



HAL
open science

Cross-Sectional Study of Prevalence, Characterization and Impact of Chronic Pain Disorders in Workers

Nicolas Kerckhove, Céline Lambert, Alice Corteval, Bruno Pereira, Alain Eschalier, Christian Dualé

► **To cite this version:**

Nicolas Kerckhove, Céline Lambert, Alice Corteval, Bruno Pereira, Alain Eschalier, et al.. Cross-Sectional Study of Prevalence, Characterization and Impact of Chronic Pain Disorders in Workers. *Journal of Pain*, 2021, 22 (5), pp.520-532. 10.1016/j.jpain.2020.11.005 . hal-04256713

HAL Id: hal-04256713

<https://uca.hal.science/hal-04256713v1>

Submitted on 22 Jul 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

1 **TITLE PAGE**

2 **Title: Cross-sectional study of prevalence, characterization and impact of chronic pain**
3 **disorders in workers**

4 *N. Kerckhove^{1,2}, C. Lambert¹, A. Corteval², B. Pereira¹, A. Eschaliere^{1,2}, C. Dualé^{1,2}*

5 1. Université Clermont Auvergne, CHU Clermont-Ferrand, INSERM, NEURO-DOL, F-
6 63000 Clermont-Ferrand, France.

7 2. Institut Analgesia, Faculté de médecine, 28 place Henri Dunant, F-63000 Clermont-
8 Ferrand, France.

9 * Corresponding author: Dr Nicolas KERCKHOVE, Institut Analgesia, Faculté de Médecine,
10 28 place Henri Dunant, F-63000 Clermont-Ferrand, France. Phone: +33 (0)4 73 17 82 30,
11 mail: nkerckhove@chu-clermontferrand.fr

12

13 Running title: Prevalence of chronic pain disorders in workers

14

15 Disclosures: This research was funded by the Analgesia Institute (Clermont-Ferrand, France),
16 IKEA France (Paris, France) and the University Hospital of Clermont-Ferrand.

17 None of the authors declare a conflict of interest.

18

19 **ABSTRACT**

20 Chronic pain prevention and treatment constitute a challenge for occupational health. The aim
21 of this study was to provide data on workers in a variety of jobs and multiple contexts to
22 determine the prevalence and characteristics of different chronic pain disorders, in view to
23 highlighting possible new targets for preventive actions. 1,008 participants working in 14
24 French IKEA stores were analyzed in this observational study on the basis of their responses
25 to surveys on their sociodemographic characteristics, psychosocial factors, lifestyle and pain
26 disorders. The prevalences of chronic pain, moderate-to-severe chronic pain and high-impact
27 chronic pain were 49%, 30% and 11%, respectively. Chronic pain was predominantly located
28 in the neck and back, and identified mostly as nociceptive, with, for some participants, a
29 neuropathic component (mixed pain). The majority of chronic pain was reported as being due
30 to professional activity, and causing at least one work stoppage during the past year in half of
31 the participants. Jobs that were the most common sources of chronic pain were those with a
32 higher proportion of repetitive gestures, no consecutive days of rest, stress at work, such as
33 cash-register/catering jobs. Overall, this study highlighted profiles at risk of developing or
34 suffering from chronic pain, and several associated factors: ≥ 40 years old, female sex,
35 overweight/obesity, repetitive gestures, no consecutive days of rest, stress, catastrophism,
36 workplace environment, poor quality of life and mental state. In conclusion, these data give
37 interesting information on the characteristics of workers with chronic pain and highlight
38 profiles of participants.

39 Registration number: NCT03931694

40 Perspective: This study provides important information about the features of chronic pain in a
41 model of a working population of Western countries. This information can be used to propose
42 preventive actions.

43 Key words: chronic pain, workplace; occupational health

44 INTRODUCTION

45 The risks of developing a chronic disease increase when the psychosocial environment is
46 unfavorable and repetitive physical efforts are added, for example, through handling work and
47 static postures^{14,33}. An unfavorable psychosocial environment corresponds to working
48 conditions that may lead to psychosocial risks, for example: overwork and stress; conflicting
49 requirements and lack of clarity about the missions to be performed; insufficient involvement
50 of workers in decisions affecting them and their careers; insufficient management of job
51 changes and job insecurity; insufficient communication and support from management or
52 colleagues; psychological and sexual harassment.

53 Chronic pain syndromes are an illustration of a chronic disease that can develop, with
54 frequent locations in the locomotor system and its innervation, its exacerbation in cases of
55 stress, anxiety and depression symptoms, and their potential negative consequences on the
56 quality of personal and professional life¹⁷. According to The International Association for the
57 Study of Pain (IASP) terminology⁴⁴, chronic pain can be of various types: nociceptive (pain
58 that arises from actual or threatened damage to non-neural tissue and is due to the activation
59 of nociceptors), neuropathic (pain caused by a lesion or disease of the somatosensory nervous
60 system), or nociplastic (pain that arises from altered nociception despite no clear evidence of
61 actual or threatened tissue damage causing the activation of peripheral nociceptors or
62 evidence of disease or lesion of the somatosensory system causing the pain). Its prevalence in
63 the general population is about 30% depending on the country^{6,7,10,28,29}. Few studies have
64 specifically assessed the prevalence of chronic pain disorders in a working population, but
65 include a Japanese study (42.7%)⁴¹, an Irish study (36.4%)³², and a Portuguese study
66 (32.2%)². Two other studies were performed on workers with pain related to musculoskeletal
67 disorders (MSD); the following prevalence was obtained: 31.9%, for a French study²⁵ and
68 44.6 to 46.1% for a European one¹⁵. Nevertheless, no study has estimated both the prevalence

69 of all painful disorders and the characterization of these disorders and painful participants
70 using various validated questionnaires in a professional environment.

71

72 Chronic pain disorders are responsible for limiting work activities and inducing job or
73 responsibility changes, job losses, anxiety and depressive states. Chronic low back pain,
74 which is estimated to be the leading cause of all-age years lived with disability²⁰, is estimated
75 to be the leading cause of absence from work¹². A European survey reported a 19.0%-rate of
76 moderate-to-severe chronic pain in the general population, of which 61.0% were less able or
77 unable to work, 19.0% had lost their jobs and 13.0% had changed their jobs because of pain⁷.
78 Beyond the personal impact in terms of altered quality of life, the economic burden of chronic
79 pain is considerable. Chronic pain leads to high consumption of care, absenteeism from work,
80 and work stoppages. It also leads to disability, which results in a minimum annual cost of
81 €441 billion in Europe and \$560 to \$635 billion in the USA^{8,19,45}. These figures demonstrate
82 the challenge faced by occupational health services in their preventive and curative approach
83 to chronic pain.

84

85 The objective of this study was to provide new data on a large sample of people working in a
86 variety of occupations, in multiple contexts, for a single employer, including non-painful
87 participant and using several validated questionnaires. Which is not the case with other
88 studies on the subject, the majority of which are confined to studies on the general population
89 or to a single pain location (mainly back pain^{26,36}), or in patients followed in pain clinic or do
90 not carry out a fine characterization of pain disorders and participants. At last, we proposed to
91 explore profiles of participants, with the aim of highlighting possible new targets for
92 preventive actions. This work also allows to highlight latent classes, which a crude description
93 is incapable of doing.

94

95 **MATERIALS & METHODS**

96 **Ethical and regulatory aspects**

97 The study was approved by the Research Ethics Committee (*Comité de Protection des*
98 *Personnes Nord-Ouest I*, Rouen, France) on 07/07/2017 (ref: 023/2017), and registered on
99 Clinicaltrials.gov (NCT03277885). It was conducted in accordance with the French laws and
100 regulations on research on human beings and data protection, and with the World Medical
101 Association Declaration of Helsinki (Tokyo 2004, revised).

102 Study data were collected and managed using REDCap^{22,23} electronic data capture tools
103 hosted by the sponsor of the study (University Hospital of Clermont-Ferrand, France). The
104 REDCap web platform (<http://project-redcap.org/>) possesses the authorization of the French
105 personal data protection authority (CNIL).

