BMJ Open

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Journal:	*BMJ Open*
Manuscript ID	bmjopen-2017-020913
Article Type:	Research
Date Submitted by the Author:	03-Dec-2017
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Primary Subject Heading:	Epidemiology
Secondary Subject Heading:	Epidemiology, Public health
Keywords:	Chronic pain, Disability, Multimorbidity, Activity restriction, cross-sectional study, Quality of life

TITLE

Living with disabling chronic pain: results from a face-to-face cross-sectional population-based study.

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The number of words in the manuscript is 3427.

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TITLE

Living with disabling chronic pain: results from a face-to-face cross-sectional population-based study**.**

ABSTRACT

Objectives: To estimate the prevalence of disabling chronic pain in Spanish adults, to analyze its characteristics, to determine its multimorbidity, and to identify its associated factors.

Settings: 2011 Andalusian Health Survey, a cross-sectional population survey based on face-to-face home interviews.

Participants: 6,507 people aged 16 or older and living in Andalusia, Spain.

Outcomes: The response variable was disabling chronic pain. Multivariate multinomial logistic regression models were used to analyze the association of factors with disabling chronic pain. The sample design was considered throughout the statistical analysis.

Results: The prevalence of disabling chronic pain in the Spanish adult population was 11.36%, while that of non-disabling chronic pain was 5.67%. Disabling chronic pain was associated with high multimorbidity (especially in women [51%] and in the elderly [70%] with three or more additional chronic diseases), as well as with disadvantaged social status (such as female gender, advanced age, unemployment, manual work, low income and reduced emotional social support). Other influential factors are worse health habits (tobacco/alcohol consumption, inadequate sleep), environmental or work conditions, and quality of life.

Conclusions: The population with disabling chronic pain was associated with multimorbidity, vulnerable social status and an impaired quality of life. In contrast, the population with non-disabling chronic pain showed almost no differences when compared with the population without chronic pain.

Keywords: Chronic pain, Disability, Multimorbidity, Activity restriction, Cross-sectional study, Quality of life.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This study provides an comprehensive epidemiological approach to disabling chronic pain.
- It includes information on chronic pain and disability which is not available in other important population health surveys, such as the European Health Interview Survey.
- It is based on a large-scale cross-sectional population-based survey which is a reliable source of information. In addition, special efforts were made to avoid sampling biases.
- However, it does not include muscle and joint pain in the lower and upper extremities (except the shoulder) nor various traumatological, postsurgical, or neuropathic conditions.
- It would have been preferable to construct the chronic pain variable from one simple overall question rather than from other chronic disease variables.

INTRODUCTION

Estimations of the prevalence of chronic pain (CP) have varied widely among studies [1-4]. It has been estimated to range between 12 and 42% worldwide (in people over 18 years old), between 12 and 30% in Europe [5] and between 19 and 30.7% in the USA [2,4]. It was reported to be 35% in Canada [1], 18.5% in Australia [6], 17.5% in Japan [7], 35% in Hong Kong [8], 42% in Sao Paulo [9], between 12 and 17.25% in Spain [3,5,10].

Most population health surveys on CP have considered it as a symptom of different chronic diseases, while others have considered CP as an independent entity and have associated it with various comorbidities [11,12]. These studies, on the basis of allostatic load models [13], found that the capacity of individuals to adapt to stress factors can be impaired by the presence of CP and two or more comorbidities, thus increasing health risks.

The impact of CP is greater when it limits activities of daily living (ADL)[2,3,5,14-16]. The World Health Organization (WHO) includes disability-related ADL limitations within the "International Classification of Functioning, Disability, and Health" (ICF Model)[17]. This biopsychosocial model considers disability as a state of impaired functioning associated with disease, disorder, lesion, or other health conditions, when it is experienced as a deficiency, a limitation on activity, or a restriction to participation in any area of life. There have been numerous studies on disability in different diseases, but few on its relationship with CP. These studies found a higher frequency of ADL-limiting CP or disabling CP (DCP) in women and in individuals with a lower socioeconomic level, health-related unemployment, elevated depression indicators [14-16], and a higher number of visits to their physician [18]. However, questions remain regarding the differences between DCP and non-disabling CP (nDCP) and their effects.

With this background, the objectives of this study were to calculate the prevalence of DCP in Spanish adults through key sociodemographic characteristics, to determine its multimorbidity, and to identify associated factors.

MATERIAL AND METHODS

Design

The *Andalusian Health Survey (EAS, Spanish acronym)* [19], the information source, is a population-based and cross-sectional survey that uses face-to-face home interviews. It is designed to evaluate the health of non-institutionalized adults (≥16 yrs) and their usage of health services in Andalusia, Spain.

A multistage stratified sample design was adopted for our research. The sampling units were municipalities, census tracts, households, and individuals. The strata were province (8), size of municipality (5) and season of the year (4). Municipalities and census tracts were selected in proportion to the population size, while households were selected with equal probability by systematic sampling. The interviewees applied quotas for each province as well as quotas for sex-age and the size of municipality within each province. A virtually constant assignation was performed per census tract (7-10 adults), and one adult per household was selected for interview. The information was collected between March of 2011 and February of 2012. (For further details please refer to the health survey report) [19].

Ethical approval

The EAS was supervised and approved by the review board of the General Secretariat of Quality and Public Health in the Health Ministry of the Andalusian Regional Government.

Sample and data collection

112 municipalities and 696 census tracts were selected, and 6,507 valid personal face-to-face interviews were conducted at home (p=q=0.5; confidence level = 95%; precision=0.0149; design effect =1.525), with a response rate of 67.9%.

The effects of non-coverage were minimized by selecting the study population within a sampling framework based on census districts and households. To minimize nonresponse, the interviews were held 7 days per week between 10:00 and 21:00, and interviewers were trained in both field work and in the study's methodology. In

addition, the survey administration was supervised and followed up, and non-responders were replaced with people of the same sex and age in a randomized manner from the same district. Moreover, we also took measures to minimize information/observation/measurement biases by providing adequate training for interviewers (see above), and by following interviews up either in-person or with telephone calls (43.1%). The questionnaire was designed with filters and controls to facilitate verification of its correct completion (100% of questionnaires were reviewed), and the sampling design was considered in the data analyses.

Variables

The study variable was DCP. This is composed of disability (WHO, 2006) and CP [20-21]. The disability definition encompasses impairments, activity limitations and participation restrictions. The question about impairments (problems in body function/structure) was whether a doctor or a nurse had told the interviewees that they suffered from any of a wide list of chronic diseases (Table 1). It was asked during home-based face-to-face interviews. Activity limitation and participation restrictions were constructed as population who declared that they were limited in their activity when asked about each of the chronic diseases listed. Finally, CP was established according to those individuals who reported a chronic disease that included the word 'pain', namely: migraine/headache/chronic cephalalgia /frequent headache'; 'angina/chest pain'; 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain'; or 'menstrual pain'. The independent variables are also listed in Table 1.

Table 1. Study variables

Disabling Chronic Pain (DCP, dependent variable): Population with CP who declared being limited in their activity by any of the above-reported chronic pains. The non-disabling CP and non-CP population was also defined with this variable
Chronic Pain (CP): individuals who declared that a doctor or a nurse had told them that they suffered from one or more of the following Chronic Diseases in the survey that included the word 'pain': 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.
Demographic and economic characteristics: Sex and age (age groups: 16-44 years; 45-64; + 65), marital status, cohabitation, living alone at home, social class (Dapcich et al., 2004) educational level, employment status, economic difficulty to make ends meet, total revenues.
Number of the following chronic diseases reported (at home, face-to-face) by the individuals: cancer, diabetes, hypertension, high cholesterol, colitis and chronic intestinal disease/ inflammatory bowel disease; stomach ulcer; chronic constipation; chronic lung disease; asthma; cardiac disorder; heart attack; fibromyalgia; chronic skin problems; chronic allergy; anemia; poor circulation; varicose leg veins; hemorrhoids; stroke; depression or anxiety; other mental problems; hearing loss; cataract; arthritis or rheumatism; osteoporosis; cirrhosis; kidney disease; urinary incontinence; infertility; prostate disorder (men); thyroid diseases. Chronic diseases in the CP dependent variable were excluded.
Health-related quality of life (physical and mental component; SF-12;Vilagut et al., 2008).
Question on self-rated health status in the last 12 months (Verbrugge, 1997).
Functional social support: total score and as confidant and affective dimensions (Ayala et al., 2012)..
Sleep and rest during sleeping hours
Limitation, disability or physical, sensory or mental handicap for more than 6 months
Healthy eating habits as (Chilet-Rosell et al., 2012): 1.5 or more liters of water per day; milk, fruit, vegetables, fish, 3 or more times per week; bread and cereal, one or more times per week; legume, pasta, rice, potatoes, 3 or more times per week (without being daily) or less than once per week; meat, 2 or more times per week (without being daily); sausage, 1 or 2 times per week or never/almost never; eggs: 1 or 2 times per week. Sweets: less than once a week or never/almost never
Suspected alcoholism (Ewing, 1984), frequency of consumption of alcoholic beverages, tobacco consumption.
Body Mass Index (BMI) as continuous variable and categorized as: low weight (BMI<18.5kg/m^2); normal weight (18.5kg/m^2≤BMI<25kg/m^2); overweight (25kg/m^2≤BMI<30 kg/m^2); obesity (BMI≥30 kg/m^2) (WHO, 2015). Both size and weight were measured objectively.
Physical activity in the workplace and physical exercise in free time
Environmental quality of the area of residence from responses to general self-assessment questions and items on noise, smell, air pollution, industry, green areas, delinquency/insecurity and heavy traffic. The sum of the scores for these items was calculated and then categorized into tertiles ($q_{33.34}$=18; $q_{66.66}$=19). Factorial analysis was also performed using these variables, , obtaining two main factors: bad odors and atmospheric pollution; and safety, noise, and green spaces.
Physical work conditions (working population), The sum of the scores for the 7 items (Liker scale responses, 1 to 4) was calculated and then categorized into tertiles ($q_{33.34}$=20; $q_{66.6}$=24).
Psychosocial level occupational exposure (Nübling et al., 2014) (working population), considering two components: 1) psychological demands and; 2) active work and development possibilities, such as influence, skill and time control. For both components, the sum of the scores for the corresponding items (Liker scale responses 1 to 5) and then categorized into 3 tertiles ($q_{33.34}$=10 y $q_{66.66}$=15, component 1; $q_{33.34}$=26 y $q_{66.66}$=34, component 2).

Statistical analysis

Data, for dependent variables and their crossing with independent variables, were reported on estimations based on the sampling design for percentages, means, population totals, 95% confidence intervals (CI95%), sampling errors, coefficients of variation, corrected typified residuals, and p-values obtained in the statistical tests (Pearson's chi-square test corrected with second-order Rao-Scott and Mann-Whitney U tests). Estimations for Spain on CP, DCP and nDCP prevalences, populations and variances, were calculated by applying a calibration technique based on marginals and on the chi-square distance. In accordance with the calibration requirements [30], the auxiliary variables selected were sex, age, educational level and employment status.

Factorial analysis was performed on environmental quality items and multivariate multinomial logistic regression models were used to analyze the association of factors with DCP, nDCP, and absence of CP (nCP). A model was initially adjusted using a backwards-stepwise procedure, using sociodemographic variables as control variables along with the remaining secondary variables. Those furthest from significance (at 5%) were successively and manually excluded, verifying at each step that the exclusion did not change the value of the other parameters by>30% of their previous value. Variables were re-entered in the model as confounding variables if a change>30% was observed [31]. The effects of age and gender interactions with the remaining independent variables were also verified in the data modeling process, and only those that were statistically significant were considered in the final model. Model assumptions were verified using residuals, model convergence, continuous variable linearity, variations in estimation standard error, and Nagelkerke R-square values [32].

Simple and stacked bar graphs and OR synthesis graphs were created. We used advanced sampling module of SPSS as well as an approximation of sampling with replacement. This gave the equivalence with probability proportional to size sampling (PPS)[33]. Individual case weight was used to adjust for municipality's population [34] following the method described in the Andalusian Health Survey [19].

Significance was considered at 5% and the sample design was considered throughout the statistical analysis (descriptive, bivariate and multivariate).

RESULTS

The main sociodemographic, economic and daily life habits characteristics of the study population as well as the number (%) missing for each variable are listed in supplementary data online as Tables 1 and 2.

Disabling CP: prevalence

The prevalence of CP in the Spanish adult population was 17.03% (CI95%=[16.88-17.19]), in which 11.36% of that population suffered from DCP (95%CI=[11.23-11.49];

4,441,556 individuals), while nDCP was reported by 5.67% (95%CI=[5.57-5.77]; 2,178,107 individuals). Of the participants with CP, pain was considered responsible for limitation in some daily life activities by 67% (Table 3, supplementary data online). DCP prevalence was three-fold higher in women than in men up to the age of 45 years old and two-fold higher in older ages. nDCP was significantly more frequent in women *versus* men up to the age of 45 years old, but there was no significant gender difference in older ages (Fig. 1). The mean age in the population with DCP was 58.5 years (95%CI 57.2-59.8]), which is significantly higher than in the population with nDCP and nCP (45.3 and 43.7 years, respectively; p<0.001]).

Figure 1. Spanish prevalences of disabling chronic pain and non-disabling chronic paina by sex and age groups

Disabling CP: characteristics

The prevalence of DCP was significantly higher (p<0.001) among the following: those who lived alone (19.5%), widows/widowers (29.6%), unskilled workers (15.1%); those who were illiterate (28.8%), those literate but with no schooling (24.9%), those who had only received primary schooling (15%); those reporting difficulties in reaching the end of the month (14.1%) and those with a net household income <1,000€/month (17%). However, nDCP was not significantly associated with any one of these characteristics.

A significantly higher likelihood of DCP (adjusted for age and sex) was found in those belonging to manual labour social classes (OR_{manual}=1.26), those with a lower schooling level ($OR_{Illiterate\ or\ literate\ but\ with\ no\ schooling}$ =1.61; $OR_{Primary\ schooling}$ =1.57), those who were unemployed but had worked previously *versus* those in employment (OR=1.33), and the residents of more rural areas (OR=1.28; Table 2).

Table 2. Sociodemographic characteristics of disabling chronic pain[a,b].

Disabling Chronic Pain (reference category: no Chronic Pain)	VARIABLE	Categories	p-value	Odds Ratio	95% Confidence Interval	
					Minimum	Maximum
Yes	Social class (p=0.68)	I. Manager with 10<salaried staff	0.196	0.704	0.413	1.199
		II. Manager with 10>salaried staff	0.231	0.776	0.512	1.176
		IIIa. Administrative staff	0.215	0.806	0.573	1.134
		IIIb. Self-employed	0.187	0.73	0.458	1.165
		IIIc. Manual work supervisor	0.673	0.839	0.37	1.9
		IVa. Qualified manual worker	0.603	0.929	0.704	1.226
		IVb. Manual worker	0.836	0.973	0.748	1.265
		V. Unskilled worker	.	1	.	.
No		I. Manager with 10<salaried staff	0.321	0.68	0.317	1.458
		II. Manager with 10>salaried staff	0.12	1.49	0.902	2.463
		IIIa. Administrative staff	0.454	1.188	0.756	1.868
		IIIb. Self-employed	0.977	0.991	0.52	1.886
		IIIc. Manual work supervisor	0.232	0.295	0.04	2.187
		IVa. Qualified manual worker	0.461	1.163	0.778	1.739
		IVb. Manual worker	0.34	1.205	0.821	1.77
		V. Unskilled worker	.	1	.	.
Yes	Social class (short version) (p=0.107)	Non-manual (I-III)	0.034	0.794	0.641	0.983
		Manual (IV-V)	.	1	.	.
No		Non-manual (I-III)	0.882	0.979	0.741	1.293
		Manual (IV-V)	.	1	.	.
Yes	Level of Education (p=0.056)	Illiterate/No formal education	0.014	1.615	1.104	2.364
		Primary education	0.008	1.57	1.127	2.187
		Lower Secondary/First-cycle Vocational Training	0.139	1.366	0.903	2.066
		Upper Secondary / Second-cycle Vocational Training	0.378	1.197	0.802	1.786
		University education	.	1	.	.
No		Illiterate/No formal education	0.347	1.268	0.773	2.081
		Primary schooling	0.97	0.993	0.68	1.45
		Lower Secondary/ First-cycle Vocational Training	0.21	1.329	0.852	2.074
		Upper Secondary / Second-cycle Vocational Training	0.482	0.845	0.528	1.351
		University education	.	1	.	.
Yes	Employment Situation (p<0.001)	Unemployed but previously worked	0.047	1.327	1.004	1.754
		Seeking first job or student	0.031	0.444	0.213	0.929
		Retired (previously employed)	<0.001	1.86	1.347	2.567
		Home keeper	0.214	1.199	0.9	1.598
		Handicap/Permanent Disability	<0.001	5.976	3.897	9.166
		Employed	.	1	.	.
No		Unemployed but previously worked	0.943	0.988	0.714	1.368
		Seeking first job or student	0.552	0.848	0.492	1.46
		Retired (previously employed)	0.942	1.017	0.649	1.592
		Home keeper	0.121	0.737	0.502	1.084
		Handicap/Permanent Disability	0.217	1.587	0.763	3.303
		Employed	.	1	.	.
Yes	Net monthly household income (p=0.024)	-999€	0.61	1.14	0.688	1.889
		1000 - 1499 €	0.617	1.136	0.689	1.873
		1500 - 2499€	0.448	0.817	0.484	1.378
		+2500€	.	1	.	.
No		-999€	0.606	0.84	0.432	1.631
		1000 - 1499 €	0.449	1.28	0.676	2.424
		1500 - 2499€	0.693	1.141	0.593	2.195
		+2500€	.	1	.	.
Yes	Rurality Index (p=0.05)	Rurality (continuous)	0.02	1.28	1.04	1.576
No		Rurality (continuous)	0.309	1.158	0.872	1.538

[a]Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain'. [b]Variables with p < 0.2 are included in the multinomial logistic regression models (except for social class). Variables not included in the multivariate: missing data for over 3.5% of a subpopulation (e.g. working population, population over 65 years old),) or treated differently (e.g. categorization or coding). All models were adjusted for age and sex. Significance level = 0.05. Interactions performed: sex * age, sex * independent variable analyzed and age * independent variable analyzed, showing the results that were statistically significant and did not affect the model convergence.

Disabling CP: multimorbidity

The ten most prevalent chronic diseases were the same in the different subpopulations, with the exception of prostate disorder which was replaced by osteoporosis in the DCP subpopulation. The prevalence of a chronic disease, regardless of which, was around two or three-fold higher in those with DCP than in those with nDCP, and three or four-fold higher in those without CP (Fig. 2). Conversely, DCP prevalence was around three or even four-fold higher among those with a chronic disease, regardless of which, while this difference was not seen in the prevalence of nDCP.

Figure 2. Prevalence of chronic diseases in the studied subpopulations

At least one chronic disease was present in 81.5% of the population with DCP *versus* 40.3% of the population without CP and 55.5% of the population with nDCP (p<0.001; Fig. 3). At least three other chronic diseases were reported in 47.7% of the population with DCP *versus* 18.8% of the population with nDCP. There was a strong tendency for the frequency of multimorbidity to be higher in women (*versus* men) among those with DCP (83.4% and 76.4%; p=0.054) but not among those with nDCP (p=0.45). The mean number of chronic diseases in women with DCP was significantly higher than in men with DCP (3.09, 95%CI=[2.85-3.33] *vs*. 2.32, 95%CI=[2.03-2.62]) and threefold higher than in women without CP (0.97, 95%CI =[0.92,1.03]).

Figure 3. Multimorbidity according to subpopulations with chronic pain.

DCP prevalence was five-fold higher among those with other chronic diseases than among those without (20.4% vs. 3.9%, respectively, p<0.001). A similar result for gender and for age group was observed. However, the differences of nDCP prevalence among those with and without chronic diseases were much smaller, with the exception of the youngest age group (Table 4, supplementary data online).

Disabling CP: associated factors

The final multivariate model for factors associated with DCP (Figs. 4a and 4b) used valid data from 96.65% of the study sample (n=6289) and it was highly significant (p<0.001; $R^2_{Nagelkerke}$=0.27).

Figure 4a. Factors associated with disabling chronic pain.

Figure 4b. Factors associated with non-disabling chronic pain.

The likelihood of DCP *versus* nCP was significantly higher in women (OR=2.12, p<0.001), individuals sleeping≤7h (OR=1.32, p=0.004), those with some physical limitation (OR=1.61, p=0.012), and smokers (OR=1.42; p=0.005), but not significantly higher in ex-smokers or in those individuals who did 'heavy work, tasks requiring great physical effort'. A higher likelihood of DCP was also observed in older age (OR_{10yrs}=1.28;

p<0.001), the presence of other chronic diseases ($OR_{1chronicdisease}$=1.26, p<0.001), worse environmental conditions (OR_{1point}=1.16; p=0.001), worse physical ($OR_{10points}$=2.38, p<0.001) or mental ($OR_{10points}$=1.21, p=0.001) quality of life, and (although this did not reach significance) lower emotional social support ($OR_{10points}$=1.041, p=0.096).

The probability of non-disabling CP was significantly higher in: women (OR=1.55, p=0.001); individuals with 'heavy work, tasks requiring great physical effort' *versus* those 'standing most of the time without much walking or major effort' (OR=2.28, p<0.001) and those 'sitting during most of the day' (OR=3.27, p=0.009); those with less emotional social support ($OR_{10points}$=1.073, p=0.023); and those with other chronic diseases (OR_{1CD}=1.28, p<0.001). In contrast, the likelihood of non-disabling CP was not significantly associated with the physical or mental quality of life, age, environmental conditions, hours of sleep, physical limitations, or smoking.

DISCUSSION

Our results show that important differences were observed between populations with disabling and non-disabling chronic pain. The failure to distinguish correctly between DCP and nDCP or their related risk factors may have major negative repercussions on the design of interventions to prevent and treat pain as well as on estimates of the size of this public health problem. The present findings are therefore highly relevant for healthcare policy-makers and professionals.

The item for measuring activity limitation was also used to measure the participation restrictions (problems in involvement in life situations) in the definition of disability [17]. Although other authors [35] use the SF-8 scale item on interference with social activities due to physical health or emotional problems, we decided not to consider that item because it is not specific to chronic pain. In fact, it did not obtain high concordance with our already constructed DCP (Kappa=0.34). The basis of the definition of CP in this study is the medical or healthcare professionals' diagnosis (reports of more than 3 months suffering the chronic disease that included the word 'pain') [20,21]. However, survey limitations detected in this study include the need to add muscle and joint pain in the lower and upper extremities (except shoulder) and various traumatological, postsurgical, and neuropathic conditions. It would also be preferable to gather direct data on CP with a simple overall question [12] and to avoid its construction based on other chronic diseases. By doing this, the possibility of overestimating its prevalence would be reduced. Gathering data on the time since CP onset, using 6 months as the criterion for chronicity [5], is also recommended. Finally, our study did not gather information to analyze neuropathic, nociceptive or dysfunctional pain because this is not essential information as these entities are considered as different points in the same continuum [36].

DCP, as observed in our study, is a highly relevant public health problem, as it affects two-thirds of the population with CP. Although there are very few population-based studies on DCP, the Spanish prevalence provided by our study (11.36%) is similar to findings in Canada (range:11.4-13.3%) [37] and higher than those reported in Germany

(7.4%) [35]. This health problem is especially relevant in women [6,38] and over-65-year-olds [38]. The greatest gender difference observed in our study was in the lower age groups [6].

The simplest example of the large differences between the DCP and nDCP populations is the mean age which it was 13 years older in the DCP population. Moreover, there was a negligible difference in mean age between those with nDCP and those without CP. Those age differences remained when controlled by the other independent variables. Thus, a much higher likelihood of DCP (vs. no CP) in older age was observed, while the likelihood of nDCP (vs. no CP) was not significantly associated with age. So, according to our definition of DCP, in the DCP group, the disability would be pain provoked, and the likelihood of that disability would increase by 28% with every 10 years of age.

The presence of other chronic diseases was reported by half of the population without CP, by almost three-quarters of the population with CP, and by over four-fifths of the population with DCP. Among individuals with DCP, multimorbidity was much more frequent in women [39]. This gender difference grew with increased age in the DCP population. But again, these differences were not observed in the population with non-disabling CP. In general, the prevalence of DCP is five-fold higher among those with other chronic diseases than among those without. The gender difference in the prevalence of DCP was even greater among those with other chronic diseases. According to allostatic load models [12], CP is more disabling in patients with a larger number of chronic diseases, thus increasing their health risk [11,12].

The prevalence of diseases such as fibromyalgia, arthritis, or rheumatism/osteoporosis was significantly higher in the DCP population when compared with the non-CP population, while it was only non-significantly higher among the nDCP population. It is not clear, due to the variability within those chronic diseases, that they always result in pain [40-42]. The prevalence of those chronic diseases between the nDCP population and the population without CP does not differ significantly. However, results obtained in the DCP population showed much higher prevalence (Fig. 2).

The prevalence of arterial hypertension in the DCP population was more than double that in the nDCP or nCP populations. The mechanisms underlying the association between CP and hypertension have not been fully elucidated, and the allostatic factors involved remain under discussion [43,44]. The population with depression or anxiety showed a prevalence of DCP that was three-fold higher than in the population without, signifying that there is an increase in disability when CP is associated with depression or anxiety [6,14,15,45-47]. The association of DCP with these mental disorders highlights the need for psychosocial services in chronic pain management [35] .

Our study showed that DCP was also associated with having only primary education, being unemployed after having worked previously, unqualified/unskilled employment, low income, low functional social support, poor health habits, impaired quality of life, worse environmental or work conditions and rural life. A statistical significant association was found between worse health-related quality of life and DCP, but not with nDCP. Both components of functional social support, which are considered to play an important role in helping sufferers cope with their pain [48,49], were significantly lower in the population with DCP, whereas the result was significantly lower for those with nDCP only in the affective component. These results go further than those provided by other studies [6,50,51].

The strength of this study is that it is based on a large-scale cross-sectional population-based survey. Its complex design (multistage stratified sample), large sample size (6.507 individuals), very good response rate (68%) and data gathering (face-to-face home interviews) make it a very reliable source of information. In addition, special efforts were made to avoid sampling biases (for further details please see Methods). Moreover, the EAS includes information on CP and disability which is not available in other important population health surveys, such as the Spanish National Health Survey (www.msssi.gob.es) or the European Health Interview Survey (http://ec.europa.eu/eurostat). It also gathers a large amount of information besides information on CP. For example, information on other diseases, activity limitations, general and employment health, and on usage of healthcare services which permit a comprehensive analysis of CP and associated factors. Andalusia, our sampling region, is

the most populated (8,399,618 people) and the second largest in area of the 19 regions in Spain. It is also the fifth most populated region in Europe and it is as populated as other European countries such as Austria or Switzerland. Moreover, we extrapolated the estimations of the DCP prevalence from Andalusia to Spain by applying calibration adjustments. This statistical method ensures that survey estimates are coherent with those already in the public domain, while simultaneously reducing sampling error and non-coverage or nonresponse bias [52]. When compared with the most important surveys published on CP [1,3,5,49], our study is of the same quality and scope, but of a higher level than other surveys on DCP.

