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

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1 **TITLE PAGE**

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

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12

13 Running title: Prevalence of chronic pain disorders in workers

14

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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:  $\geq 40$  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<sup>14,33</sup>. 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 life<sup>17</sup>. According to The International Association for the  
57 Study of Pain (IASP) terminology<sup>44</sup>, 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<sup>6,7,10,28,29</sup>. Few studies have  
64 specifically assessed the prevalence of chronic pain disorders in a working population, but  
65 include a Japanese study (42.7%)<sup>41</sup>, an Irish study (36.4%)<sup>32</sup>, and a Portuguese study  
66 (32.2%)<sup>2</sup>. 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 study<sup>25</sup> and  
68 44.6 to 46.1% for a European one<sup>15</sup>. 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 disability<sup>20</sup>, is estimated  
75 to be the leading cause of absence from work<sup>12</sup>. 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 pain<sup>7</sup>.  
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<sup>8,19,45</sup>. 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<sup>26,36</sup>), 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<sup>22,23</sup> 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]<sup>43</sup>);  
150 Pain catastrophism ( Pain Catastrophism Scale [PCS], catastrophism is proven for scores  
151  $\geq 30$ <sup>38</sup>).

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]<sup>11</sup>); Neuropathic pain  
155 screening (“*Douleur Neuropathique 4*” [DN4]<sup>5</sup>), Quality of life (Short-Form 12 questionnaire  
156 [SF-12]<sup>18</sup>); Fears and beliefs about pain (Tampa Scale of Kinesiophobia [TSK, kinesiophobia  
157 is proven for scores  $\geq 37$ ]<sup>30</sup> and Fear-avoidance beliefs questionnaire [FABQ]<sup>40</sup>). 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 ( $\geq 3$  months and all intensities) and  
161 “high-impact chronic pain” (moderate to severe chronic pain associated with pain interference  
162 BPI score  $\geq 5/10$ )<sup>39</sup> 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%<sup>25</sup>,  
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 error<sup>16</sup>. 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 ( $\geq 3$   
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)<sup>31</sup> 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 variables<sup>35</sup>. 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  $\geq 40$  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  $\leq 25$  kg/m<sup>2</sup>. 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/m<sup>2</sup>, 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  $\geq 40$  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 2016<sup>46</sup>); 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%)<sup>3</sup>, physical inactivity rates  
336 (45.1% vs 32.5%)<sup>21</sup>, anxio-depressive disorders (6.4% vs 5.9%)<sup>27</sup> and quality of life (physical  
337 SF12 score = 50.6 vs 51.2; mental SF12 score = 43.9 vs 48.4)<sup>18</sup>. 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%)<sup>8,10</sup> 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 Prevention<sup>9</sup> 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%)<sup>41</sup>, an Irish study (36.4%)<sup>32</sup>, a  
351 Portuguese study (32.2%)<sup>2</sup>, and a French study (31.9%, only MSD related pain studied)<sup>25</sup>.  
352 Finally, a European study reported 44.6 to 46.1% of European workers with MSD-related  
353 pain<sup>15</sup>. Concerning the prevalence of “high impact chronic pain”, as described previously by  
354 von Korff et al. 2016<sup>39</sup>, 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<sup>2,10,15</sup>), 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<sup>4,34,37</sup>. 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 population<sup>20</sup>. 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%)<sup>10,13,24</sup>. 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<sup>8,15,32</sup> and the localization of pain, mainly in the back<sup>2,15,32</sup> and  
372 upper body<sup>15,32</sup>. 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<sup>2,15,32</sup>, female gender<sup>2,8,10,15</sup>, age<sup>2,8,10,15,25,32</sup>, anxio-depressive states<sup>2,32,41</sup>, and  
389 overweight/obesity<sup>8,25,41</sup>, 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 designs<sup>1</sup>. Nevertheless, self-reporting  
409 provides a wider range of responses than many other data collection tools<sup>42</sup>. 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?

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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.

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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 ( $\geq 3$   
595 months); \*\* “moderate to severe chronic pain” group corresponds to participants with chronic  
596 pain ( $\geq 3$  months) of intensity  $\geq 4/10$ , including patients with high chronic pain; \*\*\* “high  
597 impact chronic pain” group corresponds to participants with chronic pain ( $\geq 3$  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.