106

107 **Study design and population**

108 This cross-sectional study was the result of close collaboration with IKEA France, which
109 partly financed the project. Our goal was to obtain data on all chronic pain disorders in the
110 workplace and on the characteristics of employees with pain, while the aim of IKEA France
111 was to have a scientific assessment of chronic pain in their employees, so that together we can
112 propose preventive actions in future. In addition to the convergence of interests, the choice of
113 IKEA France was also motivated by the following reasons: (i) it is a large global company
114 (our results can be partly disseminated and transposed to all IKEA French stores and possibly
115 to other countries with labor legislation similar to that of France); (ii) it is a company
116 established throughout France with many employees and various jobs; (iii) the 14 stores were
117 chosen based on logistical feasibility, the total number of employees and the number of
118 employees required per store to be representative of the total IKEA France workforce. To this

119 end, stores of all ages and sizes in various regions of France were selected. IKEA France had
120 no influence on obtaining the data, analyzing the results or writing the article. All the analyses
121 and interpretations of the results were carried out and formulated by the university hospital of
122 Clermont-Ferrand and the Analgesia Institute in full transparency and without the intervention
123 of IKEA France.

124 Participation in the study was offered to all the employees, whether they had painful disorders
125 or not. All the adult employees able to read and understand French and to provide their
126 approval to participate in the study were included (yes/no choice on the REDCap web
127 platform). The participants were free to withdraw their consent at any time by informing the
128 sponsor. Each employee had access to the information document (paper or electronic)
129 detailing the purpose, content and conduct of the study. If they agreed to participate, they
130 were asked to complete the questionnaires via REDCap. The internet link allowing access to
131 this platform was sent to the human resources department of each participating store for
132 distribution to all the employees. No new action by IKEA France to improve the prevention
133 and management of chronic pain disorders and the quality of working life in general was
134 carried out during the study period.

135 As the sample had to represent the global population of IKEA France in terms of jobs, age
136 and sex ratio, and as recruitment was based on the voluntary nature of the participants, a
137 sequential inclusion (4 sessions of one month each, during which online questionnaires were
138 available to employees, and separated by 3-month interruption periods) was offered to ensure
139 the optimal representativeness of the sample under study, with an interim analysis of the
140 distribution of jobs, age and sex ratio at the end of each session. In the case of under-
141 representation of one or more job types, the study sites were prompted to encourage the
142 employees to participate. In the case of over-representation of a job, an adjustment of the data
143 by weighting was planned.

144

145 **Study outcomes**

146 The participants initially responded to several general questionnaires, dealing with several
147 aspects: Sociodemographic, lifestyle and professional data (age, gender, weight, height,
148 physical activity, job type, seniority in IKEA France and job, repetitive gestures [if any], and
149 stress); Anxiety and depressive states (Hospital Anxiety and Depression scale [HADS]⁴³);
150 Pain catastrophism (Pain Catastrophism Scale [PCS], catastrophism is proven for scores
151 ≥ 30 ³⁸).

152 Then, the participants who responded that they had pain disorders were asked to complete
153 additional questionnaires (see below) to describe their pain as well as other domains related to
154 it: Characterization and impact of pain (Brief Pain Inventory [BPI]¹¹); Neuropathic pain
155 screening (“*Douleur Neuropathique 4*” [DN4]⁵), Quality of life (Short-Form 12 questionnaire
156 [SF-12]¹⁸); Fears and beliefs about pain (Tampa Scale of Kinesiophobia [TSK, kinesiophobia
157 is proven for scores ≥ 37]³⁰ and Fear-avoidance beliefs questionnaire [FABQ]⁴⁰). The report
158 of a moderate to severe chronic pain disorder was defined by an usual pain whose intensity
159 was $\geq 4/10$ and for at least 3 months. It was the primary outcome of the study used to estimate
160 prevalence. In addition, the prevalence of all chronic pain (≥ 3 months and all intensities) and
161 “high-impact chronic pain” (moderate to severe chronic pain associated with pain interference
162 BPI score $\geq 5/10$)³⁹ has also been evaluated.

163 Concerning the type of pain and the distinction between work-related and non-work-related
164 pain, declared only by the participants, a pain physician (C.D.) reviewed the responses of the
165 participants to questions on “what factors caused the pain?” (free text field for more details),
166 “was the pain caused by work?” (Yes/No), “the type of pain?” (free text field and positive or
167 negative DN4 questionnaire) and “the location of the pain?” (item of the BPI questionnaire).

168 The pain physician thus interpreted for each participant the type of pain and whether or not it
169 was work-related.

170 The questionnaires were completed by the employees at their workplace or at home using an
171 internet link to the online questionnaires. All the questionnaires were described in the inform
172 form (paper format and online on REDCap).

173

174 **Statistics**

175 *Number of participants*

176 This cross-sectional study conducted on a sample should make it possible to generalize the
177 results to the entire target population. A margin of error on the estimate (reliability of the
178 sample) is defined to calculate the number of participants required, in addition to the expected
179 proportion of chronic pain subjects (rate of participants with chronic pain disorders). Thus,
180 according to the literature, for an expected proportion of chronic pain subjects of about 30%²⁵,
181 the inclusion of at least 897 subjects made it possible to obtain a precision on this proportion
182 in the region of $\pm 3\%$; for 2,017 subjects, this accuracy was therefore $\pm 2\%$. Thus, the
183 inclusion of at least 1,000 participants was a good compromise regarding the reliability and
184 feasibility of the study.

185

186 *Statistical analysis*

187 Statistical analyses were performed using Stata software (version 13, StataCorp, College
188 Station, Texas, USA) and R 3.3.3 (<http://cran.r-project.org/>). All the tests were two-sided,
189 with a Type I error set at 0.05. Particular attention was given to the magnitude of differences,
190 in addition to inferential statistical tests expressed using p-values, without adjustment for
191 Type I error¹⁶. Categorical parameters were expressed as frequencies and associated
192 percentages, and continuous data as mean \pm standard deviations or as medians [interquartile

193 range], according to statistical distribution. The prevalence of pain was expressed as a
194 percentage and 95% confidence interval (CI). Factors associated with chronic pain (≥ 3
195 months) of moderate to severe intensity ($\geq 4/10$) were studied by mixed effect logistic
196 regressions, with the stores considered as random effect, to take into account the dependencies
197 among cluster members. In a context of multivariable analyses, the results obtained were
198 adjusted for the characteristics of the participants (age, sex, session) and stores (number of
199 participants, surface area and seniority).

200 A sensitivity analysis was planned to define the level of attrition and the statistical nature of
201 the missing data. The standard multiple imputation method (Verbeke and Molenberghs)³¹ was
202 also considered. The factors associated with the consequences of pain (none, work stoppage,
203 accommodation/change of job) were analyzed in the same way.

204 A multiple correspondence analysis (MCA) followed by a mixed unsupervised classification
205 (k-means clustering applied to the partition obtained from an ascending hierarchical
206 classification using Ward's distance) were proposed to: (i) study the relations between the
207 modalities of the variables, and (ii) determine the profiles of the participants (groups of
208 individuals sharing very similar characteristics). MCA performs cross tabulations, and can be
209 considered as a useful tool to uncover the relationships among categorical variables³⁵. The
210 result is a representation on the two first discriminant plane projection of discriminant scores
211 of patients and variables. The significance of association as tested by Chi-square or Fisher's
212 exact tests provides no information regarding significant individual associations between row-
213 column pairs. On the contrary, factorial analyses such as MCA show how the variables are
214 related, and not just if a relationship exists. This approach enables to handle a large amount of
215 data in order to unfold hidden pattern. For these analyses, the variables were chosen according
216 to univariate results, to clinical relevance and to statistical distribution (parameters always
217 present or always absent were not considered): the characteristics of stores (number of

218 employees, surface area and seniority), subjects (gender, age, body mass index, stress, quality
219 of life, pain, etc.), and work (job, repetitive gestures, etc.). Only individuals without missing
220 data were included in this analysis.

221

222 **RESULTS**

223 *Sociodemographic, lifestyle and professional data of participants*

224 The one-month sessions were conducted in October 2017, February, June, and October 2018.
225 Eleven hundred and thirty-seven (1,137) participants were included, representing 31.0% of
226 the total workforce of the participating stores (3,668 employees). The demographic data of
227 these 1,137 participants were as follows: age 18-24 years = 10.2%; 25-49 years = 77.8%; \geq 50
228 years = 12.0%, and gender = 55.2% women. Repetitive gestures (**Supplementary Figure 1**),
229 body mass index, physical activity, days of rest, stress (work and home), quality of life,
230 anxious and depressive states, and catastrophism were also investigated. The characteristics of
231 our population were similar between all participants (n=1,137) and those analyzed (n=1,008)
232 (**Table 1**).