In summary, the characteristics of chronic pain have been widely studied but without considering whether it disables or not. Our study demonstrates that a population with disabling chronic pain is the one which shows really statistically significant differences. Indeed, very few statistically significant differences were found between the nCP and nDCP populations. DCP is an important public health problem [51] which affects a large proportion of the general adult population (11.36% according to our study) with elevated multimorbidity. It has a strong association with social determinants of health (e.g. disfavored or vulnerable social status, impaired quality of health or poor health habits). Moreover, it is a highly relevant issue for health systems [51] (DCP almost doubles the health services usage compared with nDCP, especially in Primary Care)[53]. Its consequences directly affect partners, families and friends. Finally, our study contributes to knowledge on this issue, and provides evidence of the need to advance in the application of simple tools for the identification of individuals with DCP. Future research efforts, healthcare and social interventions should focus on this population and on the prevention of future disability in individuals with nDCP.

CONTRIBUTIONSHIP STATEMENT

ACL conceived the original idea with the participation of JAGH and MCB. ACL designed the analysis plan alongside LGF. Statistical analysis was conducted by LGF and subsequently by ACL. ACL developed the first version of the manuscript in collaboration with MCB for the introduction and discussion and with LGF for the methodology. All authors participated in the writing of subsequent versions and approved the final article.

COMPETING INTERESTS

The authors declare that there is no conflict of interest. The authors are solely responsible for the content and writing of the manuscript.

FUNDING

The *Andalusian Health Survey*, the source of information in this study, is funded by the Ministry of Health of the *Junta de Andalucía*, Spain.

DATA SHARING STATEMENT

Other tables, analyses, statistics and R code not included in the present article are available on demand.

REFERENCES

[1] Toth C, Lander J, Wiebe S. The prevalence and impact of chronic pain with neuropathic pain symptoms in the general population. *Pain Med* 2009; 10(5):918–29.

[2] Johannes CB, Le TK, Zhou X, Johnston JA, Dworkin RH. The prevalence of chronic pain in United States adults: results of an Internet-based survey. *J Pain* 2010; 11: 1230-9.

[3] Langley PC, Ruiz-Iban MA, Tornero Molina JT, de Andres J, Gónzalez-EscaladaCastellón JR. The prevalence, correlates and treatment of pain in Spain. *J Media Econ* 2011; 14: 367-80.

[4] Kennedy J, Roll JM, Schraudner T, Murphy S, McPherson S. Prevalence of persistent pain in the US adult population: new data from the National Health Interview Survey. *J Pain* 2014; 15:979-84.

[5] Breivik H, Collett B, Ventafridda V, Cohen R, Gallacher D. Survey of chronic pain in Europe: prevalence, impact on daily life, and treatment. *Eur J Pain* 2006; 10: 287-333.

[6] Blyth FM, March LM, Brnabic AJ, Jorm LR, Williamson M, Cousins MJ. Chronic pain in Australia: a prevalence study. *Pain* 2001; 89:127-34.

[7] Sakakibara T, Wang Z, Paholpak P, Kosuwon W, Myint T, Kasai Y. A Comparison of Chronic Pain Prevalence in Japan, Thailand, and Myanmar. *Pain Phys* 2013, 16: 603–8.

[8] Wong WS, Fielding R. Prevalence and characteristics of chronic pain in the general population of Hong Kong. *J Pain* 2011; 12: 236-45.

[9] Costa Cabral DM, Botelho Bracher ES, Prescatan Depintor JD, Eluf-Neto J. Chronic Pain Prevalence and Associated Factors in a Segment of the Population of Sao Paulo City. *J Pain* 2014; 15: 1081-91.

[10] Dueñas M, Salazar A, Ojeda B, Fernández-Palacin F, Micó JA, Torres LM, Failde I. A Nationwide study of chronic pain prevalence in the general Spanish population: identifying clinical subgroups trough cluster analysis. *Pain Med* 2014; 16:811-22.

[11] Eriksen J, Jensen MK, Sjogren P, Ekholm O, Rasmussen NK. Epidemiology of chronic non-malignant pain in Denmark. *Pain* 2003; 106:221–8.

[12] Dominick CH, Blyth FM, Nicholas MK. Unpacking the burden: understanding the relationships between chronic pain and comorbidity in the general population. *Pain* 2012; 153: 293-304.

[13] McEwen BS. Stress, adaptation, and disease: Allostasis and allostatic load. *Ann N Y Acad Sci* 1998; 840: 33-44.

[14] Raftery MN, Sarma K, Murphy AW, De la Harpe D, Normand C, McGuire BE. Chronic pain in the Republic of Ireland-community prevalence, psychosocial profile and predictors of pain-related disability: results from the Prevalence, Impact and Cost of Chronic Pain (PRIME) study, part 1. *Pain* 2011;152:1096-103.

[15] Azevedo LF, Costa-Pereira A, Mendonça L, Dias CC, Castro-Lopes JM. Epidemiology of chronic pain: a population-based nationwide study on its prevalence, characteristics and associated disability in Portugal. *J Pain* 2012; 13: 773-83.

[16] Reid MC, Eccleston C, Pillemer K. Management of chronic pain in older adults. *BMJ* 2015; 350:h532.

[17] WHO. International classification of functioning, disability, and health (ICF). World Health Organization. Switzerland: Geneva, 2007. http://www.who.int/classifications/icf/en/. Accessed 17 Jun 2017.

[18] Blyth FM, March LM, Brnabic AJM, Cousins MJ. Chronic pain and frequent use of health care. *Pain* 2004; 111:51-8.

[19] Sánchez-Cruz JJ, GarcíaFernándezLl, Mayoral Cortés JM. Andalusian Health Survey, 2011-12. Consejería de Igualdad, Salud y Políticas Sociales. 2013. http://goo.gl/2BYFhe. Accessed 3 Aug 2015.

[20] Álvarez-González J, Ayuso-Fernández A, Caba-Barrientos F. *Plan Andaluz de atención a las personas con dolor: 2010–2013*. Sevilla: Consejería de Salud. 2010. http://www.juntadeandalucia.es/export/drupaljda/plan_atencion_dolor-1_0.pdf. Accessed 3 Aug 2015.

[21] International Association for the Study of Pain (IASP). Washington. IASP Taxonomy: Pain Terms. 2104. http://www.iasp-pain.org/Taxonomy?navItemNumber=576#Pain. Accessed 3 Aug 2015.

[22] Dapcich V, Salvador G, Ribas L, Pérez C, Aranceta J, Serra-Majem Ll. *Guía de la alimentación saludable*. Sociedad Española de Nutrición Comunitaria. 2004. http://aesan.msssi.gob.es/AESAN/docs/docs/publicaciones_estudios/nutricion/guia_alimentacion.pdf. Accessed 3 Aug 2015.

[23] Vilagut G, Valderas JM, Ferrer M, Garin O, López-García E, Alonso J. Interpretation of SF-36 and SF-12 questionnaires in Spain: physical and mental components. *Med Clin* 2008;130:726-35.

[24] Verbrugge LM. A global disability indicator. *J Aging Stud* 1997;11:337-62. http://aesan.msssi.gob.es/AESAN/docs/docs/publicaciones_estudios/nutricion/guia_alimentacion.pdf. Accessed 9 Feb 2017].

[25] Ayala A, Rodríguez-Blázquez C, Frades-Payo B, Forjaza MJ, Martínez-Martín P, Fernández-Mayoralas G, Rojo-Pérez F. Psychometric properties of the Functional Social Support Questionnaire and the Loneliness Scale in non-institutionalized older adults in Spain. *Gac Sanit* 2012; 26: 317-24.

[26] Chilet-Rosell E, Álvarez-Dardet C, Domingo-Salvany A. Use of Spanish proposals for measuring social class in health sciences. *Gac Sanit* 2012; 26:566-9. http://scielo.isciii.es/pdf/gs/v26n6/original_breve1.pdf. Accessed 3 Aug 2015.

[27] Ewing JA. Detecting alcoholism. The CAGE questionnaire. *JAMA* 1984; 252:1905-7.

[28] WHO. Body Mass Classification. World Health Organization. Switzerland: Geneva, 2015. http://apps.who.int/bmi/index.jsp?introPage=intro_3.html. Accessed 3 Aug 2015.

[29] Nübling M, Burr H, Moncada S, Kristensen T.S. COPSOQ International Network: Co-operation for research and assessment of psychosocial factors at work. *Public Health Forum* 2014; 22: 18.e1–18.e3.

[30] Cabrera-León A, Lopez-Villaverde V, Rueda M, Moya-Garrido MN. Calibrated prevalence of infertility in 30- to 49-year-old women according to different approaches: a cross-sectional population-based study. *Hum Reprod* 2015; 30(11): 2677-85.

[31] Miettenen OS, Cook EF. Confounding: Essence and detection. *Am J Epidemiol* 1981; 144: 593-603.

[32] Menard, S. Coefficients of determination for multiple logistic regression analysis. *Am Stat* 2000; 54: 17-24.

[33] Lumley T. Complex Surveys: A Guide to Analysis Using R. Hoboken: Wiley;2010.

[34] Population and Housing Census 2011. National Statistics Institute (INE, Spanish acronym). http://www.ine.es/en/censos2011_datos/cen11_datos_inicio_en.htm. Accessed 3 Aug 2015.

[35] Häuser W, Schmutzer G, Hilbert A, Brähler E, Henningsen P. Prevalence of Chronic Disabling Noncancer Pain and Associated Demographic and Medical Variables: A Cross-Sectional Survey in the General German Population. *Clin J Pain* 2015;31(10):886-92; doi: 10.1097/AJP.0000000000000173.

[36] Cohen SP, Mao J. Neuropathic pain: mechanisms and their clinical implications. *BMJ* 2014;348:f7656; doi: 10.1136/bmj.f7656.

[37] Reitsma ML, Tranmer JE, Buchanan DM, Vandenkerkhof EG. The prevalence of chronic pain and pain-related interference in the Canadian population from 1994 to 2008. *Chronic Dis Inj Can* 2011;31:157–64.

[38] Bingefors K, Isacson D. Epidemiology, co-morbidity, and impact on health-related quality of life of self-reported headache and musculoskeletal pain – a gender perspective. *Eur J Pain* 2004; 8: 435–50.

[39] Scherer M, Hansen H, Gensichen J et al. Association between multimorbidity patterns and chronic pain in elderly primary care patients: a cross-sectional observational study. *BMC Fam Pract* 2016; 17:68; doi: 10.1186/s12875-016-0468-1.

[40] Slukaa KA, Clauwb DJ. Neurobiology of fibromyalgia and chronic widespread pain. *Neuroscience* 2016; S0306-4522(16)30236-6.

[41] WHO. Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. World Health Organization. Geneva, 1994. http://apps.who.int/iris/bitstream/10665/39142/1/WHO_TRS_843_eng.pdf. Accessed 17 Jun 2017.

[42] Kraus VB, Blanco FJ, Englund M, Karsdal MA, Lohmander LS. Call for standardized definitions of osteoarthritis and risk stratification for clinical trials and clinical use. *Osteoarthr cartilage* 2015; 23(8):1233-41.

[43] Zota AR, Shenassa ED, Morello-Frosh. Allostatic load amplifies the effect of blood lead levels on elevated blood pressure among middle-age U.S.: a cross-sectional study. *Environ Health Persp* 2013; 12: 64.

[44] Olsen RB, Bruehl S, Nielsen ChS, Rosselandb LA, Eggen AE, Stubhaug A. Hypertension prevalence and diminished blood pressure–related hypoalgesia in individuals reporting chronic pain in a general population: The Tromsø Study. *Pain* 2013; 154: 257-62.

[45] Ohayon MM, Stingl JC. Prevalence and comorbidity of chronic pain in the German general population. *J Psychiat Res* 2012; 46:444-50.

[46] Gerrits MM, Vogelzangs N, van Oppen P, et al. Impact of pain on the course of depressive and anxiety disorders. *Pain* 2012; 153:429-36.

[47] Loerbroks A, Bosch JA, Mommersteeg PM, Herr RM, Angerer P, Li J. The association of depression and angina pectoris across 47 countries: findings from the 2002 World Health Survey. *Eur J Epidemiol* 2014; 29: 507-15.

[48] Leonardi M, Bickenbach J, Ustun TB, Kostanjsek N, Chatterji S. The definition of disability: what is in a name?. *Lancet* 2006; 368:1219-21.

[49] Gibson SJ, Lussier MD. Prevalence and relevance of pain in older persons. *Pain Med* 2012; 13: 23-6.

[50] Smith BH, Elliot AM, Chambers WA, Smith WC, Hannaford PC, Penny K. The impact of chronic pain in the community. *Fam Pract* 2001;18(3):292-9.

[51] Blyth FM, Van Der Windt DA, Croft PR. Chronic Disabling Pain: A Significant Public Health Problem. *Am J Prev Med* 2015; 49 (1): 98-101.

[52] Cabrera-León A, Rueda M, Cantero-Braojos M. "Calibrated prevalence of disabling chronic pain: a face-to face cross-sectional population study in Southern Spain". *BMJ Open* 2017; 7:e014033; doi:10.1136/bmjopen-2016-014033.

[53] Cabrera-León A, Cantero-Braojos MA. "Impact of disabling chronic pain: results of a cross-sectional population study with face-to-face interview". *Aten Prim* 2017. In press; doi: 10.1016/j.aprim.2017.03.020

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Table 1 supplementary data. Characteristics of the study population.

Table 2 supplementary data. Life habits of the study population.

Table 3 supplementary. Prevalences of chronic pain and of other chronic diseases by sex, age and disabling condition.

Table 4 supplementary data. Disabling chronic pain prevalences according to the presence of other chronic diseases.

Table 1. Study variables

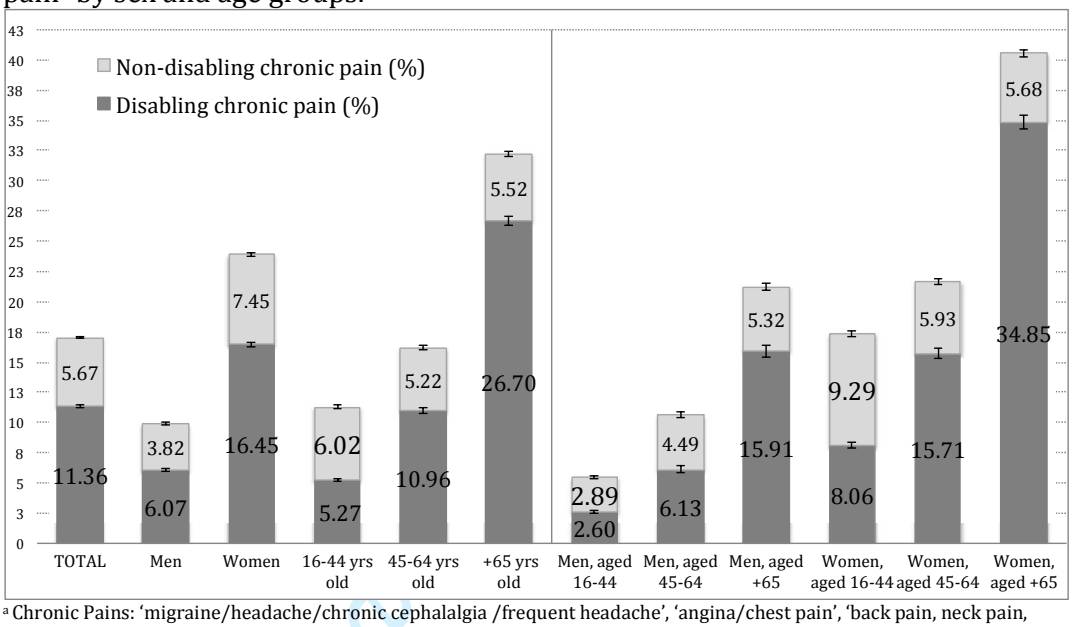
Disabling Chronic Pain (DCP, dependent variable): Population with CP who declared being limited in their activity by any of the above-reported chronic pains. The non-disabling CP and non-CP population was also defined with this variable
Chronic Pain (CP): individuals who declared that a doctor or a nurse had told them that they suffered from one or more of the following Chronic Diseases in the survey that included the word 'pain': 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.
Demographic and economic characteristics: Sex and age (age groups: 16-44 years; 45-64; + 65), marital status, cohabitation, living alone at home, social class (Dapcich et al., 2004) educational level, employment status, economic difficulty to make ends meet, total revenues.
Number of the following chronic diseases reported (at home, face-to-face) by the individuals: cancer, diabetes, hypertension, high cholesterol, colitis and chronic intestinal disease/ inflammatory bowel disease; stomach ulcer; chronic constipation; chronic lung disease; asthma; cardiac disorder; heart attack; fibromyalgia; chronic skin problems; chronic allergy; anemia; poor circulation; varicose leg veins; hemorrhoids; stroke; depression or anxiety; other mental problems; hearing loss; cataract; arthritis or rheumatism; osteoporosis; cirrhosis; kidney disease; urinary incontinence; infertility; prostate disorder (men); thyroid diseases. Chronic diseases in the CP dependent variable were excluded.
Health-related quality of life (physical and mental component; SF-12;Vilagut et al., 2008).
Question on self-rated health status in the last 12 months (Verbrugge, 1997).
Functional social support: total score and as confidant and affective dimensions (Ayala et al., 2012)..
Sleep and rest during sleeping hours
Limitation, disability or physical, sensory or mental handicap for more than 6 months
Healthy eating habits as (Chilet-Rosell et al., 2012): 1.5 or more liters of water per day; milk, fruit, vegetables, fish, 3 or more times per week; bread and cereal, one or more times per week; legume, pasta, rice, potatoes, 3 or more times per week (without being daily) or less than once per week; meat, 2 or more times per week (without being daily); sausage, 1 or 2 times per week or never/almost never; eggs: 1 or 2 times per week. Sweets: less than once a week or never/almost never
Suspected alcoholism (Ewing, 1984), frequency of consumption of alcoholic beverages, tobacco consumption.
Body Mass Index (BMI) as continuous variable and categorized as: low weight (BMI<18.5kg/m^2); normal weight (18.5kg/m^2≤BMI<25kg/m^2); overweight (25kg/m^2≤BMI<30 kg/m^2); obesity (BMI≥30 kg/m^2) (WHO, 2015). Both size and weight were measured objectively.
Physical activity in the workplace and physical exercise in free time
Environmental quality of the area of residence from responses to general self-assessment questions and items on noise, smell, air pollution, industry, green areas, delinquency/insecurity and heavy traffic. The sum of the scores for these items was calculated and then categorized into tertiles ($q_{33.34}$=18; $q_{66.66}$=19). Factorial analysis was also performed using these variables, , obtaining two main factors: bad odors and atmospheric pollution; and safety, noise, and green spaces.
Physical work conditions (working population), The sum of the scores for the 7 items (Liker scale responses, 1 to 4) was calculated and then categorized into tertiles ($q_{33.34}$=20; $q_{66.6}$=24).
Psychosocial level occupational exposure (Nübling et al., 2014) (working population), considering two components: 1) psychological demands and; 2) active work and development possibilities, such as influence, skill and time control. For both components, the sum of the scores for the corresponding items (Liker scale responses 1 to 5) and then categorized into 3 tertiles ($q_{33.34}$=10 y $q_{66.66}$=15, component 1; $q_{33.34}$=26 y $q_{66.66}$=34, component 2).

Table 2. Sociodemographic characteristics of disabling chronic pain[a,b].

Disabling Chronic Pain (reference category: no Chronic Pain)	VARIABLE	Categories	p-value	Odds Ratio	95% Confidence Interval	
					Minimum	Maximum
Yes	Social class (p=0.68)	I. Manager with 10<salaried staff	0.196	0.704	0.413	1.199
		II. Manager with 10>salaried staff	0.231	0.776	0.512	1.176
		IIIa. Administrative staff	0.215	0.806	0.573	1.134
		IIIb. Self-employed	0.187	0.73	0.458	1.165
		IIIc. Manual work supervisor	0.673	0.839	0.37	1.9
		IVa. Qualified manual worker	0.603	0.929	0.704	1.226
		IVb. Manual worker	0.836	0.973	0.748	1.265
		V. Unskilled worker	.	1	.	.
No		I. Manager with 10<salaried staff	0.321	0.68	0.317	1.458
		II. Manager with 10>salaried staff	0.12	1.49	0.902	2.463
		IIIa. Administrative staff	0.454	1.188	0.756	1.868
		IIIb. Self-employed	0.977	0.991	0.52	1.886
		IIIc. Manual work supervisor	0.232	0.295	0.04	2.187
		IVa. Qualified manual worker	0.461	1.163	0.778	1.739
		IVb. Manual worker	0.34	1.205	0.821	1.77
		V. Unskilled worker	.	1	.	.
Yes	Social class (short version) (p=0.107)	Non-manual (I-III)	0.034	0.794	0.641	0.983
		Manual (IV-V)	.	1	.	.
No		Non-manual (I-III)	0.882	0.979	0.741	1.293
		Manual (IV-V)	.	1	.	.
Yes	Level of Education (p=0.056)	Illiterate/No formal education	0.014	1.615	1.104	2.364
		Primary education	0.008	1.57	1.127	2.187
		Lower Secondary/First-cycle Vocational Training	0.139	1.366	0.903	2.066
		Upper Secondary / Second-cycle Vocational Training	0.378	1.197	0.802	1.786
		University education	.	1	.	.
No		Illiterate/No formal education	0.347	1.268	0.773	2.081
		Primary schooling	0.97	0.993	0.68	1.45
		Lower Secondary/ First-cycle Vocational Training	0.21	1.329	0.852	2.074
		Upper Secondary / Second-cycle Vocational Training	0.482	0.845	0.528	1.351
		University education	.	1	.	.
Yes	Employment Situation (p<0.001)	Unemployed but previously worked	0.047	1.327	1.004	1.754
		Seeking first job or student	0.031	0.444	0.213	0.929
		Retired (previously employed)	<0.001	1.86	1.347	2.567
		Home keeper	0.214	1.199	0.9	1.598
		Handicap/Permanent Disability	<0.001	5.976	3.897	9.166
		Employed	.	1	.	.
No		Unemployed but previously worked	0.943	0.988	0.714	1.368
		Seeking first job or student	0.552	0.848	0.492	1.46
		Retired (previously employed)	0.942	1.017	0.649	1.592
		Home keeper	0.121	0.737	0.502	1.084
		Handicap/Permanent Disability	0.217	1.587	0.763	3.303
		Employed	.	1	.	.
Yes	Net monthly household income (p=0.024)	-999€	0.61	1.14	0.688	1.889
		1000 - 1499 €	0.617	1.136	0.689	1.873
		1500 - 2499€	0.448	0.817	0.484	1.378
		+2500€		1		
No		-999€	0.606	0.84	0.432	1.631
		1000 - 1499 €	0.449	1.28	0.676	2.424
		1500 - 2499€	0.693	1.141	0.593	2.195
		+2500€	.	1	.	.
Yes	Rurality Index (p=0.05)	Rurality (continuous)	0.02	1.28	1.04	1.576
No		Rurality (continuous)	0.309	1.158	0.872	1.538

[a] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain'. [b] Variables with p < 0.2 are included in the multinomial logistic regression models (except for social class). Variables not included in the multivariate: missing data for over 3.5% of a subpopulation (e.g. working population, population over 65 years old),) or treated differently (e.g. categorization or coding). All models were adjusted for age and sex. Significance level = 0.05. Interactions performed: sex * age, sex * independent variable analyzed and age * independent variable analyzed, showing the results that were statistically significant and did not affect the model convergence.

Figure 1. Spanish prevalences of disabling chronic pain and non-disabling chronic pain[a] by sex and age groups.



[a] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.

Figure 2. Prevalence of chronic diseases[a] in the studied subpopulations[b].

Chronic pain population		Non chronic pain population		General population		Disabling chronic pain population		Non disabling chronic pain population	
Chronic disease	%	Chronic disease	%	Chronic disease	%	Chronic disease	%	Chronic disease	%
Hypertension	34.71%	Hypertension	15.33%	Hypertension	18.66%	Hypertension	42.67%	Hypertension	18.61%
High cholesterol	23.78%	High cholesterol	9.94%	High cholesterol	12.32%	Arthritis / rheumatism	28.38%	High cholesterol	15.90%
Arthritis / rheumatism	22.27%	Diabetes*	6.71%	Arthritis / rheumatism	8.68%	High cholesterol	27.68%	Depression / Anxiety	11.64%
Poor blood circulation	18.52%	Arthritis / rheumatism	5.85%	Diabetes*	8.06%	Poor blood circulation	24.22%	Allergies *	10.52%
Depression / Anxiety	17.41%	Depression / Anxiety	5.82%	Depression / Anxiety	7.82%	Depression / Anxiety	20.26%	Arthritis / rheumatism	9.93%
Varicose veins in legs	16.00%	Allergies *	5.53%	Poor blood circulation	6.39%	Varicose veins in legs	19.66%	Varicose veins in legs	8.61%
Diabetes*	14.56%	Poor blood circulation	3.87%	Allergies *	6.25%	Diabetes*	18.42%	Poor blood circulation	7.01%
Allergies *	9.64%	Heart disorders*	3.15%	Varicose veins in legs	4.82%	Heart disorders*	10.30%	Diabetes*	6.76%
Heart disorders*	8.31%	Prostate disorders	3.09%	Heart disorders*	4.03%	Allergies *	9.20%	Prostate disorders **	5.83%
Prostate disorders **	6.94%	Varicose veins in legs	2.50%	Prostate disorders	3.48%	Osteoporosis	8.95%	Cataracts**	4.33%
Osteoporosis	6.43%	Asthma	2.08%	Asthma	2.32%	Prostate disorders **	7.56%	Heart disorders*,**	4.30%
Cataracts	6.16%	Cataracts	1.43%	Cataracts	2.24%	Cataracts	7.07%	Chronic constipation**	3.24%
Hard of hearing	4.63%	Lung*	1.41%	Osteoporosis	2.09%	Hard of hearing	6.26%	Asthma	3.23%
Chronic constipation	4.49%	Cancer*	1.36%	Hard of hearing	1.63%	Hemorrhoids	5.48%	Stomach problems*,**	2.95%
Hemorrhoids	4.30%	Heart attack*	1.24%	Lung*	1.63%	Urinary incontinence	5.23%	Colitis*,**	2.68%
Urinary incontinence	4.12%	Anemia*	1.19%	Anemia*	1.62%	Chronic constipation	5.10%	Lung*,**	1.90%
Fibromyalgia	3.84%	Osteoporosis	1.18%	Cancer*	1.54%	Fibromyalgia	4.95%	Hemorrhoids	1.90%
Anemia*	3.67%	Hard of hearing	1.01%	Heart attack*	1.53%	Anemia*	4.82%	Urinary incontinence**	1.87%
Asthma	3.49%	Kidney	1.00%	Fibromyalgia	1.43%	Kidney	4.28%	Heart attack*,**	1.61%
Stomach problems*	3.13%	Skin problems*	0.96%	Kidney	1.36%	Heart attack*	3.62%	Skin problems*,**	1.61%
Kidney	3.13%	Fibromyalgia	0.93%	Skin problems*	1.30%	Asthma	3.62%	Fibromyalgia	1.60%
Heart attack*	2.95%	Colitis*	0.91%	Colitis*	1.24%	Skin problems*	3.60%	Osteoporosis**	1.35%
Skin problems*	2.94%	Stomach problems*	0.78%	Hemorrhoids	1.21%	Stomach problems*,**	3.22%	Anemia*,**	1.35%
Colitis*	2.85%	Other mental	0.72%	Stomach problems*	1.18%	Stroke*,**	3.22%	Hard of hearing**	1.35%
Lung*	2.68%	Hemorrhoids	0.57%	Chronic constipation	1.17%	Lung*,**	3.07%	Cancer*,**	1.33%
Cancer*	2.40%	Stroke*	0.53%	Urinary incontinence	1.12%	Colitis*,**	2.93%	Other mental	0.81%
Stroke*	2.24%	Cirrhosis*	0.50%	Stroke*	0.83%	Cancer*,**	2.93%	Kidney**	0.80%
Cirrhosis*,**	1.43%	Urinary incontinence	0.50%	Other mental	0.72%	Cirrhosis*,**	1.86%	Infertility**	0.54%
Infertility**	0.71%	Chronic constipation	0.48%	Cirrhosis*	0.66%	Infertility**	0.80%	Cirrhosis*,**	0.54%
Other mental**	0.71%	Infertility**	0.14%	Infertility**	0.24%	Other mental	0.66%	Stroke*,**	0.26%

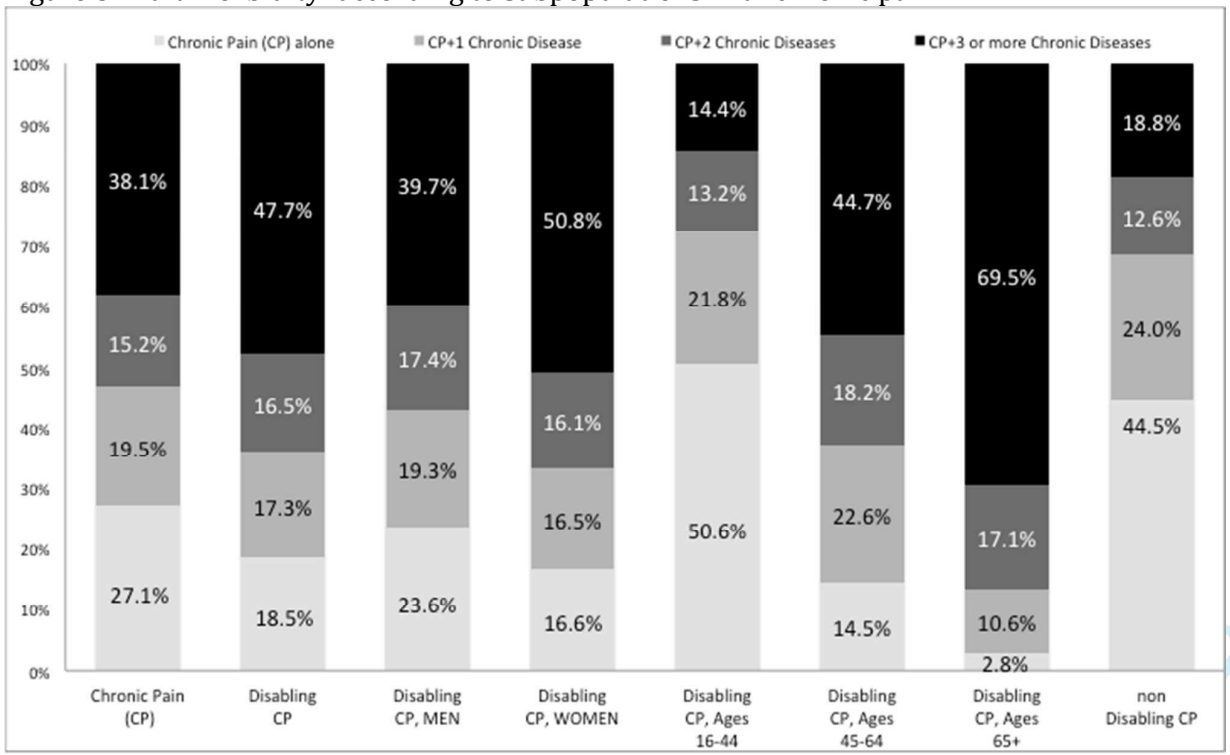
[a] Question: 'Has a healthcare professional [physician/nurse] told you that you suffer from ...?'