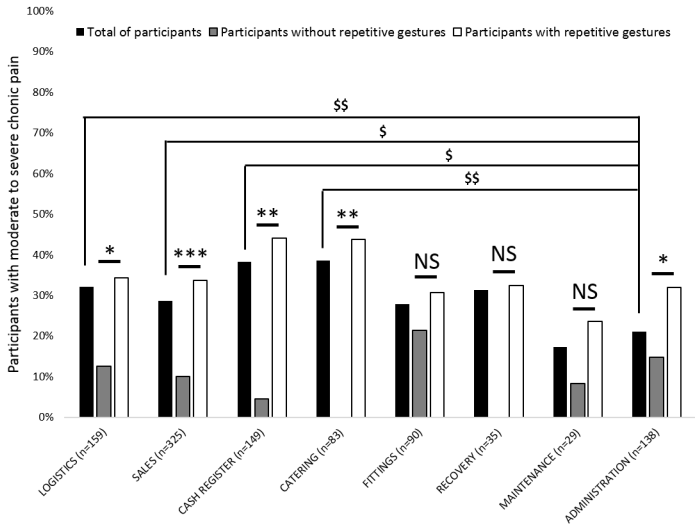
601

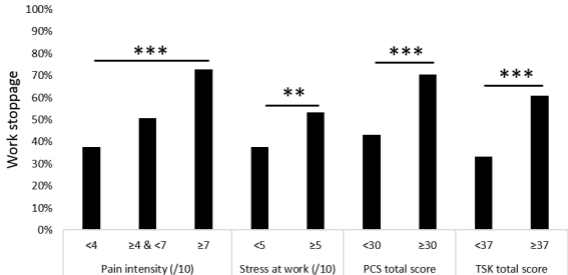
602 **Table 3. Characteristics of chronic pain disorders.**

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 ( $\geq 3$  months) of intensity  $\geq 4/10$ ; \*\*\* “high impact chronic  
609 pain” group corresponds to participants with chronic pain ( $\geq 3$  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





