12th Biennial Congress of the European Society for Health and Medical Sociology ESHMS ; Oslo August 28–30th 2008
- Chau N , Bourgkard E , Bhattacherjee A , Ravaud JF , Choquet M , Mur JM . Lorhandicap group . 2008b ; Associations of job, living conditions and lifestyle with occupational injuries in working population: A population-based study . Int Arch Occup Environ Health . 81 : 379 - 389
- Chau N , Choquet M , Falissard B . Lorhandicap group . 2008c ; Relationship of job demands to initiating smoking in working people: A population-based study . Ind Health . In press
- Congdon N , O'Colmain B , Klaver CC , Klein R , Munoz B , Friedman DS , Kempen J , Taylor HR , Mitchell P . 2004 ; Causes and prevalence of visual impairment among adults in the United States . Arch Ophthalmol . 122 : 477 - 485
- Dahlgren G , Whitehead M . 2006 ; Levelling up (Part 2): a discussion paper on European strategies for tackling social inequities in health . Copenhagen World Health Organization Regional Office for Europe ; Studies on Social and Economic determinants of Population . (3)
- Diderichsen F , Dahlgren G , Vagerö D . 1997 ; Analysis of the proportion of the total disease burden caused by specific risk factors . Stockholm National Institute for Public Health ;
- Etter JF , Pernejer TV . 1997 ; Analysis of non-response bias in a mailed health survey . J Clin Epidemiol . 50 : 1123 - 1128
- European Foundation for the Improvement of Living and Working Conditions . 2003 ; Illness, disability and social inclusion . Luxembourg Office for Official Publications of the European Communities ;
- European Foundation for the Improvement of Living and Working Conditions . 2004 ; Illness and employment. Retaining the link to work . Summary . http://www.eurofound.eu.int Cited 17 February 2006
- Flegal KM , Graubard BI , Williamson DF , Gail MH . 2005 ; Excess deaths associated with underweight, overweight, and obesity . JAMA . 293 : 1861 - 1867
- Gauchard GC , Chau N , Touron C , Benamghar L , Dehaene D , Perrin PP , Mur JM . 2003 ; Individual characteristics in occupational accidents due to imbalance: a case-control study in the employees of a railway company . Occup Environ Med . 60 : 330 - 335
- Gauchard GC , Deviterne D , Guillemin F , Sanchez J , Perrin P , Mur JM , Ravaud JF , Chau N . Lorhandicap group . 2006 ; Prevalence of sensorial and cognitive disabilities and falls, and their relationships: A community-based study . Neuroepidemiol . 26 : 108 - 118
- Gispert R , Ruiz-Ramos M , Barés MA , Viciana F , Clot-Razquin G . 2007 ; Differences in disability-free life expectancy by gender and autonomous regions in Spain . Rev Esp Salud Publica . 81 : 155 - 165