[b] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.

* Cancer, malignant tumor, including leukemia, lymphoma; Diabetes / high blood sugar / sugar in urine; hypertension; Chronic colitis and intestinal diseases / inflammatory bowel disease / Cohn's disease; stomach ulcer / duodenum; Chronic lung disease / emphysema / chronic bronchitis; Cardiac disorders / cardiac failure / congestive cardiac failure; Myocardial infarction / heart attack; Chronic skin problems; Chronic allergies (such as rhinitis, eye inflammation, dermatitis, food allergies, etc.), excluding allergic asthma; Anemia or other blood disease; Stroke / cerebral hemorrhage; Hearing loss / hearing problems; Cirrhosis / hepatic disease / hepatic dysfunction;

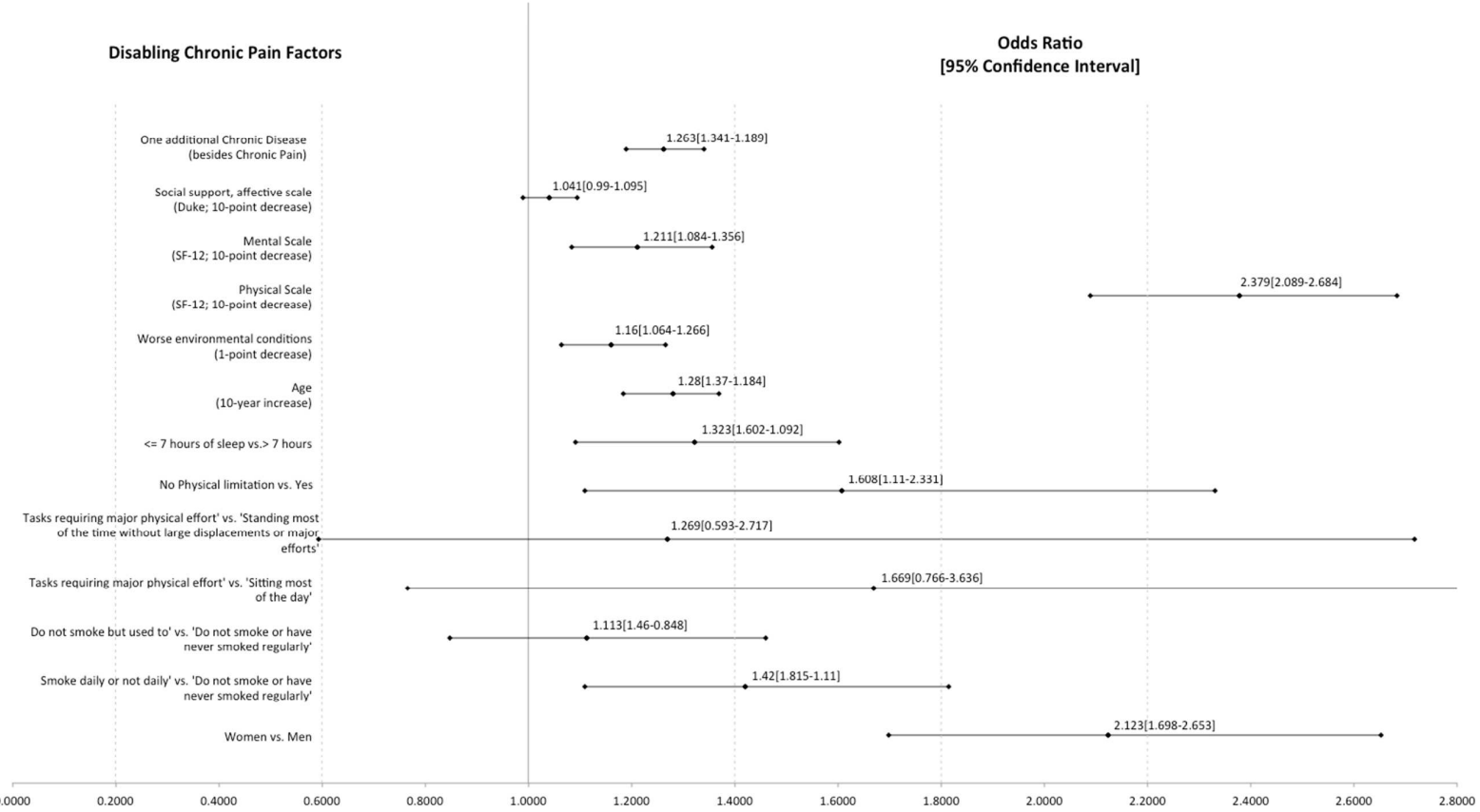
** Coefficient of variation> 20%; therefore, the results should be interpreted with caution.

Figure 3. Multimorbidity[a] according to subpopulations with chronic pain[b].



[a] Question: 'Has a healthcare professional [physician/nurse] told you that you suffer from one or more of the following Chronic Diseases …?'
[b] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.

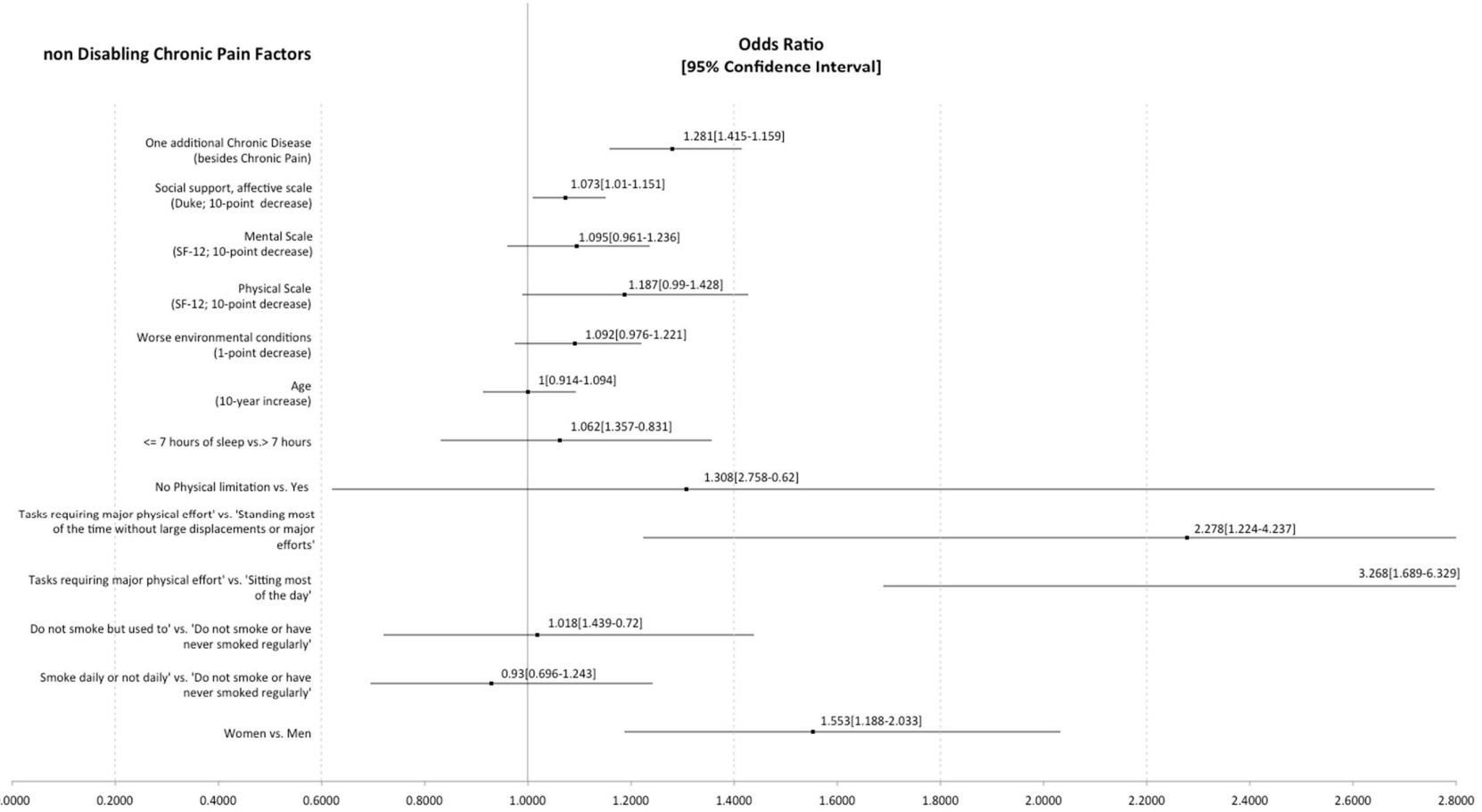
Figure 4a. Factors associated with disabling chronic pain [a,b].



[a] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain'.

[b] The odds ratios are calculated based on the following reference categories/values: Sex = Male; Tobacco = Do not smoke or have never smoked regularly; Physical activity = Tasks requiring major physical effort; Physical limitations = Yes; Sleep > 7 hours; Age = 45.4; Physical Component Score (PCS_SF-12) = 51.12; Mental Component Score (MCS_SF-12) = 50.67; Affective social support (Duke) = 81.01; Number of chronic diseases (besides CP) = 1.07; Environmental conditions = 5.83.

Figure 4b. Factors associated with non-disabling chronic pain [a,b].



[a] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain'.

[b] The odds ratios are calculated based on the following reference categories/values: Sex = Male; Tobacco = Do not smoke or have never smoked regularly; Physical activity = Tasks requiring major physical effort; Physical limitations = Yes; Sleep > 7 hours; Age = 45.4; Physical Component Score (PCS_SF-12) = 51.12; Mental Component Score (MCS_SF-12) = 50.67; Affective social support (Duke) = 81.01; Number of chronic diseases (besides CP) = 1.07; Environmental conditions = 5.83.

Table 1 supplementary data. Characteristics of the study population.

Variables (individuals with missing data; %)	Category (population aged ≥16 years; total n=6,507)	Percentage (sample sizes)	95% Confidence Interval	
			Minimum	Maximum
Sex (0)	Male	49.3% (3209)	48.1%	50.5%
	Female	50.7% (3298)	49.5%	51.9%
Age (0)	Aged 16-24 years	13.3% (867)	12.5%	14.2%
	25-44	39.3% (2556)	38.1%	40.5%
	45-54	16.7% (1087)	15.8%	17.6%
	55-64	12.3% (799)	11.5%	13.1%
	65-74	9.6% (626)	8.9%	10.4%
	+75	8.8% (572)	8.1%	9.5%
Marital Status (8, 0.1%)	Married	59.6% (3805)	58.4%	60.8%
	Single	29.6% (1882)	28.5%	30.7%
	Separated	1.9%(123)	1.6%	2.2%
	Divorced	2.8% (178)	2.4%	3.2%
	Widowed	8% (511)	7.4%	8.7%
Cohabiting (66, 2.6%)		64.9%(4180)	63.7%	66%
Social Class [27] (1359, 20.9%)	I. Manager with 10<salaried staff	5.3% (275)	4.8%	6%
	II. Manager with 10>salaried staff	7.5% (384)	6.8%	8.2%
	IIIa. Administrative staff	12.7% (654)	11.8%	13.6%
	IIIb. Self-employed	4.9% (253)	4.4%	5.5%
	IIIc. Manual work supervisor	1.7% (87)	1.4%	2.1%
	IVa. Qualified manual worker	23.6% (1216)	22.5%	24.8%
	IVb. Manual worker	21.5% (1107)	20.4%	22.6%
	V. Unskilled worker	22.8% (1170)	21.7%	23.9%
	VI. Others	0.04% (2)	0%	0.2%
Educational Level (11, 0.2%)	Illiterate	2.1% (136)	1.8%	2.5%
	No formal education but can read and write	11.6% (756)	10.9%	12.4%
	Up to 5 years primary schooling (Early education)	19.5% (1263)	18.5%	20.4%
	Up to 8 years primary schooling	23.8% (1543)	22.7%	24.8%
	Up to 4 years secondary schooling (lower secondary)	9.1% (590)	8.4%	9.8%
	First cycle of vocational training	5.3% (345)	4.8%	5.9%
	Second cycle of vocational training	6.5% (420)	5.9%	7.1%
	Up to 6 years secondary schooling (upper secondary)	9.1% (593)	8.4%	9.8%
	Short-cycle tertiary education (diploma) or Bachelor's degree	7.1% (465)	6.6%	7.8%
	Master's degree or PhD	5.9% (385)	5.4%	6.5%
Employment Situation (3, 0.05%)	Employed	34,1% (2221)	33%	35,3%
	Unemployed but previously worked	21,5% (1398)	20,6%	22,5%
	Seeking first employment	1% (66)	0,8%	1,3%
	Retired (previously employed)	14,4% (938)	13,6%	15,3%
	Home keeper	18,1% (1178)	17,2%	19,1%
	Student	8,1% (527)	7,5%	8,8%
	Handicap/Permanent Disability	2,5% (160)	2,1%	2,9%
	Other	0,2% (16)	0,2%	0,4%
Economic difficulty to make ends meet (30, 0.5 %)	Very difficult	12.7% (819)	11.9%	13.5%
	Difficult	18.4% (1190)	17.5%	19.3%
	Somewhat difficult	30% (1944)	28.9%	31.1%
	Somewhat easy	25.5% (1651)	24.4%	26.5%
	Easy	12.5% (813)	11.8%	13.4%
	Very easy	0.9% (60)	0.7%	1.2%
Total net household income (1540, 23.7%)	Up to 300 euros	0.7% (36)	0.5%	1%
	From 301 to 499 euros	4.3% (212)	3.7%	4.9%
	From 500 to 999 euros	27.6% (1368)	26.3%	28.8%
	From 1000 to 1499 euros	37.6% (1866)	36.2%	38.9%
	From 1500 to 1999 euros	17% (844)	16%	18.1%
	From 2000 to 2499 euros	8.1% (401)	7.3%	8.9%
	From 2500 to 2999 euros	3.2% (157)	2.7%	3.7%
	From 3000 to 4999 euros	1.5% (72)	1.2%	1.8%
	More than 5000 euros	0.2% (11)	0.1%	0.4%

Table 2 supplementary data. Life habits of the study population.

Variables (missing responses; %)	Category (population aged +16; total n=6,507)	Percentage (sample sizes)	95% Confidence Interval	
			Minimum	Maximum
Suspected alcoholism		3.1% (204)	2.7%	3.6%
Consumption of alcoholic beverages (2; 0.03%)	Yes, consumption of alcoholic beverage	44.4% (2891)	43.2%	45.6%
	Yes, but less than once a month	13.3% (864)	12.5%	14.1%
	No, no consumption of alcoholic beverage	42.3% (2750)	41.1%	43.5%
Smoker (3; 0.05%)	Yes, smoke daily	30.9% (2011)	29.8%	32.1%
	Yes, smoke but not daily	2.4% (157)	2.1%	2.8%
	Do not smoke but used to	17.5% (1137)	16.6%	18.4%
	Do not smoke or have never regularly smoked	49.2% (3199)	48%	50.4%
Body Mass Index [30] (0)	Low weight	3.8% (247)	3.4%	4.3%
	Normal weight	37.3% (2428)	36.1%	38.5%
	Overweight	39.7% (2585)	38.5%	40.9%
	Obesity I	17.1% (1113)	16.2%	18%
	Obesity II	2.1% (134)	1.7%	2.4%
Physical activity in the workplace or usual activity (47; 0.7%)	Sitting most of the workday	30.4% (1964)	29.3%	31.5%
	Standing most of the time without major movement or effort	55.8% (3605)	54.6%	57%
	Walking, carrying some weight. Frequent movement	11.5% (737)	10.7%	12.2%
	Hard work, tasks requiring major physical effort	2.4% (154)	2%	2.8%
Physical exercise in free time (3; 0.05%)	No physical activity	26.8% (1742)	25.7%	27.9%
	Occasional physical or sporting activity	55.9% (3639)	54.7%	57.1%
	Regular physical activity, several times a month	12% (779)	11.2%	12.8%
	Physical training several times a week	5.3% (344)	4.8%	5.9%
Dairy product consumption (7; 0.1%)	Daily	90.9% (5909)	90.2%	91.6%
	Three or more times a week	2.9% (191)	2.6%	3.4%
	One / two times a week	2.5% (163)	2.2%	2.9%
	Less than 1 time week	0.8% (52)	0.6%	1%
	Never or almost never	2.8% (185)	2.5%	3.3%
Fresh fruit consumption (11; 0.2%)	Daily	63.8% (4144)	62.6%	64.9%
	Three or more times a week	21.7% (1405)	20.7%	22.7%
	One / two times a week	9.6% (623)	8.9%	10.3%
	Less than once a week	2.9% (190)	2.5%	3.4%
	Never or almost never	2.1% (134)	1.8%	2.4%
Vegetables consumption (14; 0.2%)	Daily	41% (2665)	39.9%	42.1%
	Three or more times a week	34.1% (2211)	33%	35.2%
	One / two times a week	19.8% (1287)	18.9%	20.8%
	Less than once a week	3.7% (240)	3.3%	4.2%
	Never or almost never	1.4% (90)	1.1%	1.7%
Sweets consumption (30; 0.5%)	Daily	18.4(1191)	17.4%	19.3%
	Three or more times a week	25.2% (1629)	24.2%	26.2%
	One / two times a week	28% (1814)	27%	29.1%
	Less than once a week	14% (908)	13.2%	14.9%
	Never or almost never	14.4% (935)	13.6%	15.3%

Table 3 supplementary. Prevalences of chronic pain and of other chronic diseases by sex, age and disabling condition.

Variables			Condition		Disabling Condition (Subpopulation with the condition/s)		Disabling Condition (Total population)	
			Prevalence	95% Confidence Interval	Prevalence[b]	95% Confidence Interval	Prevalence[c]	95% Confidence Interval
Chronic Pain[a]	Total		17.2%	16.3-18.12	66.9%	64.14-69.55	11.5%	10.73-12.28
	Sex (p<0.001)	Women	23.9%	22.5-25.4	68,2%	64.9-71.3	16.3%	15.1-17.6
		Men	10.3%	9.3-11.4	63,9%	58.6-68.8	6.6%	5.8-7.5
	Age groups (p<0.001)	16-44 yrs	11.4%	10.4-12.5	48.2%	43.4-53.1	5.5%	4.8-6.3
		45-64	18.2%	16.5-20	70.4%	65.3-75	12.8%	11.4-14.4
		+65	32.3%	29.7-35	82.7%	78.6-86.1	26.7%	24.2-29.2
At least one Chronic Disease (besides Chronic Pain)	Total		45.9%	44.67-47.08	59.7%	58-61.47	29.5%	28.45-30.66
	Sex (p<0.001)	Women	52.9%	51.2-54.6	64.5%	62.2-66.7	36.8%	35.2-38.5
		Men	38.6%	37-40.3	53.1%	50.3-55.8	22.1%	20.7-23.5
	Age groups (p<0.001)	16-44 yrs	23.7%	22.3-25.1	43.3%	40-46.7	13%	11.9-14.2
		45-64	56.9%	54.6-59.1	56.6%	53.6-59.5	34%	31.9-36.2
		+65	92.1%	90.4-93.5	74.9%	72.3-77.4	69.7%	67.1-72.3

[a] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.

[b] Percentage of disabling population within that population with the corresponding condition (chronic pain or at least one chronic disease)

[c] Percentage of population with both disabling and the corresponding condition (chronic pain or at least one chronic disease).

Table 4 supplementary data. Disabling chronic pain[a] prevalences according to the presence of other chronic diseases.

Variables		POPULATION WITH OTHER CHRONIC DISEASES (total n=2987; n men=1,240; n women=1,747)		POPULATION WITHOUT OTHER CHRONIC DISEASES (total n=3,520; n men=1969; n women=1,551)	
		Prevalence[b] (Significance[c])	95% Confidence Interval	Prevalence[b] (Significance)	95% Confidence Interval
Disabling Chronic Pain	Total	20.4%	19-21.9	3.9%	3.3-4.6
	Women	25.7% (p<0.001)	23.7-27.8	5.7% (p=0.042)	4.7-7.0
	Men	13.1%	11.3-15.0	2.5%	1.9-3.3
	Ages 16-44	11.5%	9.5-13.8	3.0%	2.4-3.7
	45-64	19.3%	11.0-21.7	4.3%	3.2-5.9
	+65	28.1%(p < 0.001)	25.6-30.9	9.5%(p=0.001)	5.0-17.2
Non-disabling Chronic Pain	Total	6.9%	6-7.9	4.7%	4-5.7
	Women	8.0% (p<0.001)	6.8-9.3	7.2% (p<0.001)	6.0-8.6
	Men	5.4%	4.3-6.8	2.7%	2.1-3.5
	Ages 16-44	9.4%(p < 0.001)	7.5-11.6	3.0%	2.4-3.7
	45-64	6.4%	5.1-8.0	3.8%	2.7-5.4
	+65	5.5%	4.3-7.1	6.3%	2.9-13.3

[a] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.

[b] Prevalence of disabling or non-disabling chronic pain within the population with or without other chronic diseases.

[d] p-values are located in the cells where there are statistical significant differences.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Reported on manuscript page
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1-2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7, Table 1
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-6, Table 1
Bias	9	Describe any efforts to address potential sources of bias	6-8,12-13
Study size	10	Explain how the study size was arrived at	5-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6, Table 1
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7-8
		(*b*) Describe any methods used to examine subgroups and interactions	7-8
		(*c*) Explain how missing data were addressed	Tables 1 and 2, supplementary data online
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	7-8
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	

		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Tables 1 and 2, supplementary data online Figures 1-3
		(b) Indicate number of participants with missing data for each variable of interest	Tables 1 and 2, supplementary data online
Outcome data	15*	Report numbers of outcome events or summary measures	8-12, Table 3 supplementary data online
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-12, Table 2 and Figures 4a and 4b
		(*b*) Report category boundaries when continuous variables were categorized	Yes
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	9-10, Table 2
Discussion			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17

*Give information separately for exposed and unexposed groups.

BMJ Open

Living with disabling chronic pain: results from a face-to-face cross-sectional population-based study.

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2017-020913.R1
Article Type:	Research
Date Submitted by the Author:	15-May-2018
Complete List of Authors:	Cabrera-León, Andrés; Lecturer. Andalusian School of Public Health, Instituto de Investigación Biosanitaria ibs.GRANADA, Hospitales Universitarios de Granada/Universidad de Granada, Granada. Spain. Researcher. Biomedical Research Networking Centre on Public Health and Epidemiology (CIBERESP), Madrid. Spain. Cantero-Braojos, Miguel; Psychologist and Clinical Physiotherapist. MenSana Psichology and Health Clinic. Granada. Spain. Garcia-Fernandez, Llenalia; Ph.D. Seplin Statistical Solutions, Granada. Spain. Guerra de Hoyos, Juan; Primary Care Physician, Seville. Spain.
Primary Subject Heading:	Epidemiology
Secondary Subject Heading:	Epidemiology, Public health
Keywords:	Chronic pain, Disability, Multimorbidity, Activity restriction, cross-sectional study, Quality of life

TITLE

Living with disabling chronic pain: results from a face-to-face cross-sectional population-based study.

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The number of words in the manuscript is 3897.

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TITLE

Living with disabling chronic pain: results from a face-to-face cross-sectional population-based study**.**

ABSTRACT

Objectives: To estimate the prevalence of disabling chronic pain in Spanish adults, to analyse its characteristics, to determine its multimorbidity, and to identify its associated factors.

Settings: 2011 Andalusian Health Survey, a cross-sectional population survey based on face-to-face home interviews.

Participants: 6,507 people aged 16 or older and living in Andalusia, Spain.

Outcomes: The response variable was disabling chronic pain. Multivariate multinomial logistic regression models were used to analyse the association of factors with disabling chronic pain. The sample design was considered throughout the statistical analysis.