	<b>All participants</b> (n=1,137)	<b>Analyzable participants*</b> (n=1,008)
<b>Age, year</b>	36.6 ± 9.8	36.4 ± 9.7
<b>Female gender</b>	639 (56.2)	560 (55.6)
<b>Body mass index, kg/m<sup>2</sup></b>	24.5 ± 4.7	24.6 ± 4.8
<b>Body mass index</b>		
≤ 25 kg/m <sup>2</sup>	726/1,133 (64.1)	638/1,005 (63.5)
25 to 30 kg/m <sup>2</sup>	281/1,133 (24.8)	247/1,005 (24.6)
> 30 kg/m <sup>2</sup>	126/1,133 (11.1)	120/1,005 (11.9)
<b>Physical activity (yes)</b>	620 (54.5)	553 (54.9)
<b>Duration per week of physical activity</b>		
≤ 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)
<b>Job</b>		
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)
<b>Seniority, year</b>		
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]
<b>Consecutive days of rest (yes)</b>	533/1,136 (46.9)	474 (47.0)
<b>Repetitive gestures (yes)</b>	862/1,133 (76.1)	761 (75.5)
<b>Location of repetitive gestures</b>		
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)
<b>Type of repetitive gestures</b>		
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)
<b>Stress, score/10</b>		
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)
<b>Quality of life, score/100</b>		
SF12 physical score	50.4 ± 9.1	50.6 ± 8.9
SF12 mental score	43.8 ± 9.9	43.9 ± 10.0
<b>HAD anxiety</b>		
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)
<b>HAD depression</b>		
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)
<b>Catastrophism, score/52</b>		
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
<b>All participants</b>	497/1,008 (49.3)	NA	303/1,008 (30.1)	NA	115/1,008 (11.4)	NA
<b>Age of participants</b>						
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)	<b>&lt;0.001</b>	98/249 (39.4)	<b>&lt;0.001</b>	44/249 (17.7)	<b>0.012</b>
≥ 50 years	81/117 (69.2)	<b>&lt;0.001</b>	53/117 (45.3)	<b>&lt;0.001</b>	21/117 (17.9)	<b>0.022</b>
<b>Gender</b>						
Female	298/560 (53.2)	REF	195/560 (34.8)	REF	69/560 (12.3)	REF
Male	199/448 (44.4)	<b>0.012</b>	108/448 (24.1)	<b>&lt;0.001</b>	46/448 (10.3)	0.34
<b>Body mass index</b>						
≤ 25 kg/m <sup>2</sup>	296/638 (46.4)	REF	172/638 (27.0)	REF	50/638 (7.8)	REF
25 to 30 kg/m <sup>2</sup>	124/247 (50.2)	0.52	82/247 (33.2)	0.23	41/247 (16.6)	<b>0.001</b>
> 30 kg/m <sup>2</sup>	75/120 (62.5)	<b>0.008</b>	48/120 (40.0)	<b>0.032</b>	23/120 (19.2)	<b>0.001</b>
<b>Physical activity</b>						
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
<b>Job</b>						
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)	<b>0.027</b>
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)	<b>0.049</b>
Maintenance	11/29 (37.9)	0.17	5/29 (17.2)	0.22	5/29 (17.2)	0.94
Administration	59/138 (42.8)	<b>0.006</b>	29/138 (21.0)	<b>0.005</b>	9/138 (6.5)	<b>0.002</b>
<b>Consecutive days of rest</b>						
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)	<b>0.001</b>	41/474 (8.6)	<b>0.019</b>
<b>Repetitive gestures</b>						
No	74/247 (30.0)	REF	30/247 (12.1)	REF	7/247 (2.8)	REF
Yes	423/761 (55.6)	<b>&lt;0.001</b>	273/761 (35.9)	<b>&lt;0.001</b>	108/761 (14.2)	<b>&lt;0.001</b>
<b>Location of repetitive gestures</b>						
Back						
No	93/200 (46.5)	REF	50/200 (25.0)	REF	16/200 (8.0)	REF
Yes	330/561 (58.8)	<b>0.001</b>	223/561 (39.8)	<b>&lt;0.001</b>	92/561 (16.4)	<b>0.003</b>
Arms/shoulders raised						
No	130/266 (48.9)	REF	82/266 (30.8)	REF	25/266 (9.4)	REF
Yes	293/495 (59.2)	<b>0.004</b>	191/495 (38.6)	<b>0.012</b>	83/495 (16.8)	<b>0.005</b>
Wrists						
No	146/311 (46.9)	REF	86/311 (27.7)	REF	25/311 (8.0)	REF
Yes	277/450 (61.6)	<b>&lt;0.001</b>	187/450 (41.6)	<b>&lt;0.001</b>	83/450 (18.4)	<b>&lt;0.001</b>
Neck						
No	172/393 (43.8)	REF	103/393 (26.2)	REF	25/393 (6.4)	REF
Yes	251/368 (68.2)	<b>&lt;0.001</b>	170/368 (46.2)	<b>&lt;0.001</b>	83/368 (22.6)	<b>&lt;0.001</b>
<b>Type of repetitive gestures</b>						
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)	<b>0.013</b>	90/539 (16.7)	<b>0.001</b>
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)	<b>0.001</b>	61/146 (41.8)	<b>0.004</b>	35/146 (24.0)	<b>&lt;0.001</b>
<b>Stress at work</b>						
< 5/10	156/426 (36.6)	REF	64/426 (15.0)	REF	12/426 (2.8)	REF
≥ 5/10	341/581 (58.7)	<b>&lt;0.001</b>	239/581 (41.1)	<b>&lt;0.001</b>	103/581 (17.7)	<b>&lt;0.001</b>
<b>Stress at home</b>						
< 5/10	379/785 (48.3)	REF	216/785 (27.5)	REF	77/785 (9.8)	REF
≥ 5/10	118/223 (52.9)	<b>&lt;0.001</b>	87/223 (39.0)	<b>0.002</b>	38/223 (17.0)	<b>0.002</b>