233

234 *Prevalence of chronic pain*

235 Among the 1,137 participants, 1,008 who answered questions about whether or not they had a
236 moderate to severe chronic pain disorder (\geq 3 months and intensity \geq 4/10) were analyzed.
237 Among these 1,008 participants, 544 (54.0%, 95% CI: 50.8 to 57.1%) reported pain (all types,
238 durations and intensities). Four hundred and ninety-seven participants expressed chronic pain
239 (all intensities) representing 49.3% of the study population (95% CI: 46.2 to 52.4%),
240 including 194 (39.0%) reported mild pain ($<$ 4/10), 238 (47.9%) moderate pain (\geq 4/10 and
241 $<$ 7/10), and 65 (13.1%) severe pain (\geq 7/10). In addition, 30.1% (95% CI: 27.2 to 33.0%) of
242 the analyzed participants expressed moderate to severe chronic pain and 11.4% (95% CI: 9.5

243 to 13.5%) were identified as suffering from “high-impact chronic pain” (moderate to severe
244 chronic pain associated with pain interference BPI score $\geq 5/10$) (**Tables 2 and 3**).

245

246 *Characterization of participants and chronic pain disorders*

247 We characterized the participants according to the severity of their painful disorders (all
248 chronic pain / moderate to severe chronic pain / high impact chronic pain). Our results
249 highlighted certain factors that could be associated with chronic pain disorders: age ≥ 40 years
250 old, female sex, obesity, no consecutive days of rest, presence of repetitive gestures, stress,
251 altered physical quality of life (data not shown), anxio-depressive state, and catastrophism
252 (**Table 2**). Interestingly, physical activity appeared to have no impact on the presence or
253 absence of chronic pain disorders. Concerning the “high impact chronic pain” group, the
254 majority of the results obtained were similar to those of other groups. Nevertheless, some
255 differences were observed. There was no “sex” effect, women were not more affected than
256 men. In contrast to the other groups, overweight participants were, like obese people,
257 significantly more likely to suffer from high impact chronic pain compared to participants
258 with a BMI ≤ 25 kg/m². In terms of the professional environment, administrative, sales and
259 recovery jobs were the least likely to cause high impact chronic pain.

260 Among the workers reporting moderate to severe chronic pain, 78.5% reported moderate pain
261 ($\geq 4/10$ and $< 7/10$) and 21.5% severe pain ($\geq 7/10$). Most of chronic pain disorders were
262 nociceptive (81.8%, related to MSD), of which 21.8% had a neuropathic component (mixed
263 pain), while neuropathic and nociplastic pain syndromes represent 4.0 and 5.3%, respectively.
264 Chronic pain disorders were predominantly located in the back (84.8%), neck (55.1%) and
265 shoulders (43.9%) (**Table 3**). When comparing workers reporting moderate to severe chronic
266 pain with workers reporting mild chronic pain ($< 4/10$), we highlighted potential factors
267 associated with moderate to severe chronic pain disorders: mixed pain, professional cause of

268 pain, locations of pain, BPI pain severity/interference score, number of pain sites, FABQ
269 physical/work score, and the presence of kinesiophobia (**Table 3**).

270 Regarding the professional dimension, the most frequently reported cause of moderate to
271 severe chronic pain was professional activity (83.8%), and pain was aggravated by work,
272 affecting the quality of professional life for 76.6% and 70.6% of cases respectively (**Table 3**).

273 The observed prevalence of moderate to severe chronic pain varied from 17.2% for the least
274 pain-causing job (maintenance) to 38.6% for the most pain-causing job (catering) (**Table 2**),
275 with a statistical difference only between administrative jobs and logistics / sales / catering /
276 cash register jobs, (**Figure 1**). The main factor possibly explaining this difference was the
277 frequency of repetitive gestures which was less frequent in the administrative jobs
278 (**Supplementary Figure 1**). Globally, the more frequent the repetitive gestures, the more
279 frequently the participants had chronic pain disorders, regardless of the type of job (**Figure 1**).
280 For the “high impact chronic pain” group, the majority of the results obtained were similar to
281 the other groups.

282 The characterizations of participants with no pain disorders are presented in **Supplementary**
283 **Table 1**. The data show that these participants were young (< 35 years old), with an average
284 BMI less than 25 kg/m², working mainly in sales and having consecutive days of rest. More
285 than half of them performed repetitive movements (mainly mobilizing the upper body). At
286 last, these non-painful participants presented little stress at work (less than 50% have a stress
287 intensity $\geq 5/10$), had a normal quality of life, presented few depressive and anxiety disorders
288 (< 10%), and low catastrophism.

289 As a summary, we proposed, on an exploratory basis, a multifactorial analysis
290 (**Supplementary Table 2**). Our results showed that the sample analyzed included 3 groups of
291 participants, defined as “pain-free”, “at-risk” and “chronic pain. Pain-free participants could
292 be characterized as follows: young (<40 years), physical activity, low stress, good quality of

293 life, low catastrophism and kinesiophobia, presence of consecutive day of rest, low frequency
294 of repetitive gesture and anxio-depressive disorders. The “at risk” group being the
295 intermediate group with characteristics often qualitatively comparable to those of chronic pain
296 patients but with less pejorative levels. “Chronic pain” participants could be characterized as
297 follows: female, age ≥ 40 years, overweight/obesity, weak physical activity, presence of
298 catastrophism and kinesiophobia, high stress at work, altered quality of life, presence of
299 repetitive gestures, no consecutive day of rest, and anxiety/depressive disorders. The
300 participants in this group, recruited primarily in logistics, sales and cash register jobs [which
301 were the most likely to lead to repetitive gestures (89.9%, 88.0%, 85.2% respectively)],
302 consider, for 90% of them, that their problems are work-related. In addition, less than half of
303 them benefit from consecutive days of rest per week, unlike the participants in the other
304 groups.

305

306 *Impact of chronic pain*

307 Workers reporting moderate to severe chronic pain resorted to medical consultations for their
308 pain disorders more often and reported more work stoppages than workers with acute pain or
309 mild chronic pain intensity. Interestingly, there were about 3 times as many participants
310 (10.7% vs 29.4%) with more than 5 consultations per year among the participants with
311 moderate to severe chronic pain compared to non-chronic or mild chronic pain
312 (**Supplementary Figure 2**). Moreover, a relationship was observed between work stoppage
313 and the intensity of various parameters: the higher the pain intensity / stress at work /
314 catastrophism / kinesiophobia, the more likely the participants with moderate to severe
315 chronic pain were to take time off work during the year (**Figure 2**).

316

317 **DISCUSSION**

318 This study proposes an analysis of chronic pain in a strictly working population at their
319 workplace. The originality of this study was: (i) to provide data on a large sample of people
320 working in a variety of occupations, in multiple contexts (for a single employer); (ii) to
321 determine the prevalence and characteristics of all chronic pain disorders, whereas in most
322 existing studies, only one anatomically defined pain condition is studied (such as low back
323 pain); (iii) to ensure an overall evaluation of the participants, with profiles determination
324 using several validated questionnaires.

325 We observed a prevalence of chronic pain of 49.3%. Moreover, a prevalence of 54.0% for all
326 types and durations of pain, 30.1% of moderate to severe chronic pain and 11.4% of “high
327 impact chronic pain” were also observed.

328 The similar representation of jobs between our population and that of the participating IKEA
329 France stores (IKEA data) allowed us to extrapolate our results to the entire population of
330 these stores. On the other hand, the demographic data of our study population and the wide
331 ranging representation of different types of job were relatively close to those of the French
332 working population (data from the latest INSEE [French institute of statistics and economic
333 studies] report of 2016⁴⁶); however, women were over-represented (55.6% vs 48.2%).
334 Moreover, the physical and emotional parameters assessed in our population were close to
335 those of the general population: obesity rates (11.9% vs 15.0%)³, physical inactivity rates
336 (45.1% vs 32.5%)²¹, anxio-depressive disorders (6.4% vs 5.9%)²⁷ and quality of life (physical
337 SF12 score = 50.6 vs 51.2; mental SF12 score = 43.9 vs 48.4)¹⁸. Thus, despite the fact that our
338 population was slightly younger and women were slightly over-represented, our study sample
339 was quite representative of the majority of French workers, making it possible to generalize
340 our results and their relevance to the French working population, especially since labor
341 legislation in France applies to all companies. Nevertheless, others studies should be

342 conducted on others countries with different work legislation to verify our results and their
343 possible transposition.