Results: The prevalence of disabling chronic pain in the Spanish adult population was 11.36% (95%CI=[11.23-11.49], while that of non-disabling chronic pain was 5.67% (95%CI=[5.57-5.77]. Disabling chronic pain was associated with high multimorbidity (especially in women [51%] and in the elderly [70%] with three or more additional chronic diseases), as well as with disadvantaged social status [such as female gender (OR=2.12), advanced age ($OR_{10\text{-years increase}}$=1.28), unemployment (OR=1.33), manual work (OR=1.26), low income (OR=1.14) and reduced emotional social support (OR=1.04)]. Other influential factors were tobacco consumption (OR=1.42), sleeping≤7h

(OR=1.2)], environmental or work conditions (OR=1.16), and quality of life (OR_{mental}=1.21, $OR_{physical}$=2.37).

Conclusions: The population with disabling chronic pain was associated with multimorbidity, vulnerable social status and an impaired quality of life. In contrast, the population with non-disabling chronic pain showed almost no differences when compared with the population without chronic pain. The association between DCP and mental disorders highlights the need for psychosocial services in the management of chronic pain.

Keywords: Chronic pain, Disability, Multimorbidity, Activity restriction, Cross-sectional study, Quality of life.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This study provides a comprehensive epidemiological approach to disabling chronic pain.
- It includes information on chronic pain and disability which is not available in other important population health surveys, such as the European Health Interview Survey.
- It is based on a large-scale cross-sectional population-based survey which is a reliable source of information. In addition, special efforts were made to avoid sampling biases.
- However, it does not include muscle and joint pain in the lower and upper extremities (except the shoulder) nor various traumatological, postsurgical, or neuropathic conditions.

- It would have been preferable to construct the chronic pain variable from one simple overall question rather than from other chronic disease variables.

INTRODUCTION

Estimations of the prevalence of chronic pain (CP) have varied widely among studies [1-4]. It has been estimated to range between 12 and 42% worldwide (in people over 18 years old), between 12 and 30% in Europe [5] and between 19 and 30.7% in the USA [2,4]. It was reported to be 35% in Canada [1], 18.5% in Australia [6], 17.5% in Japan [7], 35% in Hong Kong [8], 42% in Sao Paulo [9], between 12 and 17.25% in Spain [3,5,10].

Most population health surveys on CP have considered it as a symptom of different chronic diseases, while others have considered CP as an independent entity and have associated it with various comorbidities [11,12]. These studies, on the basis of allostatic load models [13], found that the capacity of individuals to adapt to stress factors can be impaired by the presence of CP and two or more comorbidities, thus increasing health risks.

The impact of CP is greater when it limits activities of daily living (ADL)[2,3,5,14-16]. The World Health Organization (WHO) includes disability-related ADL limitations within the "International Classification of Functioning, Disability, and Health" (ICF Model)[17]. This biopsychosocial model considers disability as a state of impaired functioning associated with disease, disorder, lesion, or other health conditions, when it is experienced as a deficiency, a limitation on activity, or a restriction to participation in any area of life. There have been numerous studies on disability in different diseases, but few on its relationship with CP. These studies found a higher frequency of ADL-limiting CP or disabling CP (DCP) in women and in individuals with a lower socioeconomic level, health-related unemployment, elevated depression indicators [14-16], and a higher number of visits to their physician [18]. However, questions remain regarding the differences between DCP and non-disabling CP (nDCP) and their effects.

With this background, the objectives of this study were to calculate the prevalence of DCP in Spanish adults through key sociodemographic characteristics, to determine its multimorbidity, and to identify associated factors.

MATERIAL AND METHODS

Design

The *Andalusian Health Survey (EAS, Spanish acronym)* [19], the information source, is a population-based and cross-sectional survey that uses face-to-face home interviews. It is designed to evaluate the health of population and their usage of health services in Andalusia, Spain. The study population was adults (≥16 yrs) living in Andalusia. Those people who were institutionalized (e.g. hospitals, nursing home, prison…) were excluded from the survey, as well as those with cognitive difficulties as to be interviewed.

A multistage stratified sample design was adopted for our research. The sampling units were municipalities, census tracts, households, and individuals. The strata were province (8), size of municipality (5) and season of the year (4). Municipalities and census tracts were selected in proportion to the population size, while households were selected with equal probability by systematic sampling. The interviewees applied quotas for each province as well as quotas for sex-age and the size of municipality within each province. A virtually constant assignation was performed per census tract (7-10 adults), and one adult per household was selected for interview. The information was collected between March of 2011 and February of 2012. (For further details please refer to the health survey report) [19].

Ethical approval

The EAS was supervised and approved by the review board of the General Secretariat of Quality and Public Health in the Health Ministry of the Andalusian Regional Government.

Sample and data collection

112 municipalities and 696 census tracts were selected, and 6,507 valid personal face-to-face interviews were conducted at home (p=q=0.5; confidence level = 95%; precision=0.0149; design effect =1.525), with a response rate of 67.9% (the no respondent percentage was due to refusal to participate once the household had been contacted). The average interview time was 28.84 minutes (SD=6.8, median=30 minutes).

The effects of non-coverage were minimized by selecting the study population within a sampling framework based on census districts and households. To minimize nonresponse, the interviews were held 7 days per week between 10:00 and 21:00, and interviewers were trained in both field work and in the study's methodology. In addition, the survey administration was supervised and followed up, and non-responders were replaced with people of the same sex and age in a randomized manner from the same district. Moreover, we also took measures to minimize information/observation/measurement biases by providing adequate training for interviewers (see above), and by following interviews up either in-person or with telephone calls (43.1%). The questionnaire was designed with filters and controls to facilitate verification of its correct completion (100% of questionnaires were reviewed), and the sampling design was considered in the data analyses.

Patient and Public Involvement

This study did not involve patients and the public.

Variables

The study variable was DCP. This is composed of disability (WHO, 2006) and CP [20-21]. The disability definition encompasses impairments, activity limitations and participation restrictions. The question about impairments (problems in body function/structure) was whether a doctor or a nurse had told the interviewees that they suffered from any of a wide list of chronic diseases (Table 1). It was asked during home-based face-to-face interviews. Activity limitation and participation restrictions were constructed as population who declared that they were limited in their activity when asked about each of the chronic diseases listed (i.e. they were asked about it for each chronic disease). Finally, CP was established according to those individuals who reported a chronic disease that included the word 'pain', namely: migraine/headache/chronic cephalalgia /frequent headache'; 'angina/chest pain'; 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain'; or 'menstrual pain'. The independent variables are also listed in Table 1.

Table 1. Study variables

Disabling Chronic Pain (DCP, dependent variable): Population with CP who declared being limited in their activity by any of the above-reported chronic pains. The non-disabling CP and non-CP population was also defined with this variable
Chronic Pain (CP): individuals who declared that a doctor or a nurse had told them that they suffered from one or more of the following Chronic Diseases in the survey that included the word 'pain' [20,21]: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.
Demographic and economic characteristics: Sex and age (age groups: 16-44 years; 45-64; + 65), marital status, cohabitation, living alone at home, social class [22] educational level, employment status, economic difficulty to make ends meet, total revenues.
Number of the following chronic diseases reported (at home, face-to-face) by the individuals: cancer, diabetes, hypertension, high cholesterol, colitis and chronic intestinal disease/ inflammatory bowel disease; stomach ulcer; chronic constipation; chronic lung disease; asthma; cardiac disorder; heart attack; fibromyalgia; chronic skin problems; chronic allergy; anaemia; poor circulation; varicose leg veins; haemorrhoids; stroke; depression or anxiety; other mental problems; hearing loss; cataract; arthritis or rheumatism; osteoporosis; cirrhosis; kidney disease; urinary incontinence; infertility; prostate disorder (men); thyroid diseases. Chronic diseases in the CP dependent variable were excluded.
Health-related quality of life (physical and mental component; SF-12) [23].
Question on self-rated health status in the last 12 months [24].
Functional social support: total score and as confidant and affective dimensions [25].
Sleep and rest during sleeping hours
Limitation, disability or physical, sensory or mental handicap for more than 6 months
Healthy eating habits as [26]: 1.5 or more litres of water per day; milk, fruit, vegetables, fish, 3 or more times per week; bread and cereal, one or more times per week; legume, pasta, rice, potatoes, 3 or more times per week (without being daily) or less than once per week; meat, 2 or more times per week (without being daily); sausage, 1 or 2 times per week or never/almost never; eggs: 1 or 2 times per week. Sweets: less than once a week or never/almost never
Suspected alcoholism [27], frequency of consumption of alcoholic beverages, tobacco consumption.
Body Mass Index (BMI) as continuous variable and categorized as: low weight (BMI<18.5kg/m^2); normal weight (18.5kg/m^2≤BMI<25kg/m^2); overweight (25kg/m^2≤BMI<30 kg/m^2); obesity (BMI≥30 kg/m^2) [28]. Both size and weight were measured objectively.
Physical activity in the workplace and physical exercise in free time
Environmental quality of the area of residence from responses to general self-assessment questions and items on noise, smell, air pollution, industry, green areas, delinquency/insecurity and heavy traffic. The sum of the scores for these items was calculated and then categorized into tertiles ($q_{33.34}$=18; $q_{66.66}$=19). Factor analysis was also performed using these variables, obtaining the following two main factorsbad odours and atmospheric pollution; and safety, noise, and green spaces.
Physical work conditions (working population), The sum of the scores for the 7 items (Liker scale responses, 1 to 4) was calculated and then categorized into tertiles ($q_{33.34}$=20; $q_{66.6}$=24).
Psychosocial level occupational exposure [29] (working population), considering two components: 1) psychological demands and; 2) active work and development possibilities, such as influence, skill and time control. For both components, the sum of the scores for the corresponding items (Liker scale responses 1 to 5) and then categorized into 3 tertiles ($q_{33.34}$=10 y $q_{66.66}$=15, component 1; $q_{33.34}$=26 y $q_{66.66}$=34, component 2).

Statistical analysis

Data, for dependent variables and their crossing with independent variables, were reported on estimations based on the sampling design for percentages, means, population totals, 95% confidence intervals (CI95%), sampling errors, coefficients of variation, corrected typified residuals, and p-values obtained in the statistical tests (Pearson's chi-square test corrected with second-order Rao-Scott and Mann-Whitney U tests). Estimations for Spain on CP, DCP and nDCP prevalences, populations and

variances, were calculated by applying a calibration technique based on marginals and on the chi-square distance. In accordance with the calibration requirements [30], the auxiliary variables selected were sex, age, educational level and employment status. The 'sampling' R package [31] was used for the sample design and calibration weightings in estimations of DCP prevalence, and 'samplingVarEst' package [32] for its variance estimation.

Factor analysis was performed on environmental quality items (Table 1) and multivariate multinomial logistic regression models were used to analyse the association of factors with DCP, nDCP, and absence of CP (nCP). A model was initially adjusted using a backwards-stepwise procedure, using sociodemographic variables as control variables along with the remaining secondary variables. Those furthest from significance (at 5%) were successively and manually excluded, verifying at each step that the exclusion did not change the value of the other parameters by>30% of their previous value. Variables were re-entered in the model as confounding variables if a change>30% was observed [33]. Variables with missing data for over 3.5% of a subpopulation (e.g. working population, population over 65 years old) or treated differently (e.g. categorization or coding) were not included in the multivariate. The effects of age and gender interactions with the remaining independent variables were also verified in the data modelling process, and only those that were statistically significant were considered in the final model. Model assumptions were verified using residuals, model convergence, continuous variable linearity, variations in estimation standard error, and Nagelkerke R-square values [34]. With respect to collinearity, it was checked by studying, covariates correlation (rho>0.7) and checking parameter correlations. The association between those included in the model was lower than 0.3.

Simple and stacked bar graphs and OR synthesis graphs were created. We used advanced sampling module of SPSS as well as an approximation of sampling with replacement. This gave the equivalence with probability proportional to size sampling (PPS)[35]. Individual case weight was used to adjust for municipality's population [36] following the method described in the Andalusian Health Survey [19].

Significance was considered at 5% and the sample design was considered throughout the statistical analysis (descriptive, bivariate and multivariate).

RESULTS

The main sociodemographic, economic and daily life habits characteristics of the study population as well as the number (%) missing for each variable are listed in supplementary data online as Tables 1 and 2.

Disabling CP: prevalence

The prevalence of CP in the Spanish adult population was 17.03% (CI95%=[16.88-17.19]), in which 11.36% of that population suffered from DCP (95%CI=[11.23-11.49]; 4,441,556 individuals), while nDCP was reported by 5.67% (95%CI=[5.57-5.77]; 2,178,107 individuals). Of the participants with CP, pain was considered responsible for limitation in some daily life activities by 67% (Table 3, supplementary data online). DCP prevalence was three-fold higher in women than in men up to the age of 45 years old and two-fold higher in older ages. nDCP was significantly more frequent in women *versus* men up to the age of 45 years old, but there was no significant gender difference in older ages (Fig. 1). The mean age in the population with DCP was 58.5 years (95%CI 57.2-59.8]), which is significantly higher than in the population with nDCP and nCP (45.3 and 43.7 years, respectively; p<0.001]).

Figure 1. Spanish prevalence of disabling chronic pain and non-disabling chronic pain by sex and age groups

Disabling CP: characteristics

The prevalence of DCP was significantly higher (p<0.001) among the following: those who lived alone (19.5%), widows/widowers (29.6%), unskilled workers (15.1%); those who were illiterate (28.8%), those literate but with no schooling (24.9%), those who had only received primary schooling (15%); those reporting difficulties in reaching the end of the month (14.1%) and those with a net household income <1,000€/month

(17%). However, nDCP was not significantly associated with any one of these characteristics.

A significantly higher likelihood of DCP (adjusted for age and sex) was found in those belonging to manual labour social classes (OR_{manual}=1.26), those with a lower schooling level ($OR_{Illiterate\ or\ literate\ but\ with\ no\ schooling}$ =1.61; $OR_{Primary\ schooling}$ =1.57), those who were unemployed but had worked previously *versus* those in employment (OR=1.33), and the residents of more rural areas (OR=1.28; Table 2).

Table 2. Sociodemographic characteristics of disabling chronic pain[a,b].

VARIABLE	Disabling Chronic Pain (reference category: no Chronic Pain)	Categories	p-value	Odds Ratio	95% Confidence Interval	
					Minimum	Maximum
Social class (p=0.68)	Yes	I. Manager with 10<salaried staff	0.196	0.704	0.413	1.199
		II. Manager with 10>salaried staff	0.231	0.776	0.512	1.176
		IIIa. Administrative staff	0.215	0.806	0.573	1.134
		IIIb. Self-employed	0.187	0.73	0.458	1.165
		IIIc. Manual work supervisor	0.673	0.839	0.37	1.9
		IVa. Qualified manual worker	0.603	0.929	0.704	1.226
		IVb. Manual worker	0.836	0.973	0.748	1.265
		V. Unskilled worker	.	1	.	.
	No	I. Manager with 10<salaried staff	0.321	0.68	0.317	1.458
		II. Manager with 10>salaried staff	0.12	1.49	0.902	2.463
		IIIa. Administrative staff	0.454	1.188	0.756	1.868
		IIIb. Self-employed	0.977	0.991	0.52	1.886
		IIIc. Manual work supervisor	0.232	0.295	0.04	2.187
		IVa. Qualified manual worker	0.461	1.163	0.778	1.739
		IVb. Manual worker	0.34	1.205	0.821	1.77
		V. Unskilled worker	.	1	.	.
Social class (short version) (p=0.107)	Yes	Non-manual (I-III)	0.034	0.794	0.641	0.983
		Manual (IV-V)	.	1	.	.
	No	Non-manual (I-III)	0.882	0.979	0.741	1.293
		Manual (IV-V)	.	1	.	.
Level of Education (p=0.056)	Yes	Illiterate/No formal education	**0.014**	**1.615**	1.104	2.364
		Primary education	**0.008**	**1.57**	1.127	2.187
		Lower Secondary/First-cycle Vocational Training	0.139	**1.366**	0.903	2.066
		Upper Secondary / Second-cycle Vocational Training	0.378	1.197	0.802	1.786
		University education	.	1	.	.
	No	Illiterate/No formal education	0.347	1.268	0.773	2.081
		Primary schooling	0.97	0.993	0.68	1.45
		Lower Secondary/ First-cycle Vocational Training	0.21	1.329	0.852	2.074
		Upper Secondary / Second-cycle Vocational Training	0.482	0.845	0.528	1.351
		University education	.	1	.	.
Employment Situation (p<0.001)	Yes	Unemployed but previously worked	0.047	**1.327**	1.004	1.754
		Seeking first job or student	0.031	0.444	0.213	0.929
		Retired (previously employed)	**<0.001**	**1.86**	1.347	2.567
		Home keeper	0.214	1.199	0.9	1.598
		Handicap/Permanent Disability	**<0.001**	**5.976**	3.897	9.166
		Employed	.	1	.	.
	No	Unemployed but previously worked	0.943	0.988	0.714	1.368
		Seeking first job or student	0.552	0.848	0.492	1.46
		Retired (previously employed)	0.942	1.017	0.649	1.592
		Home keeper	0.121	0.737	0.502	1.084
		Handicap/Permanent Disability	0.217	**1.587**	0.763	3.303
		Employed	.	1	.	.
Net monthly household income (p=0.024)	Yes	-999€	0.61	**1.14**	0.688	1.889
		1000 - 1499 €	0.617	1.136	0.689	1.873
		1500 - 2499€	0.448	0.817	0.484	1.378
		+2500€		1		
	No	-999€	0.606	0.84	0.432	1.631
		1000 - 1499 €	0.449	1.28	0.676	2.424
		1500 - 2499€	0.693	1.141	0.593	2.195
		+2500€	.	1	.	.
Rurality Index (p=0.05)	Yes	Rurality (continuous)	**0.02**	**1.28**	1.04	1.576
	No	Rurality (continuous)	0.309	1.158	0.872	1.538

[a] Chronic Pains: 'migraine/headache/chronic cephalalgia/frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain'.

[b] This table includes those variables with p < 0.2 except for social class. All multinomial logistic regression models were adjusted for age and

sex. Most relevant values have been marked in bold.

Disabling CP: multimorbidity

The ten most prevalent chronic diseases were the same in the different subpopulations, with the exception of prostate disorder which was replaced by osteoporosis in the DCP subpopulation. The prevalence of a chronic disease, regardless of which, was around two or three-fold higher in those with DCP than in those with nDCP, and three or four-fold higher in those without CP (Fig. 2). Conversely, DCP prevalence was around three or even four-fold higher among those with a chronic disease, regardless of which, while this difference was not seen in the prevalence of nDCP.

Figure 2. Prevalence of chronic diseases in the studied subpopulations

At least one chronic disease was present in 81.5% of the population with DCP *versus* 40.3% of the population without CP and 55.5% of the population with nDCP (p<0.001; Fig. 3). At least three other chronic diseases were reported in 47.7% of the population with DCP *versus* 18.8% of the population with nDCP. There was a strong tendency for the frequency of multimorbidity to be higher in women (*versus* men) among those with DCP (83.4% and 76.4%; p=0.054) but not among those with nDCP (p=0.45). The mean number of chronic diseases in women with DCP was significantly higher than in men with DCP (3.09, 95%CI=[2.85-3.33] *vs*. 2.32, 95%CI=[2.03-2.62]) and threefold higher than in women without CP (0.97, 95%CI =[0.92,1.03]).

Figure 3. Multimorbidity according to subpopulations with chronic pain.

DCP prevalence was five-fold higher among those with other chronic diseases than among those without (20.4% vs. 3.9%, respectively, p<0.001). A similar result for gender and for age group was observed. However, the differences of nDCP prevalence among those with and without chronic diseases were much smaller, with the exception of the youngest age group (Table 4, supplementary data online).

Disabling CP: associated factors

The final multivariate model for factors associated with DCP (Figs. 4 and 5) used valid data from 96.65% of the study sample (n=6289) and it was highly significant ($p<0.001$; $R^2_{Nagelkerke}=0.27$).

Figure 4. Factors associated with disabling chronic pain.

Figure 5. Factors associated with non-disabling chronic pain.

The likelihood of DCP *versus* nCP was significantly higher in women (OR=2.12, $p<0.001$), individuals sleeping≤7h (OR=1.32, $p=0.004$), those with some physical limitation (OR=1.61, $p=0.012$), and smokers (OR=1.42; $p=0.005$), but not significantly higher in ex-smokers or in those individuals who did 'heavy work, tasks requiring great physical effort'. A higher likelihood of DCP was also observed in older age ($OR_{10yrs}=1.28$; $p<0.001$), the presence of other chronic diseases ($OR_{1chronicdisease}=1.26$, $p<0.001$), worse environmental conditions ($OR_{1point}=1.16$; $p=0.001$), worse physical ($OR_{10points}=2.38$, $p<0.001$) or mental ($OR_{10points}=1.21$, $p=0.001$) quality of life, and (although this did not reach significance) lower emotional social support ($OR_{10points}=1.041$, $p=0.096$).

The probability of non-disabling CP was significantly higher in: women (OR=1.55, $p=0.001$); individuals with 'heavy work, tasks requiring great physical effort' *versus* those 'standing most of the time without much walking or major effort' (OR=2.28, $p<0.001$) and those 'sitting during most of the day' (OR=3.27, $p=0.009$); those with less emotional social support ($OR_{10points}=1.073$, $p=0.023$); and those with other chronic diseases ($OR_{1CD}=1.28$, $p<0.001$). In contrast, the likelihood of non-disabling CP was not significantly associated with the physical or mental quality of life, age, environmental conditions, hours of sleep, physical limitations, or smoking.

DISCUSSION

Our results show that important differences were observed between populations with disabling and non-disabling chronic pain. The failure to distinguish correctly between DCP and nDCP or their related risk factors may have major negative repercussions on the design of interventions to prevent and treat pain as well as on estimates of the size of this public health problem. The present findings are therefore highly relevant for healthcare policy-makers and professionals.

DCP definition and prevalence

The item for measuring activity limitation was also used to measure the participation restrictions (problems in involvement in life situations) in the definition of disability [17]. Although other authors [37] use the SF-8 scale item on interference with social activities due to physical health or emotional problems, we decided not to consider that item because it is not specific to chronic pain. In fact, it did not obtain high concordance with our already constructed DCP (Kappa=0.34). In addition, people interviewed were specifically asked if they were limited in their activity by the reported chronic pains (Table 1). So the disability is due to the chronic pain, not to other medical condition. The basis of the definition of CP in this study is the medical or healthcare professionals' diagnosis (reports of more than 3 months suffering the chronic disease that included the word 'pain') [20,21]. However, survey limitations detected in this study include the need to add muscle and joint pain in the lower and upper extremities (except shoulder) and various traumatological, postsurgical, and neuropathic conditions. It would also be preferable to gather direct data on CP with a simple overall question [12] and to avoid its construction based on other chronic diseases. By doing this, the possibility of overestimating its prevalence would be reduced. Gathering data on the time since CP onset, using 6 months as the criterion for chronicity [5], is also recommended. Finally, our study did not gather information to analyse neuropathic, nociceptive or dysfunctional pain because this is not essential information as these entities are considered as different points on the same continuum [38].

DCP, as observed in our study, is a highly relevant public health problem, as it affects two-thirds of the population with CP. Although there are very few population-based studies on DCP, the Spanish prevalence provided by our study (11.36%) is similar to findings in Canada (range:11.4-13.3%) [39] and higher than those reported in Germany (7.4%) [37]. This health problem is especially relevant in women [6,40] and over-65-year-olds [40]. The greatest gender difference observed in our study was in the lower age groups [6]. In addition, nDCP could lead to DCP in time, especially in middle age and over. This can be seen in Figure 1 where nDCP prevalence is quite similar in the highest age groups, regardless of gender, while DCP prevalence presents much higher differences. Moreover, as showed in supplementary Table 4, the change over time of nDCP into DCP could be much faster among people with other chronic diseases.

One of the largest differences between the DCP and nDCP populations is the mean age, which was 13 years older in the DCP population. Moreover, there was a negligible difference in mean age between those with nDCP and those without CP. Those age differences remained when controlled by the other independent variables. Thus, a much higher likelihood of DCP (vs. no CP) in older age was observed, while the likelihood of nDCP (vs. no CP) was not significantly associated with age. Furthermore, according to our definition of DCP, in the DCP group, the disability would be pain provoked, and the likelihood of that disability would increase by 28% with every 10 years of age.

Multimorbidity

The presence of other chronic diseases was reported by half of the population without CP, by almost three-quarters of the population with CP, and by over four-fifths of the population with DCP. Among individuals with DCP, multimorbidity was much more frequent in women [41]. This gender difference grew with increased age in the DCP population. But again, these differences were not observed in the population with non-disabling CP. In general, the prevalence of DCP is five-fold higher among those with other chronic diseases than among those without (Figure 2). The gender difference in the prevalence of DCP was even greater among those with other chronic diseases. According to allostatic load models [12], CP is more disabling in patients with a larger number of chronic diseases, thus increasing their health risk [11,12].

The prevalence of diseases such as fibromyalgia, arthritis, or rheumatism/osteoporosis was significantly higher in women with DCP when compared to women with nDCP population or women without CP, while the prevalence of those diseases in men is too low to observe significant differences. In general terms, the prevalence of those chronic diseases between the nDCP population and the population without CP does not differ significantly. However, results obtained in the DCP population showed much higher prevalence (Fig. 2). It is not clear, due to the variability within those chronic diseases, that they always result in pain [42-47].

The prevalence of arterial hypertension in the DCP population was more than double that in the nDCP or nCP populations. The mechanisms underlying the association between CP and hypertension have not been fully elucidated, and the allostatic factors involved remain under discussion [48-49]. The population with depression or anxiety showed a prevalence of DCP that was three-fold higher than in the population without, signifying that there is an increase in disability when CP is associated with depression or anxiety [6,14,15,50-52]. We consider these results with caution for two reasons. Firstly, from a neurological point of view, pain and depression interact in a complex relationship of situational and physiological connections that is not yet fully understood[53]. Secondly, depression and anxiety were measured together in our study, through the same variable. Despite this, the association between DCP and these mental disorders highlights the need for psychosocial services in chronic pain management [37].

DCP associated factors

Our study showed that DCP was also associated with having only primary education, being unemployed after having worked previously, unqualified/unskilled employment, low income, low functional social support, poor health habits, impaired quality of life, worse environmental or work conditions and rural life. Further research is necessary on the interaction of lower educational attainment, employment status and type of work. A statistical significant association was found between worse health-related quality of life and DCP, but not with nDCP. Both components of functional and social support, which are considered to play an important role in helping sufferers cope with their pain

[54,55], were significantly lower in the population with DCP, whereas the result was significantly lower for those with nDCP only in the affective component. These results go further than those provided by other studies [6,56,57].