	<b>Chronic pain*</b>	<b>p</b>	<b>Moderate to severe chronic pain**</b>	<b>p</b>	<b>High impact chronic pain***</b>	<b>p</b>
<b>HAD anxiety</b>						
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)	<b>0.015</b>	107/303 (35.3)	<b>&lt;0.001</b>	36/303 (11.9)	<b>0.003</b>
Clinical caseness (score ≥ 11)	103/150 (68.7)	<b>&lt;0.001</b>	84/150 (56.0)	<b>&lt;0.001</b>	50/150 (33.3)	<b>&lt;0.001</b>
<b>HAD depression</b>						
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)	<b>&lt;0.001</b>	85/163 (52.1)	<b>&lt;0.001</b>	41/163 (25.2)	<b>&lt;0.001</b>
Clinical caseness (score ≥ 11)	47/62 (75.8)	<b>&lt;0.001</b>	37/62 (59.7)	<b>&lt;0.001</b>	30/62 (48.4)	<b>&lt;0.001</b>
<b>PCS score</b>						
< 30	407/824 (49.4)	REF	223/824 (27.1)	REF	60/824 (7.3)	REF
≥ 30	90/123 (73.2)	<b>&lt;0.001</b>	80/123 (65.0)	<b>&lt;0.001</b>	55/123 (44.7)	<b>&lt;0.001</b>

	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
<b>Type of pain</b>						
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)	<b>0.005</b>	54/87 (62.1)	33/87 (37.9)	<b>0.001</b>
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
<b>Cause of pain</b>						
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)	<b>0.002</b>	289/391 (73.9)	102/391 (26.1)	<b>0.008</b>
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)	<b>0.019</b>	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)	<b>0.024</b>	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
<b>Pain aggravated by work</b>						
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)	<b>0.015</b>	264/361 (73.1)	97/361 (26.9)	<b>0.001</b>
<b>Pain affecting the QoPL</b>						
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)	<b>&lt;0.001</b>	205/304 (67.4)	99/304 (32.6)	<b>&lt;0.001</b>
<b>BPI pain location</b>						
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)	<b>&lt;0.001</b>	283/387 (73.1)	104/387 (26.9)	<b>&lt;0.001</b>
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)	<b>0.034</b>
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)	<b>0.001</b>	166/240 (69.2)	74/240 (30.8)	<b>&lt;0.001</b>
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)	<b>0.001</b>
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)	<b>0.002</b>	90/138 (65.2)	48/138 (34.8)	<b>&lt;0.001</b>
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)	<b>0.005</b>
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)	<b>0.004</b>	77/127 (60.6)	50/127 (39.4)	<b>&lt;0.001</b>

	<b>Mild chronic pain*</b> n=194	<b>Moderate/severe chronic pain**</b> n=303	<b>p</b>	<b>No High impact chronic pain</b> n=382	<b>High impact chronic pain***</b> n=115	<b>p</b>
<b>Thighs/calves</b>						
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)	<b>&lt;0.001</b>
<b>Hips</b>						
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)	<b>0.021</b>	39/72 (54.2)	33/72 (45.8)	<b>&lt;0.001</b>
<b>Ankles</b>						
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)	<b>0.003</b>	37/64 (57.8)	27/64 (42.2)	<b>0.001</b>
<b>Trunk</b>						
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)	<b>0.029</b>	26/48 (54.2)	22/48 (45.8)	<b>&lt;0.001</b>
<b>Face</b>						
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
<b>Number of pain sites</b>						
< 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)	<b>0.001</b>	296/300 (74.0)	104/300 (26.0)	<b>0.004</b>
<b>BPI pain severity score</b>	1.7 [1.0; 2.7]	5.0 [3.9; 5.9]	<b>&lt;0.001</b>	3.0 [1.6; 4.4]	6.0 [5.2; 6.6]	<b>&lt;0.001</b>
<b>BPI pain interference</b>	1.0 [0.3; 1.9]	3.9 [1.9; 5.7]	<b>&lt;0.001</b>	1.5 [0.6; 3.1]	6.3 [5.5; 7.2]	<b>&lt;0.001</b>
<b>FABQ physical score</b>	10 [5; 15]	12 [8; 16]	<b>0.002</b>	11 [6; 15]	14 [9; 18]	<b>&lt;0.001</b>
<b>FABQ work score</b>	12 [6; 18]	20 [9; 28]	<b>&lt;0.001</b>	14 [7; 22]	24 [16; 31]	<b>&lt;0.001</b>
<b>TSK score</b>						
< 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)	<b>&lt;0.001</b>	164/247 (66.4)	83/247 (33.6)	<b>&lt;0.001</b>