344 The observed prevalences of chronic pain and moderate to severe chronic pain (49% and 30
345 %, respectively) were similar than that reported in the general French (30%), European
346 populations (25 to 35%)^{8,10} and are in line with data obtained for the working populations of
347 various countries. A recent report of the Centers for Disease Control and Prevention⁹ showed
348 that in the USA, 59.6% of the working population had experienced pain in the last 6 months
349 (all intensities and duration). Moreover, the prevalence of chronic pain in workers was
350 determined in four other studies: a Japanese study (42.7%)⁴¹, an Irish study (36.4%)³², a
351 Portuguese study (32.2%)², and a French study (31.9%, only MSD related pain studied)²⁵.
352 Finally, a European study reported 44.6 to 46.1% of European workers with MSD-related
353 pain¹⁵. Concerning the prevalence of “high impact chronic pain”, as described previously by
354 von Korff et al. 2016³⁹, our result is similar to that observed in American patients suffering
355 from chronic pain (13.7%).

356 Beyond the prevalence data, the subjects most affected by chronic pain were older and
357 predominantly female (as described previously^{2,10,15}), psychological profiles with stress,
358 catastrophism, anxiety, depression and altered quality of life. It should also be noted that
359 obesity is a factor associated with an increased prevalence of chronic pain, an observation that
360 has been described previously^{4,34,37}. On the other hand, our study allowed us to accurately
361 characterize pain disorders and to highlight a typical profile of workers with chronic pain. The
362 first observation is that the nature of chronic pain is mainly nociceptive (mainly back, neck
363 and shoulders), which is in line with data for the general population²⁰. A neuropathic
364 component was also observed in this population, while isolated neuropathic pain syndrome
365 seemed to be less represented than in the general population (7-10%)^{10,13,24}. The most
366 common cause of chronic pain reported was professional activity, which they considered to be

367 aggravating pain. Interestingly, from a preventive perspective, our study identified higher-
368 associated professional sectors such as catering/cash-register and responsibility for activities
369 with repeated gestures, involving back, neck and shoulders, in the occurrence of chronic pain.
370 These data are consistent with the literature reporting a relationship between developing
371 chronic pain in manual jobs^{8,15,32} and the localization of pain, mainly in the back^{2,15,32} and
372 upper body^{15,32}. In addition, our study highlighted an interesting factor associated with
373 chronic pain: consecutive days of rest. Indeed, less than half of the participants with chronic
374 pain disorders had at least 2 consecutive days of rest during the week (all chronic pain =
375 43.1%; moderate/severe chronic pain = 38.6%; high impact chronic pain = 35.7%; **Table 2**)
376 while the other participants with no pain disorders were 50.9% to have at least 2 consecutive
377 days of rest during the week. These data highlight the importance of having a prolonged rest
378 per week. It therefore seems interesting to implement, as a preventive measure, 2 consecutive
379 days of rest per week for employees at risk or who have developed chronic pain disorders.
380 Thus, this preventive measure, in addition to existing measures (ergonomics, warm-up before
381 starting work, management, etc.), could reduce the incidence of chronic pain disorders. A
382 clinical study should be carried out to verify the effectiveness of such a measure.

383 Finally, we propose to synthesize the data obtained by identifying three groups of participants
384 according to chronic pain: i) “pain-free” participants; ii) participants considered as “at risk” of
385 developing chronic pain; iii) a typical profile of “chronic pain” participants, that we consider
386 as needing treatment; This last group of workers is not only consistent with the literature that
387 describes associated factors for the development of chronic pain such as the presence of
388 repetitive gestures^{2,15,32}, female gender^{2,8,10,15}, age^{2,8,10,15,25,32}, anxio-depressive states^{2,32,41}, and
389 overweight/obesity^{8,25,41}, but also underlines to the risk that the absence of consecutive days
390 of rest can participate to the occurrence of chronic pain.

391 This points towards not only implementing preventive and/or curative care actions in the
392 professional environment by adapting working conditions (choice of activities, working
393 modalities, ergonomic adaptations, reduce exposition to repetitive gestures, set up consecutive
394 days of rest, etc.) within the company, but also outside it. The interest of these
395 recommendations is reinforced by the impact shown in our study of chronic pain on the
396 deterioration of quality of life (in almost 70% of patients), increased care consumption, and
397 the rate of work stoppages.

398

399 **Study limitations**

400 The main limitation was that the participants did not receive any medical follow-up or advice.
401 Thus, the data obtained were only declarative, which could affect the accuracy of the cause of
402 chronic pain and comorbidities. A second limitation was the absence of medical check-up and
403 the concern for the anonymity of the participants, which did not allow us to obtain
404 information on the type and duration of work stoppages and related compensation, or on the
405 type and number of pain treatments and medical and paramedical consultations. Thus, we
406 were unable to conduct a formal economic impact assessment. The last limitation is the risk of
407 self-reporting bias due to the use of several questionnaires. Self-reporting bias is a frequent
408 problem in the assessment of observational study designs¹. Nevertheless, self-reporting
409 provides a wider range of responses than many other data collection tools⁴². Self-reporting
410 bias can arise from social desirability, recall period, sampling approach, or selective recall. In
411 our study, social desirability might be the major risk. In this case, self-reporting data can be
412 affected by an external bias caused by social desirability or approval, especially in cases
413 where anonymity and confidentiality cannot be guaranteed at the time of data collection.
414 Because of the anonymity of the participants in our study and the fact that the participants
415 themselves did not expect compensation, we consider this bias to be negligible. Finally, since

416 all the questions dealt with the present moment or at the latest 1 to 2 weeks earlier, the recall
417 bias is also negligible.

418

419 **Conclusion**

420 This study provides information about the features of various types of chronic pain in a model
421 of the working population of Western countries. In addition, it highlights possible actions to
422 reduce the prevalence and impact of pain. Nevertheless, many other questions need to be
423 addressed in future research, in particular: (i) What are the links between work and life out of
424 work in the development and evolution of pain? (ii) How is chronic pain considered in the
425 current care system? (iii) Are our results transposable and/or found in other countries with
426 different work legislation? and, (iv) What observations might be reported in a long-term
427 follow-up?

428 **ACKNOWLEDGMENTS**

429 We would like to express our deep gratitude to IKEA France for conducting this study among
430 its employees. IKEA France played no role in the study design, data analysis, data
431 interpretation or writing of the report. We also thank Mr Aurélien Mulliez (biostatistician at
432 Clermont-Ferrand University Hospital) for his participation in the statistical discussions.

433

434 **AUTHOR CONTRIBUTIONS**

435 All authors discussed the results, commented on the manuscript, and approved this work. All
436 the authors participated in the study, either in terms of scientific expertise (rational,
437 methodology), logistics (implementation and monitoring of the project, quality assurance),
438 statistical analyses and writing / proofreading of the article.

439 **REFERENCES**

- 440 1. Althubaiti A: Information bias in health research: definition, pitfalls, and adjustment
441 methods. *J Multidiscip Healthc* 9:211–7, 2016.
- 442 2. Azevedo LF, Costa-Pereira A, Mendonça L, Dias CC, Castro-Lopes JM: Epidemiology
443 of chronic pain: a population-based nationwide study on its prevalence, characteristics
444 and associated disability in Portugal. *J Pain* 13:773–83, 2012.
- 445 3. Barbieri M, Désesquelles A, Egidi V, Demuru E, Frova L, Meslé F, Pappagallo M:
446 Obesity-related mortality in France, Italy, and the United States: a comparison using
447 multiple cause-of-death analysis. *Int J Public Health* 62:623–9, 2017.
- 448 4. Bigand T, Wilson M, Bindler R, Daratha K: Examining Risk for Persistent Pain
449 among Adults with Overweight Status. *Pain Manag Nurs* 19:549–56, 2018.
- 450 5. Bouhassira D, Attal N, Alchaar H, Boureau F, Brochet B, Bruxelle J, Cunin G,
451 Fermanian J, Ginies P, Grun-Overdyking A, Jafari-Schluep H, Lantéri-Minet M, Laurent
452 B, Mick G, Serrie A, Valade D, Vicaut E: Comparison of pain syndromes associated
453 with nervous or somatic lesions and development of a new neuropathic pain diagnostic
454 questionnaire (DN4). *Pain* 114:29–36, 2005.
- 455 6. Bouhassira D, Lantéri-Minet M, Attal N, Laurent B, Touboul C: Prevalence of chronic
456 pain with neuropathic characteristics in the general population. *Pain* 136:380–7, 2008.
- 457 7. Breivik H, Collett B, Ventafridda V, Cohen R, Gallacher D: Survey of chronic pain in
458 Europe: Prevalence, impact on daily life, and treatment. *European Journal of Pain*
459 10:287–287, 2006.
- 460 8. Breivik H, Eisenberg E, O'Brien T: The individual and societal burden of chronic pain
461 in Europe: the case for strategic prioritisation and action to improve knowledge and
462 availability of appropriate care. *BMC Public Health* 13:1229, 2013.
- 463 9. CDCMMWR: QuickStats: Age-Adjusted Percentage of Adults Aged ≥ 18 Years Who
464 Were Never in Pain, in Pain Some Days, or in Pain Most Days or Every Day in the Past
465 6 Months, by Employment Status — National Health Interview Survey, United States,
466 2016. *MMWR Morb Mortal Wkly Rep* [Internet] 66:, 2017 [cited 2019 Aug 20].
467 Available from: <https://www.cdc.gov/mmwr/volumes/66/wr/mm6629a8.htm>
- 468 10. Chenaf C, Delorme J, Delage N, Ardid D, Eschalier A, Authier N: Prevalence of chronic
469 pain with or without neuropathic characteristics in France using the capture-recapture
470 method: a population-based study. *Pain* 159:2394–402, 2018.
- 471 11. Cleeland CS, Ryan KM: Pain assessment: global use of the Brief Pain Inventory. *Ann*
472 *Acad Med Singap* 23:129–38, 1994.
- 473 12. Cougot B, Petit A, Paget C, Roedlich C, Fleury-Bahi G, Fouquet M, Menu P, Dubois C,
474 Geraut C, Roquelaure Y, Tripodi D: Chronic low back pain among French healthcare
475 workers and prognostic factors of return to work (RTW): a non-randomized controlled
476 trial. *J Occup Med Toxicol* 10:40, 2015.