Survey features

Beyond the intrinsic limitations of cross sectional studies such as poor recall or overemphasis on recent events[58], the strength of this study is that it is based on a large-scale population-based survey. Its complex design (multistage stratified sample), large sample size (6.507 individuals), very good response rate (68%) and data gathering (face-to-face home interviews) make it a very reliable source of information. In addition, special efforts were made to avoid sampling biases (for further details please see Methods). Moreover, the EAS includes information on CP and disability which is not available in other important population health surveys, such as the Spanish National Health Survey (www.msssi.gob.es) or the European Health Interview Survey (http://ec.europa.eu/eurostat). It also gathers a large amount of information besides information on CP. For example, information on other diseases, activity limitations, general and employment health, and on usage of healthcare services which permit a comprehensive analysis of CP and associated factors. Andalusia, our sampling region, is the most populated (8,399,618 people) and the second largest in area of the 19 regions in Spain. It is also the fifth most populated region in Europe and it is as populated as other European countries such as Austria or Switzerland. Moreover, we extrapolated the estimations of the DCP prevalence from Andalusia to Spain by applying calibration adjustments. They provide not only a more accurate estimation, but also a more valid one when there is non-coverage bias [30]. Thus, calibration adjustments increased the validity of generalization of DCP prevalence from a smaller area, i.e. Andalusian region, to a larger one, i.e. Spain. Due to the fact that Spain and Andalusia have different sociocultural and economic characteristics, we considered not only sex and age as calibration variables, but also educational level and employment status. All those auxiliary variables are considered in the new calibrated weights. They include information from the Andalusian sample as well as from the Spanish census [36]. Thus, the extrapolated prevalence of DCP from Andalusia to Spain is representative, at least, for all those variables [30]. In addition, the fact that those variables were associated

with the study variable (DCP) provided better results in terms of accuracy and validity of the estimations (that is shown in the multivariate model). This statistical method ensures that survey estimates are coherent with those already in the public domain, while simultaneously reducing sampling error and non-coverage or nonresponse bias [30,59]. When compared with the most important surveys published on CP [1,3,5,55], our study is of the same quality and scope, but of a higher level than other surveys on DCP.

Conclusions

In summary, the characteristics of chronic pain have been widely studied but without considering whether it disables or not. Our study demonstrates that a population with disabling chronic pain is the one which shows really statistically significant differences. Indeed, very few statistically significant differences were found between the nCP and nDCP populations. DCP is an important public health problem [57] which affects a large proportion of the general adult population (11.36% according to our study) with elevated multimorbidity. It has a strong association with social determinants of health (e.g. disfavoured or vulnerable social status, impaired quality of health or poor health habits). Moreover, it is a highly relevant issue for health systems [57] (DCP almost doubles the health services usage compared with nDCP, especially in Primary Care)[60]. Its consequences directly affect partners, families and friends. Therefore, it is a disease that could affect medical practical or political health initiatives, as well as future research areas. Also, the association between DCP and mental disorders highlights the need for psychosocial services in the management of chronic pain. Finally, our study contributes to knowledge on this issue, and provides evidence of the need to advance in the application of simple tools for the identification of individuals with DCP. Future research efforts, healthcare and social interventions should focus on this population and on the prevention of future disability in individuals with nDCP.

CONTRIBUTIONSHIP STATEMENT

ACL conceived the original idea with the participation of JAGH and MCB. ACL designed the analysis plan alongside LGF. Statistical analysis was conducted by LGF and subsequently by ACL. ACL developed the first version of the manuscript in collaboration with MCB for the introduction and discussion and with LGF for the methodology. All authors participated in the writing of subsequent versions and approved the final article.

COMPETING INTERESTS

The authors declare that there is no conflict of interest. The authors are solely responsible for the content and writing of the manuscript.

FUNDING

The *Andalusian Health Survey*, the source of information in this study, is funded by the Ministry of Health of the *Junta de Andalucía*, Spain.

DATA SHARING STATEMENT

Other tables, analyses, statistics and R code not included in the present article are available on demand.

REFERENCES

[1] Toth C, Lander J, Wiebe S. The prevalence and impact of chronic pain with neuropathic pain symptoms in the general population. *Pain Med* 2009; 10(5):918–29.

[2] Johannes CB, Le TK, Zhou X, Johnston JA, Dworkin RH. The prevalence of chronic pain in United States adults: results of an Internet-based survey. *J Pain* 2010; 11: 1230-9.

[3] Langley PC, Ruiz-Iban MA, Tornero Molina JT, de Andres J, Gónzalez-EscaladaCastellón JR. The prevalence, correlates and treatment of pain in Spain. *J Media Econ* 2011; 14: 367-80.

[4] Kennedy J, Roll JM, Schraudner T, Murphy S, McPherson S. Prevalence of persistent pain in the US adult population: new data from the National Health Interview Survey. *J Pain* 2014; 15:979-84.

[5] Breivik H, Collett B, Ventafridda V, Cohen R, Gallacher D. Survey of chronic pain in Europe: prevalence, impact on daily life, and treatment. *Eur J Pain* 2006; 10: 287-333.

[6] Blyth FM, March LM, Brnabic AJ, Jorm LR, Williamson M, Cousins MJ. Chronic pain in Australia: a prevalence study. *Pain* 2001; 89:127-34.

[7] Sakakibara T, Wang Z, Paholpak P, Kosuwon W, Myint T, Kasai Y. A Comparison of Chronic Pain Prevalence in Japan, Thailand, and Myanmar. *Pain Phys* 2013, 16: 603–8.

[8] Wong WS, Fielding R. Prevalence and characteristics of chronic pain in the general population of Hong Kong. *J Pain* 2011; 12: 236-45.

[9] Costa Cabral DM, Botelho Bracher ES, Prescatan Depintor JD, Eluf-Neto J. Chronic Pain Prevalence and Associated Factors in a Segment of the Population of Sao Paulo City. *J Pain* 2014; 15: 1081-91.

[10] Dueñas M, Salazar A, Ojeda B, Fernández-Palacin F, Micó JA, Torres LM, Failde I. A Nationwide study of chronic pain prevalence in the general Spanish population: identifying clinical subgroups trough cluster analysis. *Pain Med* 2014; 16:811-22.

[11] Eriksen J, Jensen MK, Sjogren P, Ekholm O, Rasmussen NK. Epidemiology of chronic non-malignant pain in Denmark. *Pain* 2003; 106:221–8.

[12] Dominick CH, Blyth FM, Nicholas MK. Unpacking the burden: understanding the relationships between chronic pain and comorbidity in the general population. *Pain* 2012; 153: 293-304.

[13] McEwen BS. Stress, adaptation, and disease: Allostasis and allostatic load. *Ann N Y Acad Sci* 1998; 840: 33-44.

[14] Raftery MN, Sarma K, Murphy AW, De la Harpe D, Normand C, McGuire BE. Chronic pain in the Republic of Ireland-community prevalence, psychosocial profile and predictors of pain-related disability: results from the Prevalence, Impact and Cost of Chronic Pain (PRIME) study, part 1. *Pain* 2011;152:1096-103.

[15] Azevedo LF, Costa-Pereira A, Mendonça L, Dias CC, Castro-Lopes JM. Epidemiology of chronic pain: a population-based nationwide study on its prevalence, characteristics and associated disability in Portugal. *J Pain* 2012; 13: 773-83.

[16] Reid MC, Eccleston C, Pillemer K. Management of chronic pain in older adults. *BMJ* 2015; 350:h532.

[17] WHO. International classification of functioning, disability, and health (ICF). World Health Organization. Switzerland: Geneva, 2007. http://www.who.int/classifications/icf/en/. Accessed 17 Oct 2017.

[18] Blyth FM, March LM, Brnabic AJM, Cousins MJ. Chronic pain and frequent use of health care. *Pain* 2004; 111:51-8.

[19] Sánchez-Cruz JJ, GarcíaFernándezLl, Mayoral Cortés JM. Andalusian Health Survey, 2011-12. Consejería de Igualdad, Salud y Políticas Sociales. 2013. http://goo.gl/2BYFhe. Accessed 3 Aug 2017.

[20] Álvarez-González J, Ayuso-Fernández A, Caba-Barrientos F. *Plan Andaluz de atención a las personas con dolor: 2010–2013*. Sevilla: Consejería de Salud. 2010. http://www.juntadeandalucia.es/export/drupaljda/plan_atencion_dolor-1_0.pdf. Accessed 3 Aug 2017.

[21] International Association for the Study of Pain (IASP). Washington. IASP Taxonomy: Pain Terms. 2004. http://www.iasp-pain.org/Taxonomy?navItemNumber=576#Pain. Accessed 3 Aug 2017.

[22] Dapcich V, Salvador G, Ribas L, Pérez C, Aranceta J, Serra-Majem Ll. *Guía de la alimentación saludable*. Sociedad Española de Nutrición Comunitaria. 2004. http://aesan.msssi.gob.es/AESAN/docs/docs/publicaciones_estudios/nutricion/guia_alimentacion.pdf. Accessed 3 Aug 2017.

[23] Vilagut G, Valderas JM, Ferrer M, Garin O, López-García E, Alonso J. Interpretation of SF-36 and SF-12 questionnaires in Spain: physical and mental components. *Med Clin* 2008;130:726-35.

[24] Verbrugge LM. A global disability indicator. *J Aging Stud* 1997;11:337-62. http://aesan.msssi.gob.es/AESAN/docs/docs/publicaciones_estudios/nutricion/guia_alimentacion.pdf. Accessed 9 Oct 2017].

[25] Ayala A, Rodríguez-Blázquez C, Frades-Payo B, Forjaza MJ, Martínez-Martín P, Fernández-Mayoralas G, Rojo-Pérez F. Psychometric properties of the Functional Social Support Questionnaire and the Loneliness Scale in non-institutionalized older adults in Spain. *Gac Sanit* 2012; 26: 317-24.

[26] Chilet-Rosell E, Álvarez-Dardet C, Domingo-Salvany A. Use of Spanish proposals for measuring social class in health sciences. *Gac Sanit* 2012; 26:566-9. http://scielo.isciii.es/pdf/gs/v26n6/original_breve1.pdf. Accessed 3 Aug 2017.

[27] Ewing JA. Detecting alcoholism. The CAGE questionnaire. *JAMA* 1984; 252:1905-7.

[28] WHO. Body Mass Classification. World Health Organization. Switzerland: Geneva, 2015. http://apps.who.int/bmi/index.jsp?introPage=intro_3.html. Accessed 3 Aug 2017.

[29] Nübling M, Burr H, Moncada S, Kristensen T.S. COPSOQ International Network: Co-operation for research and assessment of psychosocial factors at work. *Public Health Forum* 2014; 22: 18.e1–18.e3.

[30] Cabrera-León A, Lopez-Villaverde V, Rueda M, Moya-Garrido MN. Calibrated prevalence of infertility in 30- to 49-year-old women according to different approaches: a cross-sectional population-based study. *Hum Reprod* 2015; 30(11): 2677-85.

[31] Tillé Y, Matei A. R Package sampling: survey sampling 2015:76. https://cran.r-project.org/web/packages/sampling/sampling.pdf Accessed 5 May 2018.

[32] Escobar-Lopez E, Barrios-Zamudio E. SamplingVarEst: Sampling Variance Estimation 2015. https://cran.r-project.org/web/packages/samplingVarEst/samplingVarEst.pdf Accessed 5 May 2018.

[33] Miettenen OS, Cook EF. Confounding: Essence and detection. *Am J Epidemiol* 1981; 144: 593-603.

[34] Menard, S. Coefficients of determination for multiple logistic regression analysis. *Am Stat* 2000; 54: 17-24.

[35] Lumley T. Complex Surveys: A Guide to Analysis Using R. Hoboken: Wiley;2010.

[36] Population and Housing Census 2011. National Statistics Institute (INE, Spanish acronym). http://www.ine.es/en/censos2011_datos/cen11_datos_inicio_en.htm. Accessed 3 Aug 2017.

[37] Häuser W, Schmutzer G, Hilbert A, Brähler E, Henningsen P. Prevalence of Chronic Disabling Noncancer Pain and Associated Demographic and Medical Variables: A Cross-Sectional Survey in the General German Population. *Clin J Pain* 2015;31(10):886-92; doi: 10.1097/AJP.0000000000000173.

[38] Cohen SP, Mao J. Neuropathic pain: mechanisms and their clinical implications. *BMJ* 2014;348:f7656; doi: 10.1136/bmj.f7656.

[39] Reitsma ML, Tranmer JE, Buchanan DM, Vandenkerkhof EG. The prevalence of chronic pain and pain-related interference in the Canadian population from 1994 to 2008. *Chronic Dis Inj Can* 2011;31:157–64.

[40] Bingefors K, Isacson D. Epidemiology, co-morbidity, and impact on health-related quality of life of self-reported headache and musculoskeletal pain – a gender perspective. *Eur J Pain* 2004; 8: 435–50.

[41] Scherer M, Hansen H, Gensichen J et al. Association between multimorbidity patterns and chronic pain in elderly primary care patients: a cross-sectional observational study. *BMC Fam Pract* 2016; 17:68; doi: 10.1186/s12875-016-0468

[42] Slukaa KA, Clauwb DJ. Neurobiology of fibromyalgia and chronic widespread pain. *Neuroscience* 2016; S0306-4522(16)30236-6.

[43] WHO. Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. World Health Organization. Geneva, 1994. http://apps.who.int/iris/bitstream/10665/39142/1/WHO_TRS_843_eng.pdf. Accessed 17 Oct 2017.

[44] Kraus VB, Blanco FJ, Englund M, Karsdal MA, Lohmander LS. Call for standardized definitions of osteoarthritis and risk stratification for clinical trials and clinical use. *Osteoarthr cartilage* 2015; 23(8):1233-41.

[45] Brown AK, Conaghan PG, Karim Z, Quinn MA, Ikeda K, Peterfy CG, Hensor E, Wakefield RJ, O'Connor PJ, Emery P. An explanation for the apparent dissociation between clinical remission and continued structural deterioration in rheumatoid arthritis. Arthritis Rheum. 2008; 58(10):2958-67. doi: 10.1002/art.23945.

[46] Hannan MT, Felson DT, Pincus T. Analysis of the discordance between radiographic changes and knee pain in osteoarthritis of the knee. J Rheumatol. 2000;27(6):1513

[47] Office of the Surgeon General (US). Bone Health and Osteoporosis: A Report of the Surgeon General. Rockville (MD): Office of the Surgeon General (US); 2004. 5, The

Burden of Bone Disease. Available from: https://www.ncbi.nlm.nih.gov/books/NBK45502/

[48] Zota AR, Shenassa ED, Morello-Frosh. Allostatic load amplifies the effect of blood lead levels on elevated blood pressure among middle-age U.S.: a cross-sectional study. *Environ Health Persp* 2013; 12: 64.

[49] Olsen RB, Bruehl S, Nielsen ChS, Rosselandb LA, Eggen AE, Stubhaug A. Hypertension prevalence and diminished blood pressure–related hypoalgesia in individuals reporting chronic pain in a general population: The Tromsø Study. *Pain* 2013; 154: 257-62.

[50] Ohayon MM, Stingl JC. Prevalence and comorbidity of chronic pain in the German general population. *J Psychiat Res* 2012; 46:444-50.

[51] Gerrits MM, Vogelzangs N, van Oppen P, et al. Impact of pain on the course of depressive and anxiety disorders. Pain 2012; 153:429-36.

[52] Loerbroks A, Bosch JA, Mommersteeg PM, Herr RM, Angerer P, Li J. The association of depression and angina pectoris across 47 countries: findings from the 2002 World Health Survey. Eur J Epidemiol 2014; 29: 507-15.

[53] Chopra K, Arora V. An intricate relationship between pain and depression: clinical correlates, coactivation factors and therapeutic targets. Expert Opin Ther Targets. 2014;18(2):159-76. doi: 10.1517/14728222.2014.855720.

[54] Leonardi M, Bickenbach J, Ustun TB, Kostanjsek N, Chatterji S. The definition of disability: what is in a name?. Lancet 2006; 368:1219-21.

[55] Gibson SJ, Lussier MD. Prevalence and relevance of pain in older persons. Pain Med 2012; 13: 23-6.

[56] Smith BH, Elliot AM, Chambers WA, Smith WC, Hannaford PC, Penny K. The impact of chronic pain in the community. *Fam Pract* 2001;18(3):292-9.

[57] Blyth FM, Van Der Windt DA, Croft PR. Chronic Disabling Pain: A Significant Public Health Problem. *Am J Prev Med* 2015; 49 (1): 98-101.

[58] Sedgwick Ph. Cross sectional studies: advantages and disadvantages. BMJ. 2014;348:g2276 doi: 10.1136/bmj.g2276

[59] Cabrera-León A, Rueda M, Cantero-Braojos M. "Calibrated prevalence of disabling chronic pain: a face-to face cross-sectional population study in Southern Spain". *BMJ Open* 2017; 7:e014033; doi:10.1136/bmjopen-2016-014033.

[60] Cabrera-León A, Cantero-Braojos MA. "Impact of disabling chronic pain: results of a cross-sectional population study with face-to-face interview". *Aten Prim* 2017. In press; doi: 10.1016/j.aprim.2017.03.020.

Legends for illustrations and tables

Table 1. Study variables.

Table 2. Sociodemographic characteristics of disabling chronic pain.

Figure 1. Spanish prevalence of disabling chronic pain and non-disabling chronic pain by sex and age groups.

Figure 2. Prevalence of chronic diseases in the studied subpopulations.

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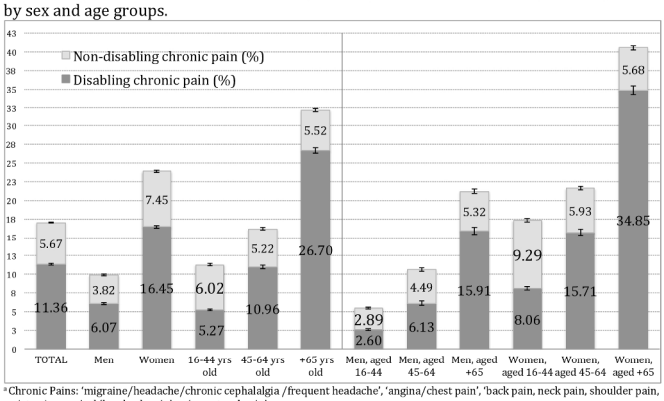
Table 1 supplementary data. Characteristics of the study population.

Table 2 supplementary data. Life habits of the study population.

Table 3 supplementary. Prevalences of chronic pain and of other chronic diseases by sex, age and disabling condition.

Table 4 supplementary data. Disabling chronic pain prevalences according to the presence of other chronic diseases.

Figure 1. Spanish prevalences of disabling chronic pain and non-disabling chronic pain[a] by sex and age groups.



[a] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.

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Figure 2. Prevalence of chronic diseases[a] in the studied subpopulations[b].

Chronic pain population		Non chronic pain population		General population		Disabling chronic pain population		Non disabling chronic pain population	
Chronic disease	%	Chronic disease	%	Chronic disease	%	Chronic disease	%	Chronic disease	%
Hypertension	34.71%	Hypertension	15.33%	Hypertension	18.66%	Hypertension	42.67%	Hypertension	18.61%
High cholesterol	23.78%	High cholesterol	9.94%	High cholesterol	12.32%	Arthritis / rheumatism	28.38%	High cholesterol	15.90%
Arthritis / rheumatism	22.27%	Diabetes*	6.71%	Arthritis / rheumatism	8.68%	High cholesterol	27.68%	Depression / Anxiety	11.64%
Poor blood circulation	18.52%	Arthritis / rheumatism	5.85%	Diabetes*	8.06%	Poor blood circulation	24.22%	Allergies *	10.52%
Depression / Anxiety	17.41%	Depression / Anxiety	5.82%	Depression / Anxiety	7.82%	Depression / Anxiety	20.26%	Arthritis / rheumatism	9.93%
Varicose veins in legs	16.00%	Allergies *	5.53%	Poor blood circulation	6.39%	Varicose veins in legs	19.66%	Varicose veins in legs	8.61%
Diabetes*	14.56%	Poor blood circulation	3.87%	Allergies *	6.25%	Diabetes*	18.42%	Poor blood circulation	7.01%
Allergies *	9.64%	Heart disorders*	3.15%	Varicose veins in legs	4.82%	Heart disorders*	10.30%	Diabetes*	6.76%
Heart disorders*	8.31%	Prostate disorders	3.09%	Heart disorders*	4.03%	Allergies *	9.20%	Prostate disorders **	5.83%
Prostate disorders **	6.94%	Varicose veins in legs	2.50%	Prostate disorders	3.48%	Osteoporosis	8.95%	Cataracts**	4.33%
Osteoporosis	6.43%	Asthma	2.08%	Asthma	2.32%	Prostate disorders **	7.56%	Heart disorders*,**	4.30%
Cataracts	6.16%	Cataracts	1.43%	Cataracts	2.24%	Cataracts	7.07%	Chronic constipation**	3.24%
Hard of hearing	4.63%	Lung*	1.41%	Osteoporosis	2.09%	Hard of hearing	6.26%	Asthma	3.23%
Chronic constipation	4.49%	Cancer*	1.36%	Hard of hearing	1.63%	Hemorrhoids	5.48%	Stomach problems*,**	2.95%
Hemorrhoids	4.30%	Heart attack*	1.24%	Lung*	1.63%	Urinary incontinence	5.23%	Colitis*,**	2.68%
Urinary incontinence	4.12%	Anemia*	1.19%	Anemia*	1.62%	Chronic constipation	5.10%	Lung*,**	1.90%
Fibromyalgia	3.84%	Osteoporosis	1.18%	Cancer*	1.54%	Fibromyalgia	4.95%	Hemorrhoids	1.90%
Anemia*	3.67%	Hard of hearing	1.01%	Heart attack*	1.53%	Anemia*	4.82%	Urinary incontinence**	1.87%
Asthma	3.49%	Kidney	1.00%	Fibromyalgia	1.43%	Kidney	4.28%	Heart attack*,**	1.61%
Stomach problems*	3.13%	Skin problems*	0.96%	Kidney	1.36%	Heart attack*	3.62%	Skin problems*,**	1.61%
Kidney	3.13%	Fibromyalgia	0.93%	Skin problems*	1.30%	Asthma	3.62%	Fibromyalgia	1.60%
Heart attack*	2.95%	Colitis*	0.91%	Colitis*	1.24%	Skin problems*	3.60%	Osteoporosis**	1.35%
Skin problems*	2.94%	Stomach problems*	0.78%	Hemorrhoids	1.21%	Stomach problems*,**	3.22%	Anemia*,**	1.35%
Colitis*	2.85%	Other mental	0.72%	Stomach problems*	1.18%	Stroke*,**	3.22%	Hard of hearing**	1.35%
Lung*	2.68%	Hemorrhoids	0.57%	Chronic constipation	1.17%	Lung*,**	3.07%	Cancer*,**	1.33%
Cancer*	2.40%	Stroke*	0.53%	Urinary incontinence	1.12%	Colitis*,**	2.93%	Other mental	0.81%
Stroke*	2.24%	Cirrhosis*	0.50%	Stroke*	0.83%	Cancer*,**	2.93%	Kidney**	0.80%
Cirrhosis*,**	1.43%	Urinary incontinence	0.50%	Other mental	0.72%	Cirrhosis*,**	1.86%	Infertility**	0.54%
Infertility**	0.71%	Chronic constipation	0.48%	Cirrhosis*	0.66%	Infertility**	0.80%	Cirrhosis*,**	0.54%
Other mental**	0.71%	Infertility**	0.14%	Infertility**	0.24%	Other mental	0.66%	Stroke*,**	0.26%

[a] Question: 'Has a healthcare professional [physician/nurse] told you that you suffer from ...?'
[b] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.
* Cancer, malignant tumor, including leukemia, lymphoma; Diabetes / high blood sugar / sugar in urine; hypertension; Chronic colitis and intestinal diseases / inflammatory bowel disease / Cohn's disease; stomach ulcer / duodenum; Chronic lung disease / emphysema / chronic bronchitis; Cardiac disorders / cardiac failure / congestive cardiac failure; Myocardial infarction / heart attack; Chronic skin problems; Chronic allergies (such as rhinitis, eye inflammation, dermatitis, food allergies, etc.), excluding allergic asthma; Anemia or other blood disease; Stroke / cerebral hemorrhage; Hearing loss / hearing problems; Cirrhosis / hepatic disease / hepatic dysfunction;
** Coefficient of variation> 20%; therefore, the results should be interpreted with caution.

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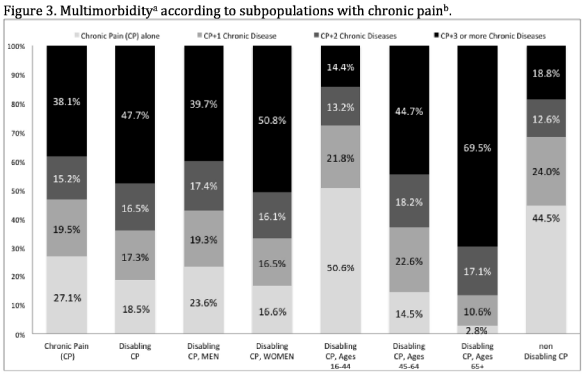
Figure 3. Multimorbidity[a] according to subpopulations with chronic pain[b].



[a] Question: 'Has a healthcare professional [physician/nurse] told you that you suffer from one or more of the following Chronic Diseases ...?'
[b] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.

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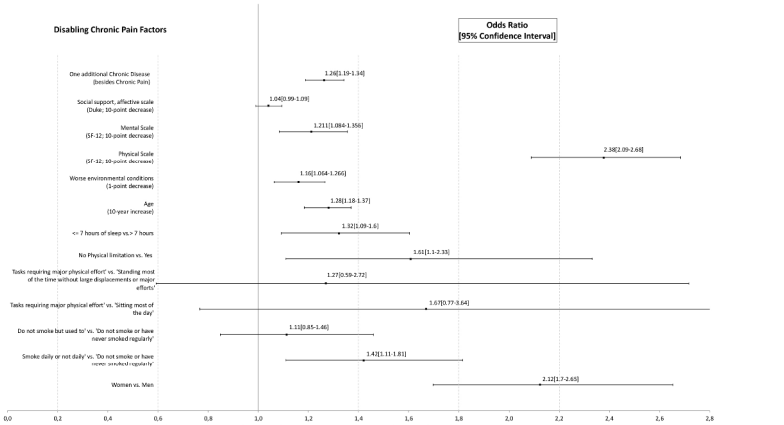
Figure 4. Factors associated with disabling chronic pain [a,b].



[a] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain'.

[b] The odds ratios are calculated based on the following reference categories/values: Sex = Male; Tobacco = Do not smoke or have never smoked regularly; Physical activity = 'Tasks requiring major physical effort; Physical limitations = Yes; Sleep > 7 hours; Age = 45.4; Physical Component Score (PCS_SF-12) = 51.12; Mental Component Score (MCS_SF-12) = 50.67; Affective social support (Duke) = 81.01; Number of chronic diseases (besides CP) = 1.07; Environmental conditions = 5.83.

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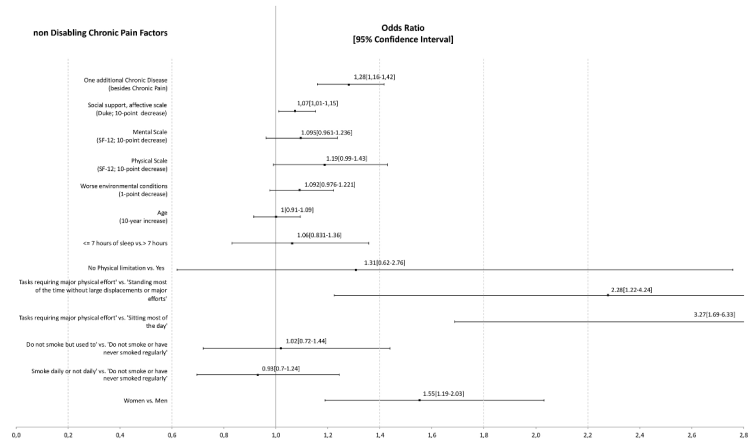
Figure 5. Factors associated with non-disabling chronic pain [a,b].