- Guilbert P , Baudier F , Gautier A . 2001 ; Baromètre santé 2000 - Résultats . 2 : Vanves Editions CFES ; http://www.inpes.sante.fr/Barometres/Baro2000/pdf/inegalites.pdf . Cited 13 February 2007
- Huisman M , Van Lenthe F , Avendano M , Mackenbach J . 2008 ; The contribution of job characteristics to socioeconomic inequalities in incidence of myocardial infarction . Soc Sci Med . in press
- Institut National de la Statistique et des Etudes Economiques (INSEE) . 1993 ; Recensement de la population de 1990 . Sondage au ¼ . Nancy INSEE ;
- Institut National de la Statistique et des Etudes Economiques (INSEE) . 2001 ; Projections de population à l'horizon 2050 . Un vieillissement inéluctable . Paris INSEE, No. 762, Mars ;
- Kant IJ , Bültmann U , Schröer KAP , Beurskens AJHM , van Amelsvoort LGPM , Swaen GMH . 2003 ; An epidemiological approach to study fatigue in the working population: the Maastricht Cohort Study . Occup Environ Med . 60 : (Suppl I) i32 - i39
- Keogh E , McCracken LM , Eccleston C . 2006 ; Gender moderates the association between depression and disability in chronic pain patients . Eur J Pain . 10 : 413 - 22
- Khlat M , Ravaud JF , Brouard N , Chau N . the Lorhandicap group . 2008 ; Occupational disparities in accidents and roles of lifestyle factors and disabilities. A population-based study in North-eastern France . Public Health . in press
- Kristal-Boneh E , Harari G , Melamed S , Froom P . 2000 ; Association of physical activity at work with mortality in Israeli industrial employees: the CORDIS study . J Occup Environ Med . 42 : 127 - 135
- Lalluka T , Lahelma E , Rahkonen O , Roos E , Laaksonen E , Martikainen P , Head J , Brunner E , Mosdol A , Marmot M , Sekine M , Nasermoaddeli A , Kagamimori S . 2008 ; Associations of job strain and working overtime with adverse health behaviors and obesity: Evidence from the Whitehall II study, Healsink Health Study, and the Japanese Civil Servants Study . Soc Sci Med . 66 : 1681 - 1698
- Lapeyre-Mestre M , Sulem P , Niezborala M , Ngoundo-Mbongue TB , Briand-Vincens D , Jansou P , Bancarel Y , Chastan E , Montastruc JL . 2004 ; Taking drugs in the working environment: a study in a sample of 2106 workers in the Toulouse metropolitan area . Therapie . 59 : 615 - 623
- Lewis RJ , Friedlander BR , Bhojani FA , Schorr WP , Salatich PG , Lawhorn EG . 2002 ; Reliability and validity of an occupational health history questionnaire . J Occup Environ Med . 44 : 39 - 47
- Lochner K , Pamuk ER , Makuc D , Kennedy B , Kawachi I . 2001 ; State-level income inequality and individual mortality risk: a prospective multilevel study . Am J Public Health . 91 : 385 - 391
- Lorhandicap group . 2000 ; Approches méthodologiques dans une enquête épidémiologique sur les handicaps en Lorraine . Handicap Revue de Sciences Humaines et Sociales . 88 : 1 - 23
- Lorhandicap group . 2004 ; Relationships of demanding work conditions with fatigue and psychosomatic disorders: A community-based study . Occup Environ Med . 61 : e46 - e46
- Marchand JL , Imbernon E , Goldberg M . 2003 ; Mortalité chez les hommes ayant travaillé à EDF-GDF . BEH . 30–31 : 150 - 152
- Mejer L . Institut National de la Statistique et des Etudes Economiques (INSEE) . 2004 ; Differential mortality in France . Département de la Démographie, Série des Documents de Travail de la Direction des Statistiques démographiques et sociales No. F0401 . Paris INSEE ;
- Newman AB , Brach JB . 2001 ; Gender gap in longevity and disability in older persons . Epidemiologic rev . 23 : 343 - 350
- Organisation Mondiale de la Santé (OMS) . 1988 ; Classification internationale des handicaps: déficiences, incapacités et désavantages . Un manuel de classification des conséquences des maladies . Paris OMS/CTNERHI/Les Editions INSERM ;
- Sekine M , Chandola T , martikainen P , marmot M , Kagamimori S . 2006 ; Socioeconomic inequalities in physical and mental functioning of Japanese civil servants: Explanations from work and family characteristics . Soc Sci Med . 63 : 430 - 445
- Smith GS , Veazie MA . International Labour Office . 1998 ; Principles of prevention: the public health approach to reducing injuries in the workplace . Encyclopaedia of Occupational Health and Safety. Chapter VIII. Accidents and safety management - Accident prevention . 3 : 4 ILO ; Genova 56.1 - 56.42
- Teschke K , Olshan AF , Daniels JL , De Roos AJ , Parks CG , Schulz M , Vaughan TL . 2002 ; Occupational exposure assessment in case-control studies: opportunities for improvement . Occup Environ Med . 59 : 575 - 594
- Warren JR , Hoonakker P , Carayon P , Brand J . 2004 ; Job characteristics as mediators in SES-health relationships . Social Science & Medicine . 59 : 1367 - 1378
- Zhang R , Reisin E . 2000 ; Obesity-hypertension: the effects on cardiovascular and renal systems . Am J Hypertens . 13 : 1308 - 1314