- 477 13. DiBonaventura MD, Sadosky A, Concialdi K, Hopps M, Kudel I, Parsons B, Cappelleri
478 JC, Hlavacek P, Alexander AH, Stacey BR, Markman JD, Farrar JT: The prevalence of
479 probable neuropathic pain in the US: results from a multimodal general-population
480 health survey. *J Pain Res* 10:2525–38, 2017.
- 481 14. Edwards RR, Dworkin RH, Sullivan MD, Turk DC, Wasan AD: The Role of
482 Psychosocial Processes in the Development and Maintenance of Chronic Pain. *J Pain*
483 17:T70-92, 2016.
- 484 15. Farioli A, Mattioli S, Quagliari A, Curti S, Violante FS, Coggon D: Musculoskeletal
485 pain in Europe: the role of personal, occupational, and social risk factors. *Scand J Work*
486 *Environ Health* 40:36–46, 2014.
- 487 16. Feise RJ: Do multiple outcome measures require p-value adjustment? *BMC Med Res*
488 *Methodol* 2:8, 2002.
- 489 17. Gallinaro AL, Feldman D, Natour J: An evaluation of the association between
490 fibromyalgia and repetitive strain injuries in metalworkers of an industry in Guarulhos,
491 Brazil. *Joint Bone Spine* 68:59–64, 2001.
- 492 18. Gandek B, Ware JE, Aaronson NK, Apolone G, Bjorner JB, Brazier JE, Bullinger M,
493 Kaasa S, Leplege A, Prieto L, Sullivan M: Cross-validation of item selection and scoring
494 for the SF-12 Health Survey in nine countries: results from the IQOLA Project.
495 *International Quality of Life Assessment. J Clin Epidemiol* 51:1171–8, 1998.
- 496 19. Gaskin DJ, Richard P: The Economic Costs of Pain in the United States. *The Journal of*
497 *Pain* 13:715–24, 2012.
- 498 20. Global Burden of Disease Study 2013 Collaborators: Global, regional, and national
499 incidence, prevalence, and years lived with disability for 301 acute and chronic diseases
500 and injuries in 188 countries, 1990-2013: a systematic analysis for the Global Burden of
501 Disease Study 2013. *Lancet* 386:743–800, 2015.
- 502 21. Hallal PC, Andersen LB, Bull FC, Guthold R, Haskell W, Ekelund U: Global physical
503 activity levels: surveillance progress, pitfalls, and prospects. *The Lancet* 380:247–57,
504 2012.
- 505 22. Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O’Neal L, McLeod L,
506 Delacqua G, Delacqua F, Kirby J, Duda SN, REDCap Consortium: The REDCap
507 consortium: Building an international community of software platform partners. *J*
508 *Biomed Inform* 95:103208, 2019.
- 509 23. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG: Research electronic
510 data capture (REDCap)—A metadata-driven methodology and workflow process for
511 providing translational research informatics support. *Journal of Biomedical Informatics*
512 42:377–81, 2009.
- 513 24. van Hecke O, Austin SK, Khan RA, Smith BH, Torrance N: Neuropathic pain in the
514 general population: a systematic review of epidemiological studies. *Pain* 155:654–62,
515 2014.

- 516 25. Herin F, Vézina M, Thaon I, Soulat J-M, Paris C, ESTEV group: Predictive risk factors
517 for chronic regional and multisite musculoskeletal pain: a 5-year prospective study in a
518 working population. *Pain* 155:937–43, 2014.
- 519 26. Hoy D, March L, Brooks P, Blyth F, Woolf A, Bain C, Williams G, Smith E, Vos T,
520 Barendregt J, Murray C, Burstein R, Buchbinder R: The global burden of low back pain:
521 estimates from the Global Burden of Disease 2010 study. *Ann Rheum Dis* 73:968–74,
522 2014.
- 523 27. Ibanez G, Son S, Chastang J, Magnier AM: Mental Health Disorders in General Practice
524 in France: A Cross-Sectional Survey. *Transl Biomed [Internet]* 07:, 2016 [cited 2019
525 Sep 17]. Available from: [http://www.transbiomedicine.com/translational-](http://www.transbiomedicine.com/translational-biomedicine/mental-health-disorders-in-general-practice-in-france-a-crosssectional-survey.php?aid=17729)
526 [biomedicine/mental-health-disorders-in-general-practice-in-france-a-crosssectional-](http://www.transbiomedicine.com/translational-biomedicine/mental-health-disorders-in-general-practice-in-france-a-crosssectional-survey.php?aid=17729)
527 [survey.php?aid=17729](http://www.transbiomedicine.com/translational-biomedicine/mental-health-disorders-in-general-practice-in-france-a-crosssectional-survey.php?aid=17729)
- 528 28. Kuehn B: Chronic Pain Prevalence. *JAMA* 320:1632, 2018.
- 529 29. Macfarlane GJ: The epidemiology of chronic pain. *Pain* 157:2158–9, 2016.
- 530 30. Miller RP, Kori SH, Todd DD: The Tampa Scale: a Measure of Kinisophobia. *The*
531 *Clinical Journal of Pain* 7:51, 1991.
- 532 31. Molenberghs G, Verbeke G: Models for Discrete Longitudinal Data [Internet]. New
533 York: Springer-Verlag; 2005 [cited 2020 Aug 17]. Available from:
534 <https://www.springer.com/gp/book/9780387251448>
- 535 32. Raftery MN, Sarma K, Murphy AW, De la Harpe D, Normand C, McGuire BE: Chronic
536 pain in the Republic of Ireland--community prevalence, psychosocial profile and
537 predictors of pain-related disability: results from the Prevalence, Impact and Cost of
538 Chronic Pain (PRIME) study, part 1. *Pain* 152:1096–103, 2011.
- 539 33. Schneiderman N, McIntosh RC, Antoni MH: Psychosocial risk and management of
540 physical diseases. *J Behav Med* 42:16–33, 2019.
- 541 34. Smuck M, Kao M-CJ, Brar N, Martinez-Ith A, Choi J, Tomkins-Lane CC: Does physical
542 activity influence the relationship between low back pain and obesity? *Spine J* 14:209–
543 16, 2014.
- 544 35. Sourial N, Wolfson C, Zhu B, Quail J, Fletcher J, Karunanathan S, Bandeen-Roche K,
545 Béland F, Bergman H: Correspondence analysis is a useful tool to uncover the
546 relationships among categorical variables. *J Clin Epidemiol* 63:638–46, 2010.
- 547 36. Steenstra IA, Munhall C, Irvin E, Oranye N, Passmore S, Van Eerd D, Mahood Q,
548 Hogg-Johnson S: Systematic Review of Prognostic Factors for Return to Work in
549 Workers with Sub Acute and Chronic Low Back Pain. *J Occup Rehabil* 27:369–81,
550 2017.
- 551 37. Stone AA, Broderick JE: Obesity and pain are associated in the United States. *Obesity*
552 (Silver Spring) 20:1491–5, 2012.
- 553 38. Sullivan MJL, Stanish W, Waite H, Sullivan M, Tripp DA: Catastrophizing, pain, and
554 disability in patients with soft-tissue injuries. *Pain* 77:253–60, 1998.