[a] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain'.

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296x209mm (300 x 300 DPI)

Table 1 supplementary data. Distribution of the sample on sociodemographic variables[a].

Variables (individuals with missing data; %)	Category (population aged ≥16 years; total n=6,507)	Percentage (sample sizes)	95% Confidence Interval	
			Minimum	Maximum
Sex (0)	Male	49.3% (3209)	48.1%	50.5%
	Female	50.7% (3298)	49.5%	51.9%
Age (0)	Aged 16-24 years	13.3% (867)	12.5%	14.2%
	25-44	39.3% (2556)	38.1%	40.5%
	45-54	16.7% (1087)	15.8%	17.6%
	55-64	12.3% (799)	11.5%	13.1%
	65-74	9.6% (626)	8.9%	10.4%
	+75	8.8% (572)	8.1%	9.5%
Marital Status (8, 0.1%)	Married	59.6% (3805)	58.4%	60.8%
	Single	29.6% (1882)	28.5%	30.7%
	Separated	1.9%(123)	1.6%	2.2%
	Divorced	2.8% (178)	2.4%	3.2%
	Widowed	8% (511)	7.4%	8.7%
Cohabiting (66, 2.6%)		64.9%(4180)	63.7%	66%
Social Class [27] (1359, 20.9%)	I. Manager with 10<salaried staff	5.3% (275)	4.8%	6%
	II. Manager with 10>salaried staff	7.5% (384)	6.8%	8.2%
	IIIa. Administrative staff	12.7% (654)	11.8%	13.6%
	IIIb. Self-employed	4.9% (253)	4.4%	5.5%
	IIIc. Manual work supervisor	1.7% (87)	1.4%	2.1%
	IVa. Qualified manual worker	23.6% (1216)	22.5%	24.8%
	IVb. Manual worker	21.5% (1107)	20.4%	22.6%
	V. Unskilled worker	22.8% (1170)	21.7%	23.9%
	VI. Others	0.04% (2)	0%	0.2%
Educational Level (11, 0.2%)	Illiterate	2.1% (136)	1.8%	2.5%
	No formal education but can read and write	11.6% (756)	10.9%	12.4%
	Up to 5 years primary schooling (Early education)	19.5% (1263)	18.5%	20.4%
	Up to 8 years primary schooling	23.8% (1543)	22.7%	24.8%
	Up to 4 years secondary schooling (lower secondary)	9.1% (590)	8.4%	9.8%
	First cycle of vocational training	5.3% (345)	4.8%	5.9%
	Second cycle of vocational training	6.5% (420)	5.9%	7.1%
	Up to 6 years secondary schooling (upper secondary)	9.1% (593)	8.4%	9.8%
	Short-cycle tertiary education (diploma) or Bachelor's degree	7.1% (465)	6.6%	7.8%
	Master's degree or PhD	5.9% (385)	5.4%	6.5%
Employment Situation (3, 0.05%)	Employed	34,1% (2221)	33%	35,3%
	Unemployed but previously worked	21,5% (1398)	20,6%	22,5%
	Seeking first employment	1% (66)	0,8%	1,3%
	Retired (previously employed)	14,4% (938)	13,6%	15,3%
	Home keeper	18,1% (1178)	17,2%	19,1%
	Student	8,1% (527)	7,5%	8,8%
	Handicap/Permanent Disability	2,5% (160)	2,1%	2,9%
	Other	0,2% (16)	0,2%	0,4%
Economic difficulty to make ends meet (30, 0.5 %)	Very difficult	12.7% (819)	11.9%	13.5%
	Difficult	18.4% (1190)	17.5%	19.3%
	Somewhat difficult	30% (1944)	28.9%	31.1%
	Somewhat easy	25.5% (1651)	24.4%	26.5%
	Easy	12.5% (813)	11.8%	13.4%
	Very easy	0.9% (60)	0.7%	1.2%
Total net household income (1540, 23.7%)	Up to 300 euros	0.7% (36)	0.5%	1%
	From 301 to 499 euros	4.3% (212)	3.7%	4.9%
	From 500 to 999 euros	27.6% (1368)	26.3%	28.8%
	From 1000 to 1499 euros	37.6% (1866)	36.2%	38.9%
	From 1500 to 1999 euros	17% (844)	16%	18.1%
	From 2000 to 2499 euros	8.1% (401)	7.3%	8.9%
	From 2500 to 2999 euros	3.2% (157)	2.7%	3.7%
	From 3000 to 4999 euros	1.5% (72)	1.2%	1.8%
	More than 5000 euros	0.2% (11)	0.1%	0.4%

[a] The sample design was not considered in this table

Table 2 supplementary data. Distribution of the sample on life habits variables[a].

Variables (missing responses; %)	Category (population aged +16; total n=6,507)	Percentage (sample sizes)	95% Confidence Interval	
			Minimum	Maximum
Suspected alcoholism		3.1% (204)	2.7%	3.6%
Consumption of alcoholic beverages (2; 0.03%)	Yes, consumption of alcoholic beverage	44.4% (2891)	43.2%	45.6%
	Yes, but less than once a month	13.3% (864)	12.5%	14.1%
	No, no consumption of alcoholic beverage	42.3% (2750)	41.1%	43.5%
Smoker (3; 0.05%)	Yes, smoke daily	30.9% (2011)	29.8%	32.1%
	Yes, smoke but not daily	2.4% (157)	2.1%	2.8%
	Do not smoke but used to	17.5% (1137)	16.6%	18.4%
	Do not smoke or have never regularly smoked	49.2% (3199)	48%	50.4%
Body Mass Index [30] (0)	Low weight	3.8% (247)	3.4%	4.3%
	Normal weight	37.3% (2428)	36.1%	38.5%
	Overweight	39.7% (2585)	38.5%	40.9%
	Obesity I	17.1% (1113)	16.2%	18%
	Obesity II	2.1% (134)	1.7%	2.4%
Physical activity in the workplace or usual activity (47; 0.7%)	Sitting most of the workday	30.4% (1964)	29.3%	31.5%
	Standing most of the time without major movement or effort	55.8% (3605)	54.6%	57%
	Walking, carrying some weight. Frequent movement	11.5% (737)	10.7%	12.2%
	Hard work, tasks requiring major physical effort	2.4% (154)	2%	2.8%
Physical exercise in free time (3; 0.05%)	No physical activity	26.8% (1742)	25.7%	27.9%
	Occasional physical or sporting activity	55.9% (3639)	54.7%	57.1%
	Regular physical activity, several times a month	12% (779)	11.2%	12.8%
	Physical training several times a week	5.3% (344)	4.8%	5.9%
Dairy product consumption (7; 0.1%)	Daily	90.9% (5909)	90.2%	91.6%
	Three or more times a week	2.9% (191)	2.6%	3.4%
	One / two times a week	2.5% (163)	2.2%	2.9%
	Less than 1 time week	0.8% (52)	0.6%	1%
	Never or almost never	2.8% (185)	2.5%	3.3%
Fresh fruit consumption (11; 0.2%)	Daily	63.8% (4144)	62.6%	64.9%
	Three or more times a week	21.7% (1405)	20.7%	22.7%
	One / two times a week	9.6% (623)	8.9%	10.3%
	Less than once a week	2.9% (190)	2.5%	3.4%
	Never or almost never	2.1% (134)	1.8%	2.4%
Vegetables consumption (14; 0.2%)	Daily	41% (2665)	39.9%	42.1%
	Three or more times a week	34.1% (2211)	33%	35.2%
	One / two times a week	19.8% (1287)	18.9%	20.8%
	Less than once a week	3.7% (240)	3.3%	4.2%
	Never or almost never	1.4% (90)	1.1%	1.7%
Sweets consumption (30; 0.5%)	Daily	18.4(1191)	17.4%	19.3%
	Three or more times a week	25.2% (1629)	24.2%	26.2%
	One / two times a week	28% (1814)	27%	29.1%
	Less than once a week	14% (908)	13.2%	14.9%
	Never or almost never	14.4% (935)	13.6%	15.3%

[a] The sample design was not considered in this table

Table 3 supplementary. Prevalences of chronic pain and of other chronic diseases by sex, age and disabling condition.

Variables			Condition		Disabling Condition (Subpopulation with the condition/s)		Disabling Condition (Total population)	
			Prevalence	95% Confidence Interval	Prevalence[b]	95% Confidence Interval	Prevalence[c]	95% Confidence Interval
Chronic Pain[a]	Total		17.2%	16.3-18.12	66.9%	64.14-69.55	11.5%	10.73-12.28
	Sex (p<0.001)	Women	23.9%	22.5-25.4	68,2%	64.9-71.3	16.3%	15.1-17.6
		Men	10.3%	9.3-11.4	63,9%	58.6-68.8	6.6%	5.8-7.5
	Age groups (p<0.001)	16-44 yrs	11.4%	10.4-12.5	48.2%	43.4-53.1	5.5%	4.8-6.3
		45-64	18.2%	16.5-20	70.4%	65.3-75	12.8%	11.4-14.4
		+65	32.3%	29.7-35	82.7%	78.6-86.1	26.7%	24.2-29.2
At least one Chronic Disease (besides Chronic Pain)	Total		45.9%	44.67-47.08	59.7%	58-61.47	29.5%	28.45-30.66
	Sex (p<0.001)	Women	52.9%	51.2-54.6	64.5%	62.2-66.7	36.8%	35.2-38.5
		Men	38.6%	37-40.3	53.1%	50.3-55.8	22.1%	20.7-23.5
	Age groups (p<0.001)	16-44 yrs	23.7%	22.3-25.1	43.3%	40-46.7	13%	11.9-14.2
		45-64	56.9%	54.6-59.1	56.6%	53.6-59.5	34%	31.9-36.2
		+65	92.1%	90.4-93.5	74.9%	72.3-77.4	69.7%	67.1-72.3

[a] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.
[b] Percentage of disabling population within that population with the corresponding condition (chronic pain or at least one chronic disease).
[c] Percentage of population with both disabling and the corresponding condition (chronic pain or at least one chronic disease).

Table 4 supplementary data. Disabling chronic pain[a] prevalences according to the presence of other chronic diseases.

Variables		POPULATION WITH OTHER CHRONIC DISEASES (total n=2987; n men=1,240; n women=1,747)		POPULATION WITHOUT OTHER CHRONIC DISEASES (total n=3,520; n men=1969; n women=1,551)	
		Prevalence[b] (Significance[c])	95% Confidence Interval	Prevalence[b] (Significance)	95% Confidence Interval
Disabling Chronic Pain	Total	20.4%	19-21.9	3.9%	3.3-4.6
	Women	25.7% (p<0.001)	23.7-27.8	5.7% (p=0.042)	4.7-7.0
	Men	13.1%	11.3-15.0	2.5%	1.9-3.3
	Ages 16-44	11.5%	9.5-13.8	3.0%	2.4-3.7
	45-64	19.3%	11.0-21.7	4.3%	3.2-5.9
	+65	28.1%(p < 0.001)	25.6-30.9	9.5%(p=0.001)	5.0-17.2
Non-disabling Chronic Pain	Total	6.9%	6-7.9	4.7%	4-5.7
	Women	8.0% (p<0.001)	6.8-9.3	7.2% (p<0.001)	6.0-8.6
	Men	5.4%	4.3-6.8	2.7%	2.1-3.5
	Ages 16-44	9.4%(p < 0.001)	7.5-11.6	3.0%	2.4-3.7
	45-64	6.4%	5.1-8.0	3.8%	2.7-5.4
	+65	5.5%	4.3-7.1	6.3%	2.9-13.3

[a] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.
[b] Prevalence of disabling or non-disabling chronic pain within the population with or without other chronic diseases.
[d] p-values are located in the cells where there are statistical significant differences.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Reported on manuscript page
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1-2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7, Table 1
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-6, Table 1
Bias	9	Describe any efforts to address potential sources of bias	6-8,12-13
Study size	10	Explain how the study size was arrived at	5-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6, Table 1
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7-8
		(*b*) Describe any methods used to examine subgroups and interactions	7-8
		(*c*) Explain how missing data were addressed	Tables 1 and 2, supplementary data online
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	7-8
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	

		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Tables 1 and 2, supplementary data online Figures 1-3
		(b) Indicate number of participants with missing data for each variable of interest	Tables 1 and 2, supplementary data online
Outcome data	15*	Report numbers of outcome events or summary measures	8-12, Table 3 supplementary data online
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-12, Table 2 and Figures 4a and 4b
		(*b*) Report category boundaries when continuous variables were categorized	Yes
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	9-10, Table 2
Discussion			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17

*Give information separately for exposed and unexposed groups.

BMJ Open

Living with disabling chronic pain: results from a face-to-face cross-sectional population-based study.

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2017-020913.R2
Article Type:	Research
Date Submitted by the Author:	18-Aug-2018
Complete List of Authors:	Cabrera-León, Andrés; Lecturer. Andalusian School of Public Health, Instituto de Investigación Biosanitaria ibs.GRANADA, Hospitales Universitarios de Granada/Universidad de Granada, Granada. Spain. Researcher. Biomedical Research Networking Centre on Public Health and Epidemiology (CIBERESP), Madrid. Spain. Cantero-Braojos, Miguel; Psychologist and Clinical Physiotherapist. MenSana Psichology and Health Clinic. Granada. Spain. Garcia-Fernandez, Llenalia; Ph.D. Seplin Statistical Solutions, Granada. Spain. Guerra de Hoyos, Juan; Primary Care Physician, Seville. Spain.
Primary Subject Heading:	Epidemiology
Secondary Subject Heading:	Epidemiology, Public health
Keywords:	Chronic pain, Disability, Multimorbidity, Activity restriction, cross-sectional study, Quality of life

TITLE

Living with disabling chronic pain: results from a face-to-face cross-sectional population-based study.

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The number of words in the manuscript is 3897.

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TITLE

Living with disabling chronic pain: results from a face-to-face cross-sectional population-based study**.**

ABSTRACT

Objectives: To estimate the prevalence of disabling chronic pain in Spanish adults, to analyse its characteristics, to determine its multimorbidity, and to identify its associated factors.

Settings: 2011 Andalusian Health Survey, a cross-sectional population survey based on face-to-face home interviews.

Participants: 6,507 people aged 16 or older and living in Andalusia, Spain.

Outcomes: The response variable was disabling chronic pain. Multivariate multinomial logistic regression models were used to analyse the association of factors with disabling chronic pain. The sample design was considered throughout the statistical analysis.

Results: The prevalence of disabling chronic pain in the Spanish adult population was 11.36% (95%CI=[11.23-11.49], while that of non-disabling chronic pain was 5.67% (95%CI=[5.57-5.77]. Disabling chronic pain was associated with high multimorbidity (especially in women [51%] and in the elderly [70%] with three or more additional chronic diseases), as well as with disadvantaged social status [such as female gender (OR=2.12), advanced age ($OR_{10\text{-years increase}}$=1.28), unemployment (OR=1.33), manual work (OR=1.26), low income (OR=1.14) and reduced emotional social support (OR=1.04)]. Other influential factors were tobacco consumption (OR=1.42), sleeping≤7h

(OR=1.2)], environmental or work conditions (OR=1.16), and quality of life (OR_{mental}=1.21, $OR_{physical}$=2.37).

Conclusions: The population with disabling chronic pain was associated with multimorbidity, vulnerable social status and an impaired quality of life. In contrast, the population with non-disabling chronic pain showed almost no differences when compared with the population without chronic pain. The association between DCP and mental disorders highlights the need for psychosocial services in the management of chronic pain.

Keywords: Chronic pain, Disability, Multimorbidity, Activity restriction, Cross-sectional study, Quality of life.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This study provides a comprehensive epidemiological approach to disabling chronic pain.
- It includes information on chronic pain and disability which is not available in other important population health surveys, such as the European Health Interview Survey.
- It is based on a large-scale cross-sectional population-based survey which is a reliable source of information. In addition, special efforts were made to avoid sampling biases.
- However, it does not include muscle and joint pain in the lower and upper extremities (except the shoulder) nor various traumatological, postsurgical, or neuropathic conditions.

- It would have been preferable to construct the chronic pain variable from one simple overall question rather than from other chronic disease variables.

INTRODUCTION

Estimations of the prevalence of chronic pain (CP) have varied widely among studies [1-4]. It has been estimated to range between 12 and 42% worldwide (in people over 18 years old), between 12 and 30% in Europe [5] and between 19 and 30.7% in the USA [2,4]. It was reported to be 35% in Canada [1], 18.5% in Australia [6], 17.5% in Japan [7], 35% in Hong Kong [8], 42% in Sao Paulo [9], between 12 and 17.25% in Spain [3,5,10].

Most population health surveys on CP have considered it as a symptom of different chronic diseases, while others have considered CP as an independent entity and have associated it with various comorbidities [11,12]. These studies, on the basis of allostatic load models [13], found that the capacity of individuals to adapt to stress factors can be impaired by the presence of CP and two or more comorbidities, thus increasing health risks.

The impact of CP is greater when it limits activities of daily living (ADL)[2,3,5,14-16]. The World Health Organization (WHO) includes disability-related ADL limitations within the "International Classification of Functioning, Disability, and Health" (ICF Model)[17]. This biopsychosocial model considers disability as a state of impaired functioning associated with disease, disorder, lesion, or other health conditions, when it is experienced as a deficiency, a limitation on activity, or a restriction to participation in any area of life. There have been numerous studies on disability in different diseases, but few on its relationship with CP. These studies found a higher frequency of ADL-limiting CP or disabling CP (DCP) in women and in individuals with a lower socioeconomic level, health-related unemployment, elevated depression indicators [14-16], and a higher number of visits to their physician [18]. However, questions remain regarding the differences between DCP and non-disabling CP (nDCP) and their effects.

With this background, the objectives of this study were to calculate the prevalence of DCP in Spanish adults through key sociodemographic characteristics, to determine its multimorbidity, and to identify associated factors.

MATERIAL AND METHODS

Design

The *Andalusian Health Survey (EAS, Spanish acronym)* [19], the information source, is a population-based and cross-sectional survey that uses face-to-face home interviews. It is designed to evaluate the health of population and their usage of health services in Andalusia, Spain. The study population was adults (≥16 yrs) living in Andalusia. Those people who were institutionalized (e.g. hospitals, nursing home, prison…) were excluded from the survey, as well as those with cognitive difficulties as to be interviewed.

A multistage stratified sample design was adopted for our research. The sampling units were municipalities, census tracts, households, and individuals. The strata were province (8), size of municipality (5) and season of the year (4). Municipalities and census tracts were selected in proportion to the population size, while households were selected with equal probability by systematic sampling. The interviewees applied quotas for each province as well as quotas for sex-age and the size of municipality within each province. A virtually constant assignation was performed per census tract (7-10 adults), and one adult per household was selected for interview. The information was collected between March of 2011 and February of 2012. (For further details please refer to the health survey report) [19].

Ethical approval

The EAS was supervised and approved by the review board of the General Secretariat of Quality and Public Health in the Health Ministry of the Andalusian Regional Government.

Sample and data collection

112 municipalities and 696 census tracts were selected, and 6,507 valid personal face-to-face interviews were conducted at home (p=q=0.5; confidence level = 95%; precision=0.0149; design effect =1.525), with a response rate of 67.9% (the no respondent percentage was due to refusal to participate once the household had been contacted). The average interview time was 28.84 minutes (SD=6.8, median=30 minutes).

The effects of non-coverage were minimized by selecting the study population within a sampling framework based on census districts and households. To minimize nonresponse, the interviews were held 7 days per week between 10:00 and 21:00, and interviewers were trained in both field work and in the study's methodology. In addition, the survey administration was supervised and followed up, and non-responders were replaced with people of the same sex and age in a randomized manner from the same district. Moreover, we also took measures to minimize information/observation/measurement biases by providing adequate training for interviewers (see above), and by following interviews up either in-person or with telephone calls (43.1%). The questionnaire was designed with filters and controls to facilitate verification of its correct completion (100% of questionnaires were reviewed), and the sampling design was considered in the data analyses.

Patient and Public Involvement

This study did not involve patients and the public.

Variables

The study variable was DCP. This is composed of disability (WHO, 2006) and CP [20-21]. The disability definition encompasses impairments, activity limitations and participation restrictions. The question about impairments (problems in body function/structure) was whether a doctor or a nurse had told the interviewees that they suffered from any of a wide list of chronic diseases (Table 1). It was asked during home-based face-to-face interviews. Activity limitation and participation restrictions were constructed as population who declared that they were limited in their activity when asked about each of the chronic diseases listed (i.e. they were asked about it for each chronic disease). Finally, CP was established according to those individuals who reported a chronic disease that included the word 'pain', namely: migraine/headache/chronic cephalalgia /frequent headache'; 'angina/chest pain'; 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain'; or 'menstrual pain'. The independent variables are also listed in Table 1.

Table 1. Study variables

Disabling Chronic Pain (DCP, dependent variable): Population with CP who declared being limited in their activity by any of the above-reported chronic pains. The non-disabling CP and non-CP population was also defined with this variable
Chronic Pain (CP): individuals who declared that a doctor or a nurse had told them that they suffered from one or more of the following Chronic Diseases in the survey that included the word 'pain' [20,21]: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.
Demographic and economic characteristics: Sex and age (age groups: 16-44 years; 45-64; + 65), marital status, cohabitation, living alone at home, social class [22] educational level, employment status, economic difficulty to make ends meet, total revenues.
Number of the following chronic diseases reported (at home, face-to-face) by the individuals: cancer, diabetes, hypertension, high cholesterol, colitis and chronic intestinal disease/ inflammatory bowel disease; stomach ulcer; chronic constipation; chronic lung disease; asthma; cardiac disorder; heart attack; fibromyalgia; chronic skin problems; chronic allergy; anaemia; poor circulation; varicose leg veins; haemorrhoids; stroke; depression or anxiety; other mental problems; hearing loss; cataract; arthritis or rheumatism; osteoporosis; cirrhosis; kidney disease; urinary incontinence; infertility; prostate disorder (men); thyroid diseases. Chronic diseases in the CP dependent variable were excluded.
Health-related quality of life (physical and mental component; SF-12) [23].
Question on self-rated health status in the last 12 months [24].
Functional social support: total score and as confidant and affective dimensions [25].
Sleep and rest during sleeping hours
Limitation, disability or physical, sensory or mental handicap for more than 6 months
Healthy eating habits as [26]: 1.5 or more litres of water per day; milk, fruit, vegetables, fish, 3 or more times per week; bread and cereal, one or more times per week; legume, pasta, rice, potatoes, 3 or more times per week (without being daily) or less than once per week; meat, 2 or more times per week (without being daily); sausage, 1 or 2 times per week or never/almost never; eggs: 1 or 2 times per week. Sweets: less than once a week or never/almost never
Suspected alcoholism [27], frequency of consumption of alcoholic beverages, tobacco consumption.
Body Mass Index (BMI) as continuous variable and categorized as: low weight (BMI<18.5kg/m^2); normal weight (18.5kg/m^2≤BMI<25kg/m^2); overweight (25kg/m^2≤BMI<30 kg/m^2); obesity (BMI≥30 kg/m^2) [28]. Both size and weight were measured objectively.
Physical activity in the workplace and physical exercise in free time
Environmental quality of the area of residence from responses to general self-assessment questions and items on noise, smell, air pollution, industry, green areas, delinquency/insecurity and heavy traffic. The sum of the scores for these items was calculated and then categorized into tertiles ($q_{33.34}$=18; $q_{66.66}$=19). Factor analysis was also performed using these variables, obtaining the following two main factorsbad odours and atmospheric pollution; and safety, noise, and green spaces.
Physical work conditions (working population), The sum of the scores for the 7 items (Liker scale responses, 1 to 4) was calculated and then categorized into tertiles ($q_{33.34}$=20; $q_{66.6}$=24).
Psychosocial level occupational exposure [29] (working population), considering two components: 1) psychological demands and; 2) active work and development possibilities, such as influence, skill and time control. For both components, the sum of the scores for the corresponding items (Liker scale responses 1 to 5) and then categorized into 3 tertiles ($q_{33.34}$=10 y $q_{66.66}$=15, component 1; $q_{33.34}$=26 y $q_{66.66}$=34, component 2).

Statistical analysis

Data, for dependent variables and their crossing with independent variables, were reported on estimations based on the sampling design for percentages, means, population totals, 95% confidence intervals (CI95%), sampling errors, coefficients of variation, corrected typified residuals, and p-values obtained in the statistical tests (Pearson's chi-square test corrected with second-order Rao-Scott and Mann-Whitney U tests). Estimations for Spain on CP, DCP and nDCP prevalences, populations and

variances, were calculated by applying a calibration technique based on marginals and on the chi-square distance. In accordance with the calibration requirements [30], the auxiliary variables selected were sex, age, educational level and employment status. The 'sampling' R package [31] was used for the sample design and calibration weightings in estimations of DCP prevalence, and 'samplingVarEst' package [32] for its variance estimation.

Factor analysis was performed on environmental quality items (Table 1) and multivariate multinomial logistic regression models were used to analyse the association of factors with DCP, nDCP, and absence of CP (nCP). A model was initially adjusted using a backwards-stepwise procedure, using sociodemographic variables as control variables along with the remaining secondary variables. Those furthest from significance (at 5%) were successively and manually excluded, verifying at each step that the exclusion did not change the value of the other parameters by>30% of their previous value. Variables were re-entered in the model as confounding variables if a change>30% was observed [33]. Variables with missing data for over 3.5% of a subpopulation (e.g. working population, population over 65 years old) or treated differently (e.g. categorization or coding) were not included in the multivariate. The effects of age and gender interactions with the remaining independent variables were also verified in the data modelling process, and only those that were statistically significant were considered in the final model. Model assumptions were verified using residuals, model convergence, continuous variable linearity, variations in estimation standard error, and Nagelkerke R-square values [34]. With respect to collinearity, it was checked by studying, covariates correlation (rho>0.7) and checking parameter correlations. The association between those included in the model was lower than 0.3.

Simple and stacked bar graphs and OR synthesis graphs were created. We used advanced sampling module of SPSS as well as an approximation of sampling with replacement. This gave the equivalence with probability proportional to size sampling (PPS)[35]. Individual case weight was used to adjust for municipality's population [36] following the method described in the Andalusian Health Survey [19].

Significance was considered at 5% and the sample design was considered throughout the statistical analysis (descriptive, bivariate and multivariate).

RESULTS

The main sociodemographic, economic and daily life habits characteristics of the study population as well as the number (%) missing for each variable are listed in supplementary data online as Tables 1 and 2.

Disabling CP: prevalence

The prevalence of CP in the Spanish adult population was 17.03% (CI95%=[16.88-17.19]), in which 11.36% of that population suffered from DCP (95%CI=[11.23-11.49]; 4,441,556 individuals), while nDCP was reported by 5.67% (95%CI=[5.57-5.77]; 2,178,107 individuals). Of the participants with CP, pain was considered responsible for limitation in some daily life activities by 67% (Table 3, supplementary data online). DCP prevalence was three-fold higher in women than in men up to the age of 45 years old and two-fold higher in older ages. nDCP was significantly more frequent in women *versus* men up to the age of 45 years old, but there was no significant gender difference in older ages (Fig. 1). The mean age in the population with DCP was 58.5 years (95%CI 57.2-59.8]), which is significantly higher than in the population with nDCP and nCP (45.3 and 43.7 years, respectively; p<0.001]).