Table 1

Distribution according to sex and age of the sample studied and of the general population of Lorraine ([INSEE 1993]) (%)

	Sample studied	Lorraine general population
No. of subjects	6,216	1,848,579
Women	52.4	51.5
Age (yr)		
15–19	5.4	9.6
20–24	8.0	9.8
25–29	9.7	9.7
30–34	10.4	9.6
35–39	10.5	9.6
40–44	7.9	9.3
45–49	8.5	5.9
50–54	6.0	6.6
55–59	6.3	6.8
60–64	7.2	6.6
65–69	7.5	5.7
70 or over	12.6	10.8

Only people aged 15 or more were considered.

Table 2

Relationships between various factors and functional limitations: % and crude odds ratios (OR) and 95% confidence intervals (3,368 subjects)

	%	Physical functional limitation		Cognitive functional limitation	
Age (years):					
18–29	21.8	1.00		1.00	
30–39	34.7	1.07	0.80–1.44	0.87	0.71–1.08
40–49	26.9	2.05‡	1.54–2.72	1.22§	0.98–1.51
50–59	14.4	3.96‡	2.92–5.35	1.79‡	1.40–2.29
60–64	2.2	4.56‡	2.68–7.77	2.02†	1.24–3.31
Men	53.4	0.58‡	0.48–0.69	0.62‡	0.53–0.72
Physical job demands					
Vibrating hand tools (other than pneumatic tools)	4.9	1.47*	1.01–2.14	1.43*	1.03–1.98
Handling objects	13.1	1.49‡	1.17–1.91	1.42‡	1.15–1.75
Pneumatic tools	2.3	1.22	0.69–2.16	2.17‡	1.37–3.43
Work in adverse climate (bad weather)	6.1	1.06	0.73–1.54	1.21	0.89–1.63
Vibrating platform	3.8	1.21	0.77–1.88	1.47*	1.02–2.12
Cold	16.1	1.35†	1.07–1.70	1.67‡	1.38–2.02
	18.7	1.19			

Heat			0.95–1.48	1.39‡	1.15–1.67
Awkward posture	14.9	1.94‡	1.55–2.43	1.77‡	1.46–2.16
Hammer	1.5	1.66	0.88–3.13	2.74‡	1.58–4.75
Pace of working	17.7	1.13	0.90–1.42	1.34†	1.11–1.62
Working on a production line	4.2	1.65†	1.12–2.45	1.94‡	1.38–2.72
Standing about and walking	18.3	1.54‡	1.24–1.92	1.52‡	1.26–1.83
Obese (body mass index >30 kg/m^2)	6.4	2.76‡	2.05–3.72	1.17	0.87–1.57
Current smoking	34.2	0.92	0.76–1.12	1.09	0.93–1.27
Alcohol abuse	9.0	1.27*	1.03–1.57	1.46‡	1.23–1.74
Low educational level (primary school)	18.4	2.38‡	1.94–2.92	2.35‡	1.97–2.82
Living alone	9.0	1.05	0.77–1.44	1.37*	1.07–1.76
Job category					
Upper professionals	13.4	1.00		1.00	
Intermediate professionals	9.4	0.93	0.56–1.55	2.01‡	1.39–2.91
Manual workers	26.5	2.01‡	1.39–2.90	2.83‡	2.09–3.83
Clerks	34.8	2.37‡	1.67–3.38	2.65‡	1.98–3.56
Farmers	1.8	2.00§	0.94–4.23	2.85‡	1.55–5.22
Craftsmen and tradesmen	2.1	2.45†	1.26–4.77	2.58‡	1.45–4.59
Other professionals or unknown	12.0	3.30‡	2.23–4.89	3.52‡	2.52–4.92

* p<0.05,
† p<0.01,
‡ p<0.001.
§ Close to significance (p<0.10).