- 555 39. Von Korff M, Scher AI, Helmick C, Carter-Pokras O, Dodick DW, Goulet J, Hamill-
556 Ruth R, LeResche L, Porter L, Tait R, Terman G, Veasley C, Mackey S: United States
557 National Pain Strategy for Population Research: Concepts, Definitions, and Pilot Data. *J*
558 *Pain* 17:1068–80, 2016.
- 559 40. Waddell G, Newton M, Henderson I, Somerville D, Main CJ: A Fear-Avoidance Beliefs
560 Questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain
561 and disability. *Pain* 52:157–68, 1993.
- 562 41. Yamada K, Wakaizumi K, Fukai K, Iso H, Sobue T, Shibata M, Matsudaira K: Study of
563 chronic pain and its associated risk factors among Japanese industry workers: the
564 Quality of Working Life Influenced by Chronic pain (QWLIC) study. *Sangyo Eiseigaku*
565 *Zasshi* 59:125–34, 2017.
- 566 42. Zhu K, McKnight B, Stergachis A, Daling JR, Levine RS: Comparison of self-report
567 data and medical records data: results from a case-control study on prostate cancer. *Int J*
568 *Epidemiol* 28:409–17, 1999.
- 569 43. Zigmond AS, Snaith RP: The hospital anxiety and depression scale. *Acta Psychiatr*
570 *Scand* 67:361–70, 1983.
- 571 44. IASP Terminology - IASP [Internet]. [cited 2020 Aug 17]. Available from:
572 <https://www.iasp-pain.org/Education/Content.aspx?ItemNumber=1698>
- 573 45. Impact of pain on society costs the EU up to 441 billion Euros annually [Internet].
574 Societal Impact of Pain (SIP). [cited 2019 Oct 30]. Available from: [https://www.sip-](https://www.sip-platform.eu/press-area/article/impact-of-pain-on-society-costs-the-eu-up-to-441-billion-euros-annually)
575 [platform.eu/press-area/article/impact-of-pain-on-society-costs-the-eu-up-to-441-billion-](https://www.sip-platform.eu/press-area/article/impact-of-pain-on-society-costs-the-eu-up-to-441-billion-euros-annually)
576 [euros-annually](https://www.sip-platform.eu/press-area/article/impact-of-pain-on-society-costs-the-eu-up-to-441-billion-euros-annually)
- 577 46. Population active – Tableaux de l'Économie Française | Insee [Internet]. [cited 2019
578 Aug 20]. Available from:
579 <https://www.insee.fr/fr/statistiques/1906671?sommaire=1906743#tableau-T16F041G2>
- 580
581

582 **FIGURES / TABLES LEGENDS**

583

584 **Table 1. Characteristics of all participants included and analyzed.**

585 Data are presented as frequencies (associated percentage), as mean \pm standard deviation, or as
586 median [interquartile range]. *Participants who answered questions about whether or not they
587 had pain disorders. Abbreviations: HAD, Hospital Anxiety and Depression scale; PCS, Pain
588 Catastrophism Scale; SF12, Short Form 12.

589

590 **Table 2. Prevalence of chronic pain disorders according to characteristics of**
591 **participants.**

592 Data are presented as frequencies (associated percentage). Percentage are expressed in rows:
593 for example, 34.8% of female vs 24.1% of male suffering moderate to severe chronic pain,
594 $p < 0.001$. * “chronic pain” group corresponds to participants with all chronic pain (≥ 3
595 months); ** “moderate to severe chronic pain” group corresponds to participants with chronic
596 pain (≥ 3 months) of intensity $\geq 4/10$, including patients with high chronic pain; *** “high
597 impact chronic pain” group corresponds to participants with chronic pain (≥ 3 months) of
598 intensity $\geq 4/10$ with pain interference BPI score $\geq 5/10$. p: adjustment for age, gender,
599 session, number of employees and store seniority. Abbreviations: HAD, Hospital Anxiety and
600 Depression scale; NA: not applicable; PCS, Pain Catastrophism Scale; REF: reference.

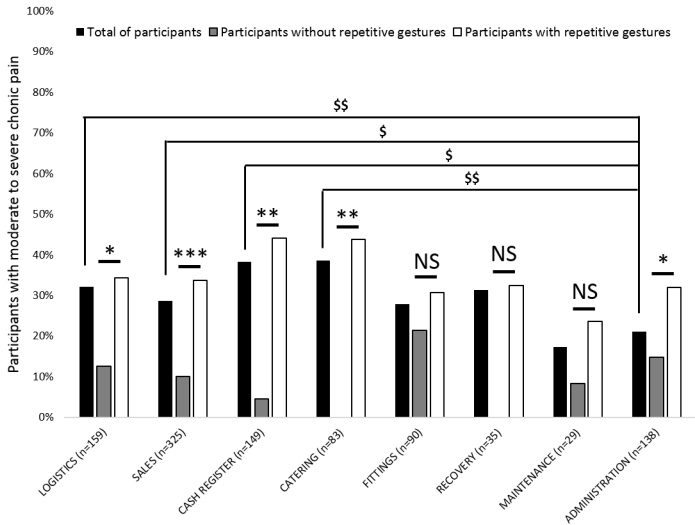
601

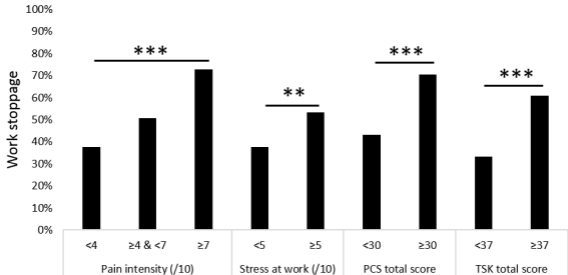
602 **Table 3. Characteristics of chronic pain disorders.**

603 Data are presented as frequencies (associated percentage), or as median [interquartile range].
604 Percentage are expressed in rows: for example, 64.3% of participants whose pain is
605 aggravated by work suffering from moderate/severe pain vs. 52.2% of participants whose pain
606 is not aggravated by work, $p=0.015$. * “mild chronic pain” group corresponds to participants
607 with chronic pain intensity $< 4/10$; ** “moderate/severe chronic pain” group corresponds to
608 participants with chronic pain (≥ 3 months) of intensity $\geq 4/10$; *** “high impact chronic
609 pain” group corresponds to participants with chronic pain (≥ 3 months) of intensity $\geq 4/10$
610 with pain interference BPI score $\geq 5/10$. p: adjustment for age, gender, session, number of
611 employees and store seniority. Abbreviations: BPI, Brief Pain Inventory; FABQ, Fear-
612 Avoidance Beliefs Questionnaire; QoPL, Quality of Professional Life; TSK, Tampa Scale
613 Kinesiophobia.