Figure 1. Spanish prevalence of disabling chronic pain and non-disabling chronic pain by sex and age groups

Disabling CP: characteristics

The prevalence of DCP was significantly higher (p<0.001) among the following: those who lived alone (19.5%), widows/widowers (29.6%), unskilled workers (15.1%); those who were illiterate (28.8%), those literate but with no schooling (24.9%), those who had only received primary schooling (15%); those reporting difficulties in reaching the end of the month (14.1%) and those with a net household income <1,000€/month

(17%). However, nDCP was not significantly associated with any one of these characteristics.

A significantly higher likelihood of DCP (adjusted for age and sex) was found in those belonging to manual labour social classes (OR_{manual}=1.26), those with a lower schooling level ($OR_{Illiterate\ or\ literate\ but\ with\ no\ schooling}$ =1.61; $OR_{Primary\ schooling}$ =1.57), those who were unemployed but had worked previously *versus* those in employment (OR=1.33), and the residents of more rural areas (OR=1.28; Table 2).

Table 2. Sociodemographic characteristics of disabling chronic pain and non-disabling chronic pain[a,b].

OUTCOMES	INDEPENDENT VARIABLES	Categories	p-value	Odds Ratio	95% Confidence Interval	
					Minimum	Maximum
Disabling Chronic Pain (reference category: no Chronic Pain)	Social class (p=0.68)	I. Manager with 10<salaried staff	0.196	0.704	0.413	1.199
		II. Manager with 10>salaried staff	0.231	0.776	0.512	1.176
		IIIa. Administrative staff	0.215	0.806	0.573	1.134
		IIIb. Self-employed	0.187	0.73	0.458	1.165
		IIIc. Manual work supervisor	0.673	0.839	0.37	1.9
		IVa. Qualified manual worker	0.603	0.929	0.704	1.226
		IVb. Manual worker	0.836	0.973	0.748	1.265
		V. Unskilled worker	.	1	.	.
	Social class (short version) (p=0.107)	Non-manual (I-III)	.	1		
		Manual (IV-V)	0.034	1.259	1.017	1.56
	Level of Education (p=0.056)	Illiterate/No formal education	0.014	1.615	1.104	2.364
		Primary education	0.008	1.57	1.127	2.187
		Lower Secondary/First-cycle Vocational Training	0.139	1.366	0.903	2.066
		Upper Secondary / Second-cycle Vocational Training	0.378	1.197	0.802	1.786
		University education	.	1	.	.
	Employment Situation (p<0.001)	Unemployed but previously worked	0.047	1.327	1.004	1.754
		Seeking first job or student	0.031	0.444	0.213	0.929
		Retired (previously employed)	<0.001	1.86	1.347	2.567
		Home keeper	0.214	1.199	0.9	1.598
		Handicap/Permanent Disability	<0.001	5.976	3.897	9.166
		Employed	.	1	.	.
	Net monthly household income (p=0.024)	-999€	0.61	1.14	0.688	1.889
		1000 - 1499 €	0.617	1.136	0.689	1.873
		1500 - 2499€	0.448	0.817	0.484	1.378
		+2500€		1		
	Rurality Index (p=0.05)	Rurality (continuous)	0.02	1.28	1.04	1.576
Non-disabling chronic pain (reference category: no Chronic Pain)	Social class (p=0.68)	I. Manager with 10<salaried staff	0.321	0.68	0.317	1.458
		II. Manager with 10>salaried staff	0.12	1.49	0.902	2.463
		IIIa. Administrative staff	0.454	1.188	0.756	1.868
		IIIb. Self-employed	0.977	0.991	0.52	1.886
		IIIc. Manual work supervisor	0.232	0.295	0.04	2.187
		IVa. Qualified manual worker	0.461	1.163	0.778	1.739
		IVb. Manual worker	0.34	1.205	0.821	1.77
		V. Unskilled worker	.	1	.	.
	Social class (short version) (p=0.107)	Non-manual (I-III)	.	1		
		Manual (IV-V)	0.882	1.021	0.773	1.35
	Level of Education (p=0.056)	Illiterate/No formal education	0.347	1.268	0.773	2.081
		Primary schooling	0.97	0.993	0.68	1.45
		Lower Secondary/ First-cycle Vocational Training	0.21	1.329	0.852	2.074
		Upper Secondary / Second-cycle Vocational Training	0.482	0.845	0.528	1.351
		University education	.	1	.	.
	Employment Situation (p<0.001)	Unemployed but previously worked	0.943	0.988	0.714	1.368
		Seeking first job or student	0.552	0.848	0.492	1.46
		Retired (previously employed)	0.942	1.017	0.649	1.592
		Home keeper	0.121	0.737	0.502	1.084
		Handicap/Permanent Disability	0.217	1.587	0.763	3.303
		Employed	.	1	.	.
	Net monthly household income (p=0.024)	-999€	0.606	0.84	0.432	1.631
		1000 - 1499 €	0.449	1.28	0.676	2.424
		1500 - 2499€	0.693	1.141	0.593	2.195
		+2500€	.	1	.	.
	Rurality Index (p=0.05)	Rurality (continuous)	0.309	1.158	0.872	1.538

a Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain'. b Variables with $p < 0.2$ are included in the multinomial logistic regression models (except for social class). Variables not included in the multivariate: missing data for over 3.5% of a subpopulation (e.g. working population, population over 65 years old),) or treated

differently (e.g. categorization or coding). All models were adjusted for age and sex. Significance level = 0.05. Interactions performed: sex * age, sex * independent variable analyzed and age * independent variable analyzed, showing the results that were statistically significant and did not affect the model convergence.

Disabling CP: multimorbidity

The ten most prevalent chronic diseases were the same in the different subpopulations, with the exception of prostate disorder which was replaced by osteoporosis in the DCP subpopulation. The prevalence of a chronic disease, regardless of which, was around two or three-fold higher in those with DCP than in those with nDCP, and three or four-fold higher in those without CP (Fig. 2). Conversely, DCP prevalence was around three or even four-fold higher among those with a chronic disease, regardless of which, while this difference was not seen in the prevalence of nDCP.

Figure 2. Prevalence of chronic diseases in the studied subpopulations

At least one chronic disease was present in 81.5% of the population with DCP *versus* 40.3% of the population without CP and 55.5% of the population with nDCP (p<0.001; Fig. 3). At least three other chronic diseases were reported in 47.7% of the population with DCP *versus* 18.8% of the population with nDCP. There was a strong tendency for the frequency of multimorbidity to be higher in women (*versus* men) among those with DCP (83.4% and 76.4%; p=0.054) but not among those with nDCP (p=0.45). The mean number of chronic diseases in women with DCP was significantly higher than in men with DCP (3.09, 95%CI=[2.85-3.33] *vs*. 2.32, 95%CI=[2.03-2.62]) and threefold higher than in women without CP (0.97, 95%CI =[0.92,1.03]).

Figure 3. Multimorbidity according to subpopulations with chronic pain.

DCP prevalence was five-fold higher among those with other chronic diseases than among those without (20.4% vs. 3.9%, respectively, p<0.001). A similar result for gender and for age group was observed. However, the differences of nDCP prevalence among those with and without chronic diseases were much smaller, with the exception of the youngest age group (Table 4, supplementary data online).

Disabling CP: associated factors

The final multivariate model for factors associated with DCP (Figs. 4 and 5) used valid data from 96.65% of the study sample (n=6289) and it was highly significant ($p<0.001$; $R^2_{Nagelkerke}=0.27$).

Figure 4. Factors associated with disabling chronic pain.

Figure 5. Factors associated with non-disabling chronic pain.

The likelihood of DCP *versus* nCP was significantly higher in women (OR=2.12, $p<0.001$), individuals sleeping≤7h (OR=1.32, $p=0.004$), those with some physical limitation (OR=1.61, $p=0.012$), and smokers (OR=1.42; $p=0.005$), but not significantly higher in ex-smokers or in those individuals who did 'heavy work, tasks requiring great physical effort'. A higher likelihood of DCP was also observed in older age ($OR_{10yrs}=1.28$; $p<0.001$), the presence of other chronic diseases ($OR_{1chronicdisease}=1.26$, $p<0.001$), worse environmental conditions ($OR_{1point}=1.16$; $p=0.001$), worse physical ($OR_{10points}=2.38$, $p<0.001$) or mental ($OR_{10points}=1.21$, $p=0.001$) quality of life, and (although this did not reach significance) lower emotional social support ($OR_{10points}=1.041$, $p=0.096$).

The probability of non-disabling CP was significantly higher in: women (OR=1.55, $p=0.001$); individuals with 'heavy work, tasks requiring great physical effort' *versus* those 'standing most of the time without much walking or major effort' (OR=2.28, $p<0.001$) and those 'sitting during most of the day' (OR=3.27, $p=0.009$); those with less emotional social support ($OR_{10points}=1.073$, $p=0.023$); and those with other chronic diseases ($OR_{1CD}=1.28$, $p<0.001$). In contrast, the likelihood of non-disabling CP was not significantly associated with the physical or mental quality of life, age, environmental conditions, hours of sleep, physical limitations, or smoking.

DISCUSSION

Our results show that important differences were observed between populations with disabling and non-disabling chronic pain. The failure to distinguish correctly between DCP and nDCP or their related risk factors may have major negative repercussions on the design of interventions to prevent and treat pain as well as on estimates of the size of this public health problem. The present findings are therefore highly relevant for healthcare policy-makers and professionals.

DCP definition and prevalence

The item for measuring activity limitation was also used to measure the participation restrictions (problems in involvement in life situations) in the definition of disability [17]. Although other authors [37] use the SF-8 scale item on interference with social activities due to physical health or emotional problems, we decided not to consider that item because it is not specific to chronic pain. In fact, it did not obtain high concordance with our already constructed DCP (Kappa=0.34). In addition, people interviewed were specifically asked if they were limited in their activity by the reported chronic pains (Table 1). So the disability is due to the chronic pain, not to other medical condition. The basis of the definition of CP in this study is the medical or healthcare professionals' diagnosis (reports of more than 3 months suffering the chronic disease that included the word 'pain') [20,21]. However, survey limitations detected in this study include the need to add muscle and joint pain in the lower and upper extremities (except shoulder) and various traumatological, postsurgical, and neuropathic conditions. It would also be preferable to gather direct data on CP with a simple overall question [12] and to avoid its construction based on other chronic diseases. By doing this, the possibility of overestimating its prevalence would be reduced. Gathering data on the time since CP onset, using 6 months as the criterion for chronicity [5], is also recommended. Finally, our study did not gather information to analyse neuropathic, nociceptive or dysfunctional pain because this is not essential information as these entities are considered as different points on the same continuum [38].

DCP, as observed in our study, is a highly relevant public health problem, as it affects two-thirds of the population with CP. Although there are very few population-based studies on DCP, the Spanish prevalence provided by our study (11.36%) is similar to findings in Canada (range:11.4-13.3%) [39] and higher than those reported in Germany (7.4%) [37]. This health problem is especially relevant in women [6,40] and over-65-year-olds [40]. The greatest gender difference observed in our study was in the lower age groups [6]. In addition, nDCP could lead to DCP in time, especially in middle age and over. This can be seen in Figure 1 where nDCP prevalence is quite similar in the highest age groups, regardless of gender, while DCP prevalence presents much higher differences. Moreover, as showed in supplementary Table 4, the change over time of nDCP into DCP could be much faster among people with other chronic diseases.

One of the largest differences between the DCP and nDCP populations is the mean age, which was 13 years older in the DCP population. Moreover, there was a negligible difference in mean age between those with nDCP and those without CP. Those age differences remained when controlled by the other independent variables. Thus, a much higher likelihood of DCP (vs. no CP) in older age was observed, while the likelihood of nDCP (vs. no CP) was not significantly associated with age. Furthermore, according to our definition of DCP, in the DCP group, the disability would be pain provoked, and the likelihood of that disability would increase by 28% with every 10 years of age.

Multimorbidity

The presence of other chronic diseases was reported by half of the population without CP, by almost three-quarters of the population with CP, and by over four-fifths of the population with DCP. Among individuals with DCP, multimorbidity was much more frequent in women [41]. This gender difference grew with increased age in the DCP population. But again, these differences were not observed in the population with non-disabling CP. In general, the prevalence of DCP is five-fold higher among those with other chronic diseases than among those without (Figure 2). The gender difference in the prevalence of DCP was even greater among those with other chronic diseases. According to allostatic load models [12], CP is more disabling in patients with a larger number of chronic diseases, thus increasing their health risk [11,12].

The prevalence of diseases such as fibromyalgia, arthritis, or rheumatism/osteoporosis was significantly higher in women with DCP when compared to women with nDCP population or women without CP, while the prevalence of those diseases in men is too low to observe significant differences. In general terms, the prevalence of those chronic diseases between the nDCP population and the population without CP does not differ significantly. However, results obtained in the DCP population showed much higher prevalence (Fig. 2). It is not clear, due to the variability within those chronic diseases, that they always result in pain [42-47].

The prevalence of arterial hypertension in the DCP population was more than double that in the nDCP or nCP populations. The mechanisms underlying the association between CP and hypertension have not been fully elucidated, and the allostatic factors involved remain under discussion [48-49]. The population with depression or anxiety showed a prevalence of DCP that was three-fold higher than in the population without, signifying that there is an increase in disability when CP is associated with depression or anxiety [6,14,15,50-52]. We consider these results with caution for two reasons. Firstly, from a neurological point of view, pain and depression interact in a complex relationship of situational and physiological connections that is not yet fully understood[53]. Secondly, depression and anxiety were measured together in our study, through the same variable. Despite this, the association between DCP and these mental disorders highlights the need for psychosocial services in chronic pain management [37].

DCP associated factors

Our study showed that DCP was also associated with having only primary education, being unemployed after having worked previously, unqualified/unskilled employment, low income, low functional social support, poor health habits, impaired quality of life, worse environmental or work conditions and rural life. Further research is necessary on the interaction of lower educational attainment, employment status and type of work. A statistical significant association was found between worse health-related quality of life and DCP, but not with nDCP. Both components of functional and social support, which are considered to play an important role in helping sufferers cope with their pain

[54,55], were significantly lower in the population with DCP, whereas the result was significantly lower for those with nDCP only in the affective component. These results go further than those provided by other studies [6,56,57].

Survey features

Beyond the intrinsic limitations of cross sectional studies such as poor recall or overemphasis on recent events[58], the strength of this study is that it is based on a large-scale population-based survey. Its complex design (multistage stratified sample), large sample size (6.507 individuals), very good response rate (68%) and data gathering (face-to-face home interviews) make it a very reliable source of information. In addition, special efforts were made to avoid sampling biases (for further details please see Methods). Moreover, the EAS includes information on CP and disability which is not available in other important population health surveys, such as the Spanish National Health Survey (www.msssi.gob.es) or the European Health Interview Survey (http://ec.europa.eu/eurostat). It also gathers a large amount of information besides information on CP. For example, information on other diseases, activity limitations, general and employment health, and on usage of healthcare services which permit a comprehensive analysis of CP and associated factors. Andalusia, our sampling region, is the most populated (8,399,618 people) and the second largest in area of the 19 regions in Spain. It is also the fifth most populated region in Europe and it is as populated as other European countries such as Austria or Switzerland. Moreover, we extrapolated the estimations of the DCP prevalence from Andalusia to Spain by applying calibration adjustments. They provide not only a more accurate estimation, but also a more valid one when there is non-coverage bias [30]. Thus, calibration adjustments increased the validity of generalization of DCP prevalence from a smaller area, i.e. Andalusian region, to a larger one, i.e. Spain. Due to the fact that Spain and Andalusia have different sociocultural and economic characteristics, we considered not only sex and age as calibration variables, but also educational level and employment status. All those auxiliary variables are considered in the new calibrated weights. They include information from the Andalusian sample as well as from the Spanish census [36]. Thus, the extrapolated prevalence of DCP from Andalusia to Spain is representative, at least, for all those variables [30]. In addition, the fact that those variables were associated

with the study variable (DCP) provided better results in terms of accuracy and validity of the estimations (that is shown in the multivariate model). This statistical method ensures that survey estimates are coherent with those already in the public domain, while simultaneously reducing sampling error and non-coverage or nonresponse bias [30,59]. When compared with the most important surveys published on CP [1,3,5,55], our study is of the same quality and scope, but of a higher level than other surveys on DCP.

Conclusions

In summary, the characteristics of chronic pain have been widely studied but without considering whether it disables or not. Our study demonstrates that a population with disabling chronic pain is the one which shows really statistically significant differences. Indeed, very few statistically significant differences were found between the nCP and nDCP populations. DCP is an important public health problem [57] which affects a large proportion of the general adult population (11.36% according to our study) with elevated multimorbidity. It has a strong association with social determinants of health (e.g. disfavoured or vulnerable social status, impaired quality of health or poor health habits). Moreover, it is a highly relevant issue for health systems [57] (DCP almost doubles the health services usage compared with nDCP, especially in Primary Care)[60]. Its consequences directly affect partners, families and friends. Therefore, it is a disease that could affect medical practical or political health initiatives, as well as future research areas. Also, the association between DCP and mental disorders highlights the need for psychosocial services in the management of chronic pain. Finally, our study contributes to knowledge on this issue, and provides evidence of the need to advance in the application of simple tools for the identification of individuals with DCP. Future research efforts, healthcare and social interventions should focus on this population and on the prevention of future disability in individuals with nDCP.

CONTRIBUTIONSHIP STATEMENT

ACL conceived the original idea with the participation of JAGH and MCB. ACL designed the analysis plan alongside LGF. Statistical analysis was conducted by LGF and subsequently by ACL. ACL developed the first version of the manuscript in collaboration with MCB for the introduction and discussion and with LGF for the methodology. All authors participated in the writing of subsequent versions and approved the final article.

COMPETING INTERESTS

The authors declare that there is no conflict of interest. The authors are solely responsible for the content and writing of the manuscript.

FUNDING

The *Andalusian Health Survey*, the source of information in this study, is funded by the Ministry of Health of the *Junta de Andalucía*, Spain.

DATA SHARING STATEMENT

Other tables, analyses, statistics and R code not included in the present article are available on demand.

REFERENCES

[1] Toth C, Lander J, Wiebe S. The prevalence and impact of chronic pain with neuropathic pain symptoms in the general population. *Pain Med* 2009; 10(5):918–29.

[2] Johannes CB, Le TK, Zhou X, Johnston JA, Dworkin RH. The prevalence of chronic pain in United States adults: results of an Internet-based survey. *J Pain* 2010; 11: 1230-9.

[3] Langley PC, Ruiz-Iban MA, Tornero Molina JT, de Andres J, Gónzalez-EscaladaCastellón JR. The prevalence, correlates and treatment of pain in Spain. *J Media Econ* 2011; 14: 367-80.

[4] Kennedy J, Roll JM, Schraudner T, Murphy S, McPherson S. Prevalence of persistent pain in the US adult population: new data from the National Health Interview Survey. *J Pain* 2014; 15:979-84.

[5] Breivik H, Collett B, Ventafridda V, Cohen R, Gallacher D. Survey of chronic pain in Europe: prevalence, impact on daily life, and treatment. *Eur J Pain* 2006; 10: 287-333.

[6] Blyth FM, March LM, Brnabic AJ, Jorm LR, Williamson M, Cousins MJ. Chronic pain in Australia: a prevalence study. *Pain* 2001; 89:127-34.

[7] Sakakibara T, Wang Z, Paholpak P, Kosuwon W, Myint T, Kasai Y. A Comparison of Chronic Pain Prevalence in Japan, Thailand, and Myanmar. *Pain Phys* 2013, 16: 603–8.

[8] Wong WS, Fielding R. Prevalence and characteristics of chronic pain in the general population of Hong Kong. *J Pain* 2011; 12: 236-45.

[9] Costa Cabral DM, Botelho Bracher ES, Prescatan Depintor JD, Eluf-Neto J. Chronic Pain Prevalence and Associated Factors in a Segment of the Population of Sao Paulo City. *J Pain* 2014; 15: 1081-91.

[10] Dueñas M, Salazar A, Ojeda B, Fernández-Palacin F, Micó JA, Torres LM, Failde I. A Nationwide study of chronic pain prevalence in the general Spanish population: identifying clinical subgroups trough cluster analysis. *Pain Med* 2014; 16:811-22.

[11] Eriksen J, Jensen MK, Sjogren P, Ekholm O, Rasmussen NK. Epidemiology of chronic non-malignant pain in Denmark. *Pain* 2003; 106:221–8.

[12] Dominick CH, Blyth FM, Nicholas MK. Unpacking the burden: understanding the relationships between chronic pain and comorbidity in the general population. *Pain* 2012; 153: 293-304.

[13] McEwen BS. Stress, adaptation, and disease: Allostasis and allostatic load. *Ann N Y Acad Sci* 1998; 840: 33-44.

[14] Raftery MN, Sarma K, Murphy AW, De la Harpe D, Normand C, McGuire BE. Chronic pain in the Republic of Ireland-community prevalence, psychosocial profile and predictors of pain-related disability: results from the Prevalence, Impact and Cost of Chronic Pain (PRIME) study, part 1. *Pain* 2011;152:1096-103.

[15] Azevedo LF, Costa-Pereira A, Mendonça L, Dias CC, Castro-Lopes JM. Epidemiology of chronic pain: a population-based nationwide study on its prevalence, characteristics and associated disability in Portugal. *J Pain* 2012; 13: 773-83.

[16] Reid MC, Eccleston C, Pillemer K. Management of chronic pain in older adults. *BMJ* 2015; 350:h532.

[17] WHO. International classification of functioning, disability, and health (ICF). World Health Organization. Switzerland: Geneva, 2007. http://www.who.int/classifications/icf/en/. Accessed 17 Oct 2017.

[18] Blyth FM, March LM, Brnabic AJM, Cousins MJ. Chronic pain and frequent use of health care. *Pain* 2004; 111:51-8.

[19] Sánchez-Cruz JJ, GarcíaFernándezLl, Mayoral Cortés JM. Andalusian Health Survey, 2011-12. Consejería de Igualdad, Salud y Políticas Sociales. 2013. http://goo.gl/2BYFhe. Accessed 3 Aug 2017.

[20] Álvarez-González J, Ayuso-Fernández A, Caba-Barrientos F. *Plan Andaluz de atención a las personas con dolor: 2010–2013*. Sevilla: Consejería de Salud. 2010. http://www.juntadeandalucia.es/export/drupaljda/plan_atencion_dolor-1_0.pdf. Accessed 3 Aug 2017.

[21] International Association for the Study of Pain (IASP). Washington. IASP Taxonomy: Pain Terms. 2004. http://www.iasp-pain.org/Taxonomy?navItemNumber=576#Pain. Accessed 3 Aug 2017.

[22] Dapcich V, Salvador G, Ribas L, Pérez C, Aranceta J, Serra-Majem Ll. *Guía de la alimentación saludable*. Sociedad Española de Nutrición Comunitaria. 2004. http://aesan.msssi.gob.es/AESAN/docs/docs/publicaciones_estudios/nutricion/guia_alimentacion.pdf. Accessed 3 Aug 2017.

[23] Vilagut G, Valderas JM, Ferrer M, Garin O, López-García E, Alonso J. Interpretation of SF-36 and SF-12 questionnaires in Spain: physical and mental components. *Med Clin* 2008;130:726-35.

[24] Verbrugge LM. A global disability indicator. *J Aging Stud* 1997;11:337-62. http://aesan.msssi.gob.es/AESAN/docs/docs/publicaciones_estudios/nutricion/guia_alimentacion.pdf. Accessed 9 Oct 2017].

[25] Ayala A, Rodríguez-Blázquez C, Frades-Payo B, Forjaza MJ, Martínez-Martín P, Fernández-Mayoralas G, Rojo-Pérez F. Psychometric properties of the Functional Social Support Questionnaire and the Loneliness Scale in non-institutionalized older adults in Spain. *Gac Sanit* 2012; 26: 317-24.

[26] Chilet-Rosell E, Álvarez-Dardet C, Domingo-Salvany A. Use of Spanish proposals for measuring social class in health sciences. *Gac Sanit* 2012; 26:566-9. http://scielo.isciii.es/pdf/gs/v26n6/original_breve1.pdf. Accessed 3 Aug 2017.

[27] Ewing JA. Detecting alcoholism. The CAGE questionnaire. *JAMA* 1984; 252:1905-7.

[28] WHO. Body Mass Classification. World Health Organization. Switzerland: Geneva, 2015. http://apps.who.int/bmi/index.jsp?introPage=intro_3.html. Accessed 3 Aug 2017.

[29] Nübling M, Burr H, Moncada S, Kristensen T.S. COPSOQ International Network: Co-operation for research and assessment of psychosocial factors at work. *Public Health Forum* 2014; 22: 18.e1–18.e3.

[30] Cabrera-León A, Lopez-Villaverde V, Rueda M, Moya-Garrido MN. Calibrated prevalence of infertility in 30- to 49-year-old women according to different approaches: a cross-sectional population-based study. *Hum Reprod* 2015; 30(11): 2677-85.

[31] Tillé Y, Matei A. R Package sampling: survey sampling 2015:76. https://cran.r-project.org/web/packages/sampling/sampling.pdf Accessed 5 May 2018.

[32] Escobar-Lopez E, Barrios-Zamudio E. SamplingVarEst: Sampling Variance Estimation 2015. https://cran.r-project.org/web/packages/samplingVarEst/samplingVarEst.pdf Accessed 5 May 2018.

[33] Miettenen OS, Cook EF. Confounding: Essence and detection. *Am J Epidemiol* 1981; 144: 593-603.

[34] Menard, S. Coefficients of determination for multiple logistic regression analysis. *Am Stat* 2000; 54: 17-24.

[35] Lumley T. Complex Surveys: A Guide to Analysis Using R. Hoboken: Wiley;2010.

[36] Population and Housing Census 2011. National Statistics Institute (INE, Spanish acronym). http://www.ine.es/en/censos2011_datos/cen11_datos_inicio_en.htm. Accessed 3 Aug 2017.

[37] Häuser W, Schmutzer G, Hilbert A, Brähler E, Henningsen P. Prevalence of Chronic Disabling Noncancer Pain and Associated Demographic and Medical Variables: A Cross-Sectional Survey in the General German Population. *Clin J Pain* 2015;31(10):886-92; doi: 10.1097/AJP.0000000000000173.

[38] Cohen SP, Mao J. Neuropathic pain: mechanisms and their clinical implications. *BMJ* 2014;348:f7656; doi: 10.1136/bmj.f7656.

[39] Reitsma ML, Tranmer JE, Buchanan DM, Vandenkerkhof EG. The prevalence of chronic pain and pain-related interference in the Canadian population from 1994 to 2008. *Chronic Dis Inj Can* 2011;31:157–64.

[40] Bingefors K, Isacson D. Epidemiology, co-morbidity, and impact on health-related quality of life of self-reported headache and musculoskeletal pain – a gender perspective. *Eur J Pain* 2004; 8: 435–50.

[41] Scherer M, Hansen H, Gensichen J et al. Association between multimorbidity patterns and chronic pain in elderly primary care patients: a cross-sectional observational study. *BMC Fam Pract* 2016; 17:68; doi: 10.1186/s12875-016-0468

[42] Slukaa KA, Clauwb DJ. Neurobiology of fibromyalgia and chronic widespread pain. *Neuroscience* 2016; S0306-4522(16)30236-6.

[43] WHO. Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. World Health Organization. Geneva, 1994. http://apps.who.int/iris/bitstream/10665/39142/1/WHO_TRS_843_eng.pdf. Accessed 17 Oct 2017.

[44] Kraus VB, Blanco FJ, Englund M, Karsdal MA, Lohmander LS. Call for standardized definitions of osteoarthritis and risk stratification for clinical trials and clinical use. *Osteoarthr cartilage* 2015; 23(8):1233-41.