Table 3
Relationships between cumulated physical job demands (PJD) and functional limitations: adjusted odds ratios (ORa) and 95% confidence intervals (3,368 subjects)

	Physical functional limitation		**Cognitive functional limitation**	
Logistic regression model including sex and age only				
PJD[a] : vs. PJD=0 (48.9%)				
1–29 (33.1%)	1.39†	1.11–1.74	1.32†	1.11–1.57
30–99 (14.7%)	1.80‡	1.38–2.34	1.82‡	1.46–2.27
≥ 100 (3.3%)	2.98‡	1.91–4.64	2.55‡	1.70–3.83
Men	0.49‡	0.40–0.58	0.56‡	0.48–0.65
Age (yr): vs. 18–29				
30–39	1.06	0.79–1.43	0.85	0.68–1.05

40–49	2.03‡	1.51–2.73	1.18	0.94–1.47
50–59	3.81‡	2.77–5.24	1.67‡	1.29–2.17
60–64	4.53‡	2.62–7.82	1.95†	1.18–3.22
Logistic regression model including all factors considered				
PJD[a] : vs. PJD=0				
1–29	1.41†	1.12–1.78	1.28†	1.06–1.54
30–99	1.72‡	1.30–2.27	1.60‡	1.26–2.03
≥ 100	2.57‡	1.62–4.10	2.00‡	1.31–3.05
Men	0.53‡	0.42–0.66	0.52‡	0.44–0.63
Age (yr): vs. 18–29				
30–39	1.06	0.78–1.43	0.85	0.68–1.06
40–49	1.93‡	1.42–2.63	1.14	0.90–1.44
50–59	3.67‡	2.62–5.14	1.57‡	1.19–2.07
60–64	3.91‡	2.20–6.94	1.73*	1.02–2.94
Obese	2.17‡	1.57–2.99	0.93	0.68–1.28
Current smoking	1.18	0.96–1.46	1.17§	0.98–1.38
Alcohol abuse	1.44†	1.14–1.82	1.71‡	1.41–2.08
Low educational level (primary school)	1.47‡	1.17–1.86	1.80‡	1.48–2.21
Living alone	0.95	0.68–1.33	1.30*	1.00–1.69
Job category: vs. upper professionals				
Intermediate professionals	0.89	0.53–1.51	2.05‡	1.40–2.99
Manual workers	1.56*	1.05–2.33	2.24‡	1.62–3.10
Clerks	1.98‡	1.36–2.89	2.11‡	1.55–2.87
Farmers	1.57	0.70–3.52	2.54†	1.34–4.80
Craftsmen and tradesmen	1.37	0.68–2.77	1.66§	0.91–3.02
Other professionals or unknown	2.68‡	1.76–4.07	2.71‡	1.91–3.85

* p<0.05,
† p<0.01,
‡ p<0.001.
§ Close to significance (p<0.10).
a Defined as the product of years of employment during the working life with the cumulative number of high physical job demands.

Table 4

Relationships between cumulated physical job demands (PJD) and functional limitation: adjusted odds ratios[a] (ORa) and 95% confidence intervals (3,368 subjects)

	Physical functional limitation (for 3 or over items)[b]		**Cognitive functional limitation (for 3 or over items)[b]**	
PJD[b] : vs. PJD=0				
1–29	1.23	0.89–1.71	1.45*	1.04–2.02
30–99	1.75†	1.21–2.52	1.75†	1.16–2.63
≥ 100	3.34‡	1.92–5.81	2.93‡	1.57–5.47

* p<0.05,
† p<0.01,
‡ p<0.001.

a Adjusted for all factors considered (Table 2), vs. subjects free of the functional limitation considered. Were excluded the subjects with positive response for 1 or 2 items.

b Defined as the product of years of employment during the working life with the cumulative number of high physical job demands.