614

615





	All participants (n=1,137)	Analyzable participants* (n=1,008)
Age, year	36.6 ± 9.8	36.4 ± 9.7
Female gender	639 (56.2)	560 (55.6)
Body mass index, kg/m²	24.5 ± 4.7	24.6 ± 4.8
Body mass index		
≤ 25 kg/m ²	726/1,133 (64.1)	638/1,005 (63.5)
25 to 30 kg/m ²	281/1,133 (24.8)	247/1,005 (24.6)
> 30 kg/m ²	126/1,133 (11.1)	120/1,005 (11.9)
Physical activity (yes)	620 (54.5)	553 (54.9)
Duration per week of physical activity		
≤ 1 hour	123/620 (19.8)	111/553 (20.1)
2 to 3 hours	312/620 (50.3)	277/553 (50.1)
4 to 5 hours	112/620 (18.1)	101/553 (18.2)
> 5 hours	73/620 (11.8)	64/553 (11.6)
Job		
Logistics	176 (15.5)	159 (15.8)
Sales	379 (33.3)	325 (32.2)
Cash register	178 (15.7)	149 (14.8)
Catering	87 (7.7)	83 (8.2)
Fittings	100 (8.8)	90 (8.9)
Recovery	38 (3.3)	35 (3.5)
Maintenance	32 (2.8)	29 (2.9)
Administration	147 (12.9)	138 (13.7)
Seniority, year		
Company	7.0 [2.0; 12.0]	7.2 [2.1; 12.0]
Job	3.5 [1.3; 10.0]	3.5 [1.3; 10.0]
Consecutive days of rest (yes)	533/1,136 (46.9)	474 (47.0)
Repetitive gestures (yes)	862/1,133 (76.1)	761 (75.5)
Location of repetitive gestures		
Back	638/862 (74.0)	561/761 (73.7)
Arms/shoulders raised	561/862 (65.1)	495/761 (65.0)
Wrists	508/862 (58.9)	450/761 (59.1)
Neck	419/862 (48.6)	368/761 (48.4)
Type of repetitive gestures		
Moving heavy loads	601/862 (69.7)	539/761 (70.8)
Extended work on screen	503/862 (58.4)	448/761 (58.9)
Static standing position	428/862 (49.7)	368/761 (48.4)
Static sitting position	264/862 (30.6)	235/761 (30.9)
Vibrations	167/862 (19.4)	146/761 (19.2)
Stress, score/10		
Work	4.9 ± 2.5	4.8 ± 2.5
≥ 5/10	659/1,132 (58.2)	581/1,007 (57.7)
Home	2.9 ± 2.1	2.9 ± 2.1
≥ 5/10	246/1,132 (21.7)	223 (22.1)
Quality of life, score/100		
SF12 physical score	50.4 ± 9.1	50.6 ± 8.9
SF12 mental score	43.8 ± 9.9	43.9 ± 10.0
HAD anxiety		
No symptoms (score < 7)	531/1,011 (52.5)	507/960 (52.8)
Borderline (score ≥ 7 to < 11)	321/1,011 (31.8)	303/960 (31.6)
Clinical caseness (score ≥ 11)	159/1,011 (15.7)	150/960 (15.6)
HAD depression		
No symptoms (score < 7)	773/1,011 (76.5)	735/960 (76.6)
Borderline (score ≥ 7 to < 11)	174/1,011 (17.2)	163/960 (17.0)
Clinical caseness (score ≥ 11)	64/1,011 (6.3)	62/960 (6.4)
Catastrophism, score/52		
PCS total score	11 [5; 22]	11 [5; 22]
PCS score ≥ 30	130/980 (13.3)	123/947 (13.0)

	Chronic pain*	p	Moderate to severe chronic pain**	p	High impact chronic pain***	p
All participants	497/1,008 (49.3)	NA	303/1,008 (30.1)	NA	115/1,008 (11.4)	NA
Age of participants						
18 to 29 years	105/269 (39.0)	REF	59/269 (21.9)	REF	25/269 (9.3)	REF
30 to 39 years	159/373 (42.6)	0.41	93/373 (24.9)	0.44	25/373 (6.7)	0.19
40 to 49 years	152/249 (61.0)	<0.001	98/249 (39.4)	<0.001	44/249 (17.7)	0.012
≥ 50 years	81/117 (69.2)	<0.001	53/117 (45.3)	<0.001	21/117 (17.9)	0.022
Gender						
Female	298/560 (53.2)	REF	195/560 (34.8)	REF	69/560 (12.3)	REF
Male	199/448 (44.4)	0.012	108/448 (24.1)	<0.001	46/448 (10.3)	0.34
Body mass index						
≤ 25 kg/m ²	296/638 (46.4)	REF	172/638 (27.0)	REF	50/638 (7.8)	REF
25 to 30 kg/m ²	124/247 (50.2)	0.52	82/247 (33.2)	0.23	41/247 (16.6)	0.001
> 30 kg/m ²	75/120 (62.5)	0.008	48/120 (40.0)	0.032	23/120 (19.2)	0.001
Physical activity						
No	238/455 (52.3)	REF	146/455 (32.1)	REF	57/455 (12.5)	REF
Yes	259/553 (46.8)	0.20	157/553 (28.4)	0.50	58/553 (10.5)	0.38
Job						
Logistics	87/159 (54.7)	REF	51/159 (32.1)	REF	28/159 (17.6)	REF
Sales	148/325 (45.5)	0.18	93/325 (28.6)	0.66	30/325 (9.2)	0.027
Cash register	78/149 (52.4)	0.31	57/149 (38.3)	0.85	18/149 (12.1)	0.094
Catering	46/83 (55.4)	0.98	32/83 (38.6)	0.41	12/83 (14.5)	0.53
Fittings	49/90 (54.4)	0.87	25/90 (27.8)	0.36	12/90 (13.3)	0.43
Recovery	19/35 (54.3)	0.99	11/35 (31.4)	0.98	1/35 (2.9)	0.049
Maintenance	11/29 (37.9)	0.17	5/29 (17.2)	0.22	5/29 (17.2)	0.94
Administration	59/138 (42.8)	0.006	29/138 (21.0)	0.005	9/138 (6.5)	0.002
Consecutive days of rest						
No	283/534 (53.0)	REF	186/534 (34.8)	REF	74/534 (13.9)	REF
Yes	214/474 (45.1)	0.085	117/474 (24.7)	0.001	41/474 (8.6)	0.019
Repetitive gestures						
No	74/247 (30.0)	REF	30/247 (12.1)	REF	7/247 (2.8)	REF
Yes	423/761 (55.6)	<0.001	273/761 (35.9)	<0.001	108/761 (14.2)	<0.001
Location of repetitive gestures						
Back						
No	93/200 (46.5)	REF	50/200 (25.0)	REF	16/200 (8.0)	REF
Yes	330/561 (58.8)	0.001	223/561 (39.8)	<0.001	92/561 (16.4)	0.003
Arms/shoulders raised						
No	130/266 (48.9)	REF	82/266 (30.8)	REF	25/266 (9.4)	REF
Yes	293/495 (59.2)	0.004	191/495 (38.6)	0.012	83/495 (16.8)	0.005
Wrists						
No	146/311 (46.9)	REF	86/311 (27.7)	REF	25/311 (8.0)	REF
Yes	277/450 (61.6)	<0.001	187/450 (41.6)	<0.001	83/450 (18.4)	<0.001
Neck						
No	172/393 (43.8)	REF	103/393 (26.2)	REF	25/393 (6.4)	REF
Yes	251/368 (68.2)	<0.001	170/368 (46.2)	<0.001	83/368 (22.6)	<0.001
Type of repetitive gestures						
Moving heavy loads						
No	120/222 (54.1)	REF	70/222 (31.5)	REF	18/222 (8.1)	REF
Yes	303/539 (56.2)	0.16	203/539 (37.7)	0.013	90/539 (16.7)	0.001
Extended work on screen						
No	174/313 (55.6)	REF	119/313 (38.0)	REF	47/313 (15.0)	REF
Yes	249/448 (55.6)	0.83	154/448 (34.4)	0.23	61/448 (13.6)	0.58
Static standing position						
No	207/393 (52.7)	REF	126/393 (32.1)	REF	50/393 (12.7)	REF
Yes	216/368 (58.7)	0.20	147/368 (39.9)	0.075	58/368 (15.8)	0.25
Static sitting position						
No	288/526 (54.8)	REF	189/526 (35.9)	REF	72/526 (13.7)	REF
Yes	135/235 (57.4)	0.62	84/235 (35.7)	0.93	36/235 (15.3)	0.59
Vibrations						
No	328/615 (53.3)	REF	212/615 (34.5)	REF	73/615 (11.9)	REF
Yes	95/146 (65.1)	0.001	61/146 (41.8)	0.004	35/146 (24.0)	<0.001
Stress at work						
< 5/10	156/426 (36.6)	REF	64/426 (15.0)	REF	12/426 (2.8)	REF
≥ 5/10	341/581 (58.7)	<0.001	239/581 (41.1)	<0.001	103/581 (17.7)	<0.001
Stress at home						
< 5/10	379/785 (48.3)	REF	216/785 (27.5)	REF	77/785 (9.8)	REF
≥ 5/10	118/223 (52.9)	<0.001	87/223 (39.0)	0.002	38/223 (17.0)	0.002

	Chronic pain*	p	Moderate to severe chronic pain**	p	High impact chronic pain***	p
HAD anxiety						
No symptoms (score < 7)	226/507 (44.6)	REF	112/507 (22.1)	REF	29/507 (5.7)	REF
Borderline (score ≥7 to < 11)	168/303 (55.4)	0.015	107/303 (35.3)	<0.001	36/303 (11.9)	0.003
Clinical caseness (score ≥ 11)	103/150 (68.7)	<0.001	84/150 (56.0)	<0.001	50/150 (33.3)	<0.001
HAD depression						
No symptoms (score < 7)	335/735 (45.6)	REF	181/735 (24.6)	REF	44/735 (6.0)	REF
Borderline (score ≥7 to < 11)	115/163 (70.6)	<0.001	85/163 (52.1)	<0.001	41/163 (25.2)	<0.001
Clinical caseness (score ≥ 11)	47/62 (75.8)	<0.001	37/62 (59.7)	<0.001	30/62 (48.4)	<0.001
PCS score						
< 30	407/824 (49.4)	REF	223/824 (27.1)	REF	60/824 (7.3)	REF
≥ 30	90/123 (73.2)	<0.001	80/123 (65.0)	<0.001	55/123 (44.7)	<0.001

	Mild chronic pain* n=194	Moderate/severe chronic pain** n=303	p	No High impact chronic pain n=382	High impact chronic pain*** n=115	p
Type of pain						
Nociceptive	132/314 (42.0)	182/314 (58.0)	REF	255/314 (81.2)	59/314 (18.8)	REF
Neuropathic	6/18 (33.3)	12/18 (66.7)	0.38	14/18 (77.8)	4/18 (22.2)	0.75
Mixed	21/87 (24.1)	66/87 (75.9)	0.005	54/87 (62.1)	33/87 (37.9)	0.001
Nociplastic	7/23 (30.4)	16/23 (69.6)	0.41	15/23 (65.2)	8/23 (34.8)	0.056
Undetermined	28/55 (50.9)	27/55 (49.1)	0.32	44/55 (80.0)	11/55 (20.0)	0.71
Cause of pain						
Undetermined						
No	184/475 (38.7)	291/475 (61.3)	REF	363/475 (76.4)	112/475 (23.6)	REF
Yes	10/22 (45.5)	12/22 (54.5)	0.37	19/22 (86.4)	3/22 (13.6)	0.36
Professional						
No	47/84 (56.0)	37/84 (44.0)	REF	74/84 (88.1)	10/84 (11.9)	REF
Yes	137/391 (35.0)	254/391 (65.0)	0.002	289/391 (73.9)	102/391 (26.1)	0.008
Sport						
No	155/425 (36.5)	270/425 (63.5)	REF	320/425 (75.3)	105/425 (24.7)	REF
Yes	29/50 (58.0)	21/50 (42.0)	0.019	43/50 (86.0)	7/50 (14.0)	0.16
Medical						
No	147/403 (36.5)	256/403 (63.5)	REF	302/403 (74.9)	101/403 (25.1)	REF
Yes	37/72 (51.4)	35/72 (48.6)	0.024	61/72 (84.7)	11/72 (15.3)	0.088
Personal						
No	165/437 (37.8)	272/437 (62.2)	REF	332/437 (76.0)	105/437 (24.0)	REF
Yes	19/38 (50.0)	19/38 (50.0)	0.16	31/38 (81.6)	7/38 (18.4)	0.43
Pain aggravated by work						
No	65/136 (47.8)	71/136 (52.2)	REF	118/136 (86.8)	18/136 (13.2)	REF
Yes	129/361 (35.7)	232/361 (64.3)	0.015	264/361 (73.1)	97/361 (26.9)	0.001
Pain affecting the QoPL						
No	104/193 (53.9)	89/193 (46.1)	REF	177/193 (91.7)	16/193 (8.3)	REF
Yes	90/304 (29.6)	214/304 (70.4)	<0.001	205/304 (67.4)	99/304 (32.6)	<0.001
BPI pain location						
Dorsolumbar rachis						
No	64/110 (58.2)	46/110 (41.8)	REF	99/110 (90.0)	11/110 (10.0)	REF
Yes	130/387 (33.6)	257/387 (66.4)	<0.001	283/387 (73.1)	104/387 (26.9)	<0.001
Shoulders						
No	126/296 (42.6)	170/296 (57.4)	REF	239/296 (80.7)	57/296 (19.3)	REF
Yes	68/201 (33.8)	133/201 (66.2)	0.16	143/201 (71.1)	58/201 (28.9)	0.034
Neck						
No	121/257 (47.1)	136/257 (52.9)	REF	216/257 (84.0)	41/257 (16.0)	REF
Yes	73/240 (30.4)	167/240 (69.6)	0.001	166/240 (69.2)	74/240 (30.8)	<0.001
Knees						
No	142/350 (40.6)	208/350 (59.4)	REF	284/350 (81.1)	66/350 (18.9)	REF
Yes	52/147 (35.4)	95/147 (64.6)	0.23	98/147 (66.7)	49/147 (33.3)	0.001
Arms/forearm						
No	149/386 (38.6)	237/386 (61.4)	REF	301/386 (78.0)	85/386 (22.0)	REF
Yes	45/111 (40.5)	66/111 (59.5)	0.45	81/111 (73.0)	30/111 (27.0)	0.56
Wrists						
No	157/359 (43.7)	202/359 (56.3)	REF	292/359 (81.3)	67/359 (18.7)	REF
Yes	37/138 (26.8)	101/138 (73.2)	0.002	90/138 (65.2)	48/138 (34.8)	<0.001
Hands						
No	153/368 (41.6)	215/368 (58.4)	REF	296/368 (80.4)	72/368 (19.6)	REF
Yes	41/129 (31.8)	88/129 (68.2)	0.13	86/129 (66.7)	43/129 (33.3)	0.005
Head						
No	155/391 (39.6)	236/391 (60.4)	REF	307/391 (78.5)	84/391 (21.5)	REF
Yes	39/106 (36.8)	67/106 (63.2)	0.84	75/106 (70.8)	31/106 (29.2)	0.11
Feet						
No	160/370 (43.2)	210/370 (56.8)	REF	305/370 (82.4)	65/370 (17.6)	REF
Yes	34/127 (26.8)	93/127 (73.2)	0.004	77/127 (60.6)	50/127 (39.4)	<0.001

	Mild chronic pain* n=194	Moderate/severe chronic pain** n=303	p	No High impact chronic pain n=382	High impact chronic pain*** n=115	p
Thighs/calves						
No	173/421 (41.1)	248/421 (58.9)	REF	338/421 (80.3)	83/421 (19.7)	REF
Yes	21/76 (27.6)	55/76 (72.4)	0.054	44/76 (57.9)	32/76 (42.1)	<0.001
Hips						
No	176/425 (41.4)	249/425 (58.6)	REF	343/425 (80.7)	82/425 (19.3)	REF
Yes	18/72 (25.0)	54/72 (75.0)	0.021	39/72 (54.2)	33/72 (45.8)	<0.001
Ankles						
No	181/433 (41.8)	252/433 (58.2)	REF	345/433 (79.7)	88/433 (20.3)	REF
Yes	13/64 (20.3)	51/64 (79.7)	0.003	37/64 (57.8)	27/64 (42.2)	0.001
Trunk						
No	182/449 (40.5)	267/449 (59.5)	REF	356/449 (79.3)	93/449 (20.7)	REF
Yes	12/48 (25.0)	36/48 (75.0)	0.029	26/48 (54.2)	22/48 (45.8)	<0.001
Face						
No	190/478 (39.7)	288/478 (60.3)	REF	369/478 (77.2)	109/478 (23.8)	REF
Yes	4/19 (21.1)	15/19 (78.9)	0.10	13/19 (68.4)	6/19 (31.6)	0.32
Number of pain sites						
< 2	54/97 (55.7)	43/97 (44.3)	REF	86/97 (88.7)	11/97 (11.3)	REF
≥ 2	140/300 (35.0)	260/300 (65.0)	0.001	296/300 (74.0)	104/300 (26.0)	0.004
BPI pain severity score	1.7 [1.0; 2.7]	5.0 [3.9; 5.9]	<0.001	3.0 [1.6; 4.4]	6.0 [5.2; 6.6]	<0.001
BPI pain interference	1.0 [0.3; 1.9]	3.9 [1.9; 5.7]	<0.001	1.5 [0.6; 3.1]	6.3 [5.5; 7.2]	<0.001
FABQ physical score	10 [5; 15]	12 [8; 16]	0.002	11 [6; 15]	14 [9; 18]	<0.001
FABQ work score	12 [6; 18]	20 [9; 28]	<0.001	14 [7; 22]	24 [16; 31]	<0.001
TSK score						
< 37	105/210 (50.0)	105/210 (50.0)	REF	183/210 (87.1)	27/210 (12.9)	REF
≥ 37	75/247 (30.4)	172/247 (69.6)	<0.001	164/247 (66.4)	83/247 (33.6)	<0.001