[45] Brown AK, Conaghan PG, Karim Z, Quinn MA, Ikeda K, Peterfy CG, Hensor E, Wakefield RJ, O'Connor PJ, Emery P. An explanation for the apparent dissociation between clinical remission and continued structural deterioration in rheumatoid arthritis. Arthritis Rheum. 2008; 58(10):2958-67. doi: 10.1002/art.23945.

[46] Hannan MT, Felson DT, Pincus T. Analysis of the discordance between radiographic changes and knee pain in osteoarthritis of the knee. J Rheumatol. 2000;27(6):1513

[47] Office of the Surgeon General (US). Bone Health and Osteoporosis: A Report of the Surgeon General. Rockville (MD): Office of the Surgeon General (US); 2004. 5, The

Burden of Bone Disease. Available from: https://www.ncbi.nlm.nih.gov/books/NBK45502/

[48] Zota AR, Shenassa ED, Morello-Frosh. Allostatic load amplifies the effect of blood lead levels on elevated blood pressure among middle-age U.S.: a cross-sectional study. *Environ Health Persp* 2013; 12: 64.

[49] Olsen RB, Bruehl S, Nielsen ChS, Rosselandb LA, Eggen AE, Stubhaug A. Hypertension prevalence and diminished blood pressure–related hypoalgesia in individuals reporting chronic pain in a general population: The Tromsø Study. *Pain* 2013; 154: 257-62.

[50] Ohayon MM, Stingl JC. Prevalence and comorbidity of chronic pain in the German general population. *J Psychiat Res* 2012; 46:444-50.

[51] Gerrits MM, Vogelzangs N, van Oppen P, et al. Impact of pain on the course of depressive and anxiety disorders. Pain 2012; 153:429-36.

[52] Loerbroks A, Bosch JA, Mommersteeg PM, Herr RM, Angerer P, Li J. The association of depression and angina pectoris across 47 countries: findings from the 2002 World Health Survey. Eur J Epidemiol 2014; 29: 507-15.

[53] Chopra K, Arora V. An intricate relationship between pain and depression: clinical correlates, coactivation factors and therapeutic targets. Expert Opin Ther Targets. 2014;18(2):159-76. doi: 10.1517/14728222.2014.855720.

[54] Leonardi M, Bickenbach J, Ustun TB, Kostanjsek N, Chatterji S. The definition of disability: what is in a name?. Lancet 2006; 368:1219-21.

[55] Gibson SJ, Lussier MD. Prevalence and relevance of pain in older persons. Pain Med 2012; 13: 23-6.

[56] Smith BH, Elliot AM, Chambers WA, Smith WC, Hannaford PC, Penny K. The impact of chronic pain in the community. *Fam Pract* 2001;18(3):292-9.

[57] Blyth FM, Van Der Windt DA, Croft PR. Chronic Disabling Pain: A Significant Public Health Problem. *Am J Prev Med* 2015; 49 (1): 98-101.

[58] Sedgwick Ph. Cross sectional studies: advantages and disadvantages. BMJ. 2014;348:g2276 doi: 10.1136/bmj.g2276

[59] Cabrera-León A, Rueda M, Cantero-Braojos M. "Calibrated prevalence of disabling chronic pain: a face-to face cross-sectional population study in Southern Spain". *BMJ Open* 2017; 7:e014033; doi:10.1136/bmjopen-2016-014033.

[60] Cabrera-León A, Cantero-Braojos MA. "Impact of disabling chronic pain: results of a cross-sectional population study with face-to-face interview". *Aten Prim* 2017. In press; doi: 10.1016/j.aprim.2017.03.020.

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Table 1. Study variables.

Table 2. Sociodemographic characteristics of disabling chronic pain.

Figure 1. Spanish prevalence of disabling chronic pain and non-disabling chronic pain by sex and age groups.

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Table 1 supplementary data. Characteristics of the study population.

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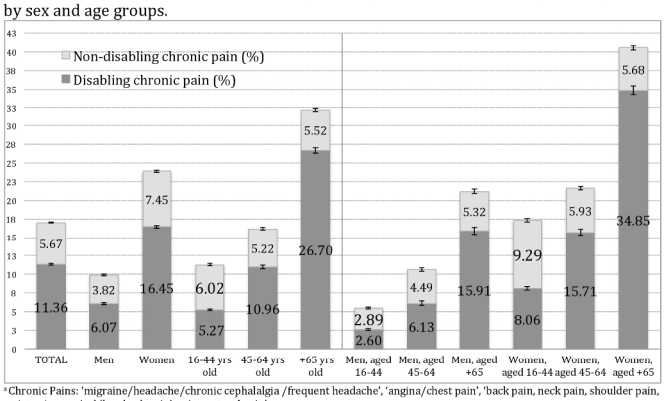
Figure 1. Spanish prevalences of disabling chronic pain and non-disabling chronic pain[a] by sex and age groups.



[a] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.

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Figure 2. Prevalence of chronic diseases[a] in the studied subpopulations[b].

Chronic pain population		Non chronic pain population		General population		Disabling chronic pain population		Non disabling chronic pain population	
Chronic disease	%	Chronic disease	%	Chronic disease	%	Chronic disease	%	Chronic disease	%
Hypertension	34.71%	Hypertension	15.33%	Hypertension	18.66%	Hypertension	42.67%	Hypertension	18.61%
High cholesterol	23.78%	High cholesterol	9.94%	High cholesterol	12.32%	Arthritis / rheumatism	28.38%	High cholesterol	15.90%
Arthritis / rheumatism	22.27%	Diabetes*	6.71%	Arthritis / rheumatism	8.68%	High cholesterol	27.68%	Depression / Anxiety	11.64%
Poor blood circulation	18.52%	Arthritis / rheumatism	5.85%	Diabetes*	8.06%	Poor blood circulation	24.22%	Allergies *	10.52%
Depression / Anxiety	17.41%	Depression / Anxiety	5.82%	Depression / Anxiety	7.82%	Depression / Anxiety	20.26%	Arthritis / rheumatism	9.93%
Varicose veins in legs	16.00%	Allergies *	5.53%	Poor blood circulation	6.39%	Varicose veins in legs	19.66%	Varicose veins in legs	8.61%
Diabetes*	14.56%	Poor blood circulation	3.87%	Allergies *	6.25%	Diabetes*	18.42%	Poor blood circulation	7.01%
Allergies *	9.64%	Heart disorders*	3.15%	Varicose veins in legs	4.82%	Heart disorders*	10.30%	Diabetes*	6.76%
Heart disorders*	8.31%	Prostate disorders	3.09%	Heart disorders*	4.03%	Allergies *	9.20%	Prostate disorders **	5.83%
Prostate disorders **	6.94%	Varicose veins in legs	2.50%	Prostate disorders	3.48%	Osteoporosis	8.95%	Cataracts**	4.33%
Osteoporosis	6.43%	Asthma	2.08%	Asthma	2.32%	Prostate disorders **	7.56%	Heart disorders*,**	4.30%
Cataracts	6.16%	Cataracts	1.43%	Cataracts	2.24%	Cataracts	7.07%	Chronic constipation**	3.24%
Hard of hearing	4.63%	Lung*	1.41%	Osteoporosis	2.09%	Hard of hearing	6.26%	Asthma	3.23%
Chronic constipation	4.49%	Cancer*	1.36%	Hard of hearing	1.63%	Hemorrhoids	5.48%	Stomach problems*,**	2.95%
Hemorrhoids	4.30%	Heart attack*	1.24%	Lung*	1.63%	Urinary incontinence	5.23%	Colitis*,**	2.68%
Urinary incontinence	4.12%	Anemia*	1.19%	Anemia*	1.62%	Chronic constipation	5.10%	Lung*,**	1.90%
Fibromyalgia	3.84%	Osteoporosis	1.18%	Cancer*	1.54%	Fibromyalgia	4.95%	Hemorrhoids	1.90%
Anemia*	3.67%	Hard of hearing	1.01%	Heart attack*	1.53%	Anemia*	4.82%	Urinary incontinence**	1.87%
Asthma	3.49%	Kidney	1.00%	Fibromyalgia	1.43%	Kidney	4.28%	Heart attack*,**	1.61%
Stomach problems*	3.13%	Skin problems*	0.96%	Kidney	1.36%	Heart attack*	3.62%	Skin problems*,**	1.61%
Kidney	3.13%	Fibromyalgia	0.93%	Skin problems*	1.30%	Asthma	3.62%	Fibromyalgia	1.60%
Heart attack*	2.95%	Colitis*	0.91%	Colitis*	1.24%	Skin problems*	3.60%	Osteoporosis**	1.35%
Skin problems*	2.94%	Stomach problems*	0.78%	Hemorrhoids	1.21%	Stomach problems*,**	3.22%	Anemia*,**	1.35%
Colitis*	2.85%	Other mental	0.72%	Stomach problems*	1.18%	Stroke*,**	3.22%	Hard of hearing**	1.35%
Lung*	2.68%	Hemorrhoids	0.57%	Chronic constipation	1.17%	Lung*,**	3.07%	Cancer*,**	1.33%
Cancer*	2.40%	Stroke*	0.53%	Urinary incontinence	1.12%	Colitis*,**	2.93%	Other mental	0.81%
Stroke*	2.24%	Cirrhosis*	0.50%	Stroke*	0.83%	Cancer*,**	2.93%	Kidney**	0.80%
Cirrhosis*,**	1.43%	Urinary incontinence	0.50%	Other mental	0.72%	Cirrhosis*,**	1.86%	Infertility**	0.54%
Infertility**	0.71%	Chronic constipation	0.48%	Cirrhosis*	0.66%	Infertility**	0.80%	Cirrhosis*,**	0.54%
Other mental**	0.71%	Infertility**	0.14%	Infertility**	0.24%	Other mental	0.66%	Stroke*,**	0.26%

[a] Question: 'Has a healthcare professional [physician/nurse] told you that you suffer from ...?'
[b] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.
* Cancer, malignant tumor, including leukemia, lymphoma; Diabetes / high blood sugar / sugar in urine; hypertension; Chronic colitis and intestinal diseases / inflammatory bowel disease / Cohn's disease; stomach ulcer / duodenum; Chronic lung disease / emphysema / chronic bronchitis; Cardiac disorders / cardiac failure / congestive cardiac failure; Myocardial infarction / heart attack; Chronic skin problems; Chronic allergies (such as rhinitis, eye inflammation, dermatitis, food allergies, etc.), excluding allergic asthma; Anemia or other blood disease; Stroke / cerebral hemorrhage; Hearing loss / hearing problems; Cirrhosis / hepatic disease / hepatic dysfunction;
** Coefficient of variation> 20%; therefore, the results should be interpreted with caution.

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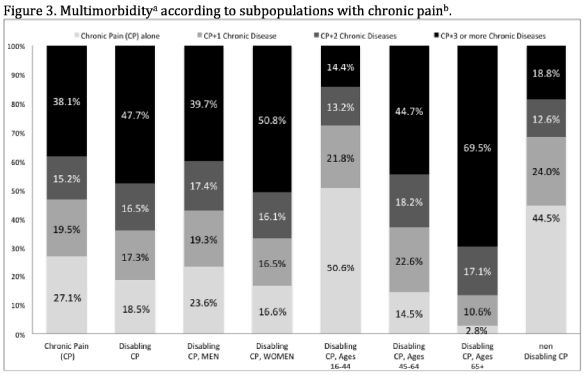
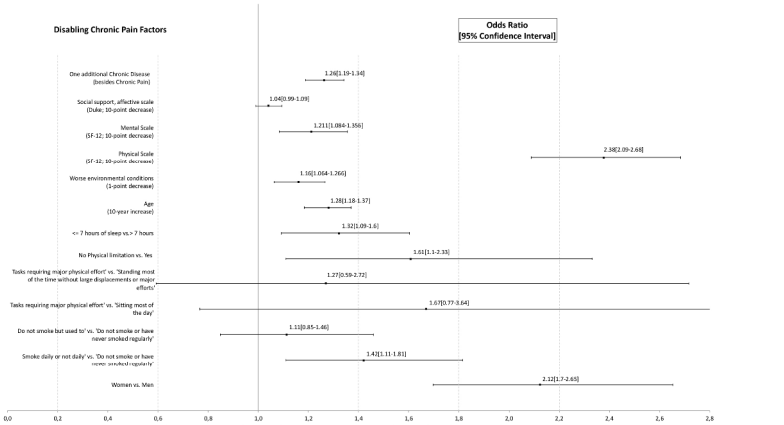
Figure 3. Multimorbidity[a] according to subpopulations with chronic pain[b].



[a] Question: 'Has a healthcare professional [physician/nurse] told you that you suffer from one or more of the following Chronic Diseases ...?'
[b] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.

296x209mm (300 x 300 DPI)

Figure 4. Factors associated with disabling chronic pain [a,b].



[a] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain'.

[b] The odds ratios are calculated based on the following reference categories/values: Sex = Male; Tobacco = Do not smoke or have never smoked regularly; Physical activity = 'Tasks requiring major physical effort; Physical limitations = Yes; Sleep > 7 hours; Age = 45.4; Physical Component Score (PCS_SF-12) = 51.12; Mental Component Score (MCS_SF-12) = 50.67; Affective social support (Duke) = 81.01; Number of chronic diseases (besides CP) = 1.07; Environmental conditions = 5.83.

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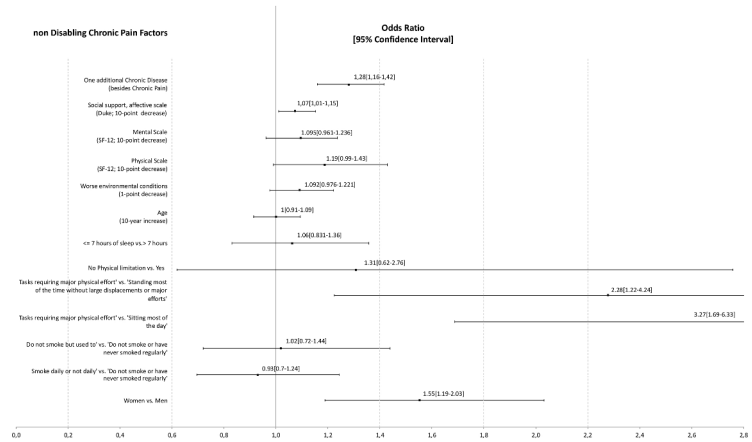
Figure 5. Factors associated with non-disabling chronic pain [a,b].



[a] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain'.

[b] The odds ratios are calculated based on the following reference categories/values: Sex = Male; Tobacco = Do not smoke or have never smoked regularly; Physical activity = Tasks requiring major physical effort; Physical limitations = Yes; Sleep > 7 hours; Age = 45.4; Physical Component Score (PCS_SF-12) = 51.12; Mental Component Score (MCS_SF-12) = 50.67; Affective social support (Duke) = 81.01; Number of chronic diseases (besides CP) = 1.07; Environmental conditions = 5.83.

296x209mm (300 x 300 DPI)

Table 1 supplementary data. Distribution of the sample on sociodemographic variables[a].

Variables (individuals with missing data; %)	Category (population aged ≥16 years; total n=6,507)	Percentage (sample sizes)	95% Confidence Interval	
			Minimum	Maximum
Sex (0)	Male	49.3% (3209)	48.1%	50.5%
	Female	50.7% (3298)	49.5%	51.9%
Age (0)	Aged 16-24 years	13.3% (867)	12.5%	14.2%
	25-44	39.3% (2556)	38.1%	40.5%
	45-54	16.7% (1087)	15.8%	17.6%
	55-64	12.3% (799)	11.5%	13.1%
	65-74	9.6% (626)	8.9%	10.4%
	+75	8.8% (572)	8.1%	9.5%
Marital Status (8, 0.1%)	Married	59.6% (3805)	58.4%	60.8%
	Single	29.6% (1882)	28.5%	30.7%
	Separated	1.9%(123)	1.6%	2.2%
	Divorced	2.8% (178)	2.4%	3.2%
	Widowed	8% (511)	7.4%	8.7%
Cohabiting (66, 2.6%)		64.9%(4180)	63.7%	66%
Social Class [27] (1359, 20.9%)	I. Manager with 10<salaried staff	5.3% (275)	4.8%	6%
	II. Manager with 10>salaried staff	7.5% (384)	6.8%	8.2%
	IIIa. Administrative staff	12.7% (654)	11.8%	13.6%
	IIIb. Self-employed	4.9% (253)	4.4%	5.5%
	IIIc. Manual work supervisor	1.7% (87)	1.4%	2.1%
	IVa. Qualified manual worker	23.6% (1216)	22.5%	24.8%
	IVb. Manual worker	21.5% (1107)	20.4%	22.6%
	V. Unskilled worker	22.8% (1170)	21.7%	23.9%
	VI. Others	0.04% (2)	0%	0.2%
Educational Level (11, 0.2%)	Illiterate	2.1% (136)	1.8%	2.5%
	No formal education but can read and write	11.6% (756)	10.9%	12.4%
	Up to 5 years primary schooling (Early education)	19.5% (1263)	18.5%	20.4%
	Up to 8 years primary schooling	23.8% (1543)	22.7%	24.8%
	Up to 4 years secondary schooling (lower secondary)	9.1% (590)	8.4%	9.8%
	First cycle of vocational training	5.3% (345)	4.8%	5.9%
	Second cycle of vocational training	6.5% (420)	5.9%	7.1%
	Up to 6 years secondary schooling (upper secondary)	9.1% (593)	8.4%	9.8%
	Short-cycle tertiary education (diploma) or Bachelor's degree	7.1% (465)	6.6%	7.8%
	Master's degree or PhD	5.9% (385)	5.4%	6.5%
Employment Situation (3, 0.05%)	Employed	34,1% (2221)	33%	35,3%
	Unemployed but previously worked	21,5% (1398)	20,6%	22,5%
	Seeking first employment	1% (66)	0,8%	1,3%
	Retired (previously employed)	14,4% (938)	13,6%	15,3%
	Home keeper	18,1% (1178)	17,2%	19,1%
	Student	8,1% (527)	7,5%	8,8%
	Handicap/Permanent Disability	2,5% (160)	2,1%	2,9%
	Other	0,2% (16)	0,2%	0,4%
Economic difficulty to make ends meet (30, 0.5 %)	Very difficult	12.7% (819)	11.9%	13.5%
	Difficult	18.4% (1190)	17.5%	19.3%
	Somewhat difficult	30% (1944)	28.9%	31.1%
	Somewhat easy	25.5% (1651)	24.4%	26.5%
	Easy	12.5% (813)	11.8%	13.4%
	Very easy	0.9% (60)	0.7%	1.2%
Total net household income (1540, 23.7%)	Up to 300 euros	0.7% (36)	0.5%	1%
	From 301 to 499 euros	4.3% (212)	3.7%	4.9%
	From 500 to 999 euros	27.6% (1368)	26.3%	28.8%
	From 1000 to 1499 euros	37.6% (1866)	36.2%	38.9%
	From 1500 to 1999 euros	17% (844)	16%	18.1%
	From 2000 to 2499 euros	8.1% (401)	7.3%	8.9%
	From 2500 to 2999 euros	3.2% (157)	2.7%	3.7%
	From 3000 to 4999 euros	1.5% (72)	1.2%	1.8%
	More than 5000 euros	0.2% (11)	0.1%	0.4%

[a] The sample design was not considered in this table

Table 2 supplementary data. Distribution of the sample on life habits variables[a].

Variables (missing responses; %)	Category (population aged +16; total n=6,507)	Percentage (sample sizes)	95% Confidence Interval	
			Minimum	Maximum
Suspected alcoholism		3.1% (204)	2.7%	3.6%
Consumption of alcoholic beverages (2; 0.03%)	Yes, consumption of alcoholic beverage	44.4% (2891)	43.2%	45.6%
	Yes, but less than once a month	13.3% (864)	12.5%	14.1%
	No, no consumption of alcoholic beverage	42.3% (2750)	41.1%	43.5%
Smoker (3; 0.05%)	Yes, smoke daily	30.9% (2011)	29.8%	32.1%
	Yes, smoke but not daily	2.4% (157)	2.1%	2.8%
	Do not smoke but used to	17.5% (1137)	16.6%	18.4%
	Do not smoke or have never regularly smoked	49.2% (3199)	48%	50.4%
Body Mass Index [30] (0)	Low weight	3.8% (247)	3.4%	4.3%
	Normal weight	37.3% (2428)	36.1%	38.5%
	Overweight	39.7% (2585)	38.5%	40.9%
	Obesity I	17.1% (1113)	16.2%	18%
	Obesity II	2.1% (134)	1.7%	2.4%
Physical activity in the workplace or usual activity (47; 0.7%)	Sitting most of the workday	30.4% (1964)	29.3%	31.5%
	Standing most of the time without major movement or effort	55.8% (3605)	54.6%	57%
	Walking, carrying some weight. Frequent movement	11.5% (737)	10.7%	12.2%
	Hard work, tasks requiring major physical effort	2.4% (154)	2%	2.8%
Physical exercise in free time (3; 0.05%)	No physical activity	26.8% (1742)	25.7%	27.9%
	Occasional physical or sporting activity	55.9% (3639)	54.7%	57.1%
	Regular physical activity, several times a month	12% (779)	11.2%	12.8%
	Physical training several times a week	5.3% (344)	4.8%	5.9%
Dairy product consumption (7; 0.1%)	Daily	90.9% (5909)	90.2%	91.6%
	Three or more times a week	2.9% (191)	2.6%	3.4%
	One / two times a week	2.5% (163)	2.2%	2.9%
	Less than 1 time week	0.8% (52)	0.6%	1%
	Never or almost never	2.8% (185)	2.5%	3.3%
Fresh fruit consumption (11; 0.2%)	Daily	63.8% (4144)	62.6%	64.9%
	Three or more times a week	21.7% (1405)	20.7%	22.7%
	One / two times a week	9.6% (623)	8.9%	10.3%
	Less than once a week	2.9% (190)	2.5%	3.4%
	Never or almost never	2.1% (134)	1.8%	2.4%
Vegetables consumption (14; 0.2%)	Daily	41% (2665)	39.9%	42.1%
	Three or more times a week	34.1% (2211)	33%	35.2%
	One / two times a week	19.8% (1287)	18.9%	20.8%
	Less than once a week	3.7% (240)	3.3%	4.2%
	Never or almost never	1.4% (90)	1.1%	1.7%
Sweets consumption (30; 0.5%)	Daily	18.4(1191)	17.4%	19.3%
	Three or more times a week	25.2% (1629)	24.2%	26.2%
	One / two times a week	28% (1814)	27%	29.1%
	Less than once a week	14% (908)	13.2%	14.9%
	Never or almost never	14.4% (935)	13.6%	15.3%

[a] The sample design was not considered in this table

Table 3 supplementary. Prevalences of chronic pain and of other chronic diseases by sex, age and disabling condition.

Variables			Condition		Disabling Condition (Subpopulation with the condition/s)		Disabling Condition (Total population)	
			Prevalence	95% Confidence Interval	Prevalence[b]	95% Confidence Interval	Prevalence[c]	95% Confidence Interval
Chronic Pain[a]	Total		17.2%	16.3-18.12	66.9%	64.14-69.55	11.5%	10.73-12.28
	Sex (p<0.001)	Women	23.9%	22.5-25.4	68,2%	64.9-71.3	16.3%	15.1-17.6
		Men	10.3%	9.3-11.4	63,9%	58.6-68.8	6.6%	5.8-7.5
	Age groups (p<0.001)	16-44 yrs	11.4%	10.4-12.5	48.2%	43.4-53.1	5.5%	4.8-6.3
		45-64	18.2%	16.5-20	70.4%	65.3-75	12.8%	11.4-14.4
		+65	32.3%	29.7-35	82.7%	78.6-86.1	26.7%	24.2-29.2
At least one Chronic Disease (besides Chronic Pain)	Total		45.9%	44.67-47.08	59.7%	58-61.47	29.5%	28.45-30.66
	Sex (p<0.001)	Women	52.9%	51.2-54.6	64.5%	62.2-66.7	36.8%	35.2-38.5
		Men	38.6%	37-40.3	53.1%	50.3-55.8	22.1%	20.7-23.5
	Age groups (p<0.001)	16-44 yrs	23.7%	22.3-25.1	43.3%	40-46.7	13%	11.9-14.2
		45-64	56.9%	54.6-59.1	56.6%	53.6-59.5	34%	31.9-36.2
		+65	92.1%	90.4-93.5	74.9%	72.3-77.4	69.7%	67.1-72.3

[a] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.
[b] Percentage of disabling population within that population with the corresponding condition (chronic pain or at least one chronic disease).
[c] Percentage of population with both disabling and the corresponding condition (chronic pain or at least one chronic disease).

Table 4 supplementary data. Disabling chronic pain[a] prevalences according to the presence of other chronic diseases.

Variables		POPULATION WITH OTHER CHRONIC DISEASES (total n=2987; n men=1,240; n women=1,747)		POPULATION WITHOUT OTHER CHRONIC DISEASES (total n=3,520; n men=1969; n women=1,551)	
		Prevalence[b] (Significance[c])	95% Confidence Interval	Prevalence[b] (Significance)	95% Confidence Interval
Disabling Chronic Pain	Total	20.4%	19-21.9	3.9%	3.3-4.6
	Women	25.7% (p<0.001)	23.7-27.8	5.7% (p=0.042)	4.7-7.0
	Men	13.1%	11.3-15.0	2.5%	1.9-3.3
	Ages 16-44	11.5%	9.5-13.8	3.0%	2.4-3.7
	45-64	19.3%	11.0-21.7	4.3%	3.2-5.9
	+65	28.1%(p < 0.001)	25.6-30.9	9.5%(p=0.001)	5.0-17.2
Non-disabling Chronic Pain	Total	6.9%	6-7.9	4.7%	4-5.7
	Women	8.0% (p<0.001)	6.8-9.3	7.2% (p<0.001)	6.0-8.6
	Men	5.4%	4.3-6.8	2.7%	2.1-3.5
	Ages 16-44	9.4%(p < 0.001)	7.5-11.6	3.0%	2.4-3.7
	45-64	6.4%	5.1-8.0	3.8%	2.7-5.4
	+65	5.5%	4.3-7.1	6.3%	2.9-13.3

[a] Chronic Pains: 'migraine/headache/chronic cephalalgia /frequent headache', 'angina/chest pain', 'back pain, neck pain, shoulder pain, waist pain, cervical/low back pain' or 'menstrual pain'.
[b] Prevalence of disabling or non-disabling chronic pain within the population with or without other chronic diseases.
[d] p-values are located in the cells where there are statistical significant differences.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Reported on manuscript page
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1-2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6-7, Table 1
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-6, Table 1
Bias	9	Describe any efforts to address potential sources of bias	6-8,12-13
Study size	10	Explain how the study size was arrived at	5-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6, Table 1
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7-8
		(*b*) Describe any methods used to examine subgroups and interactions	7-8
		(*c*) Explain how missing data were addressed	Tables 1 and 2, supplementary data online
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	7-8
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	

		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Tables 1 and 2, supplementary data online Figures 1-3
		(b) Indicate number of participants with missing data for each variable of interest	Tables 1 and 2, supplementary data online
Outcome data	15*	Report numbers of outcome events or summary measures	8-12, Table 3 supplementary data online
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-12, Table 2 and Figures 4a and 4b
		(*b*) Report category boundaries when continuous variables were categorized	Yes
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	9-10, Table 2
Discussion			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17

*Give information separately for exposed and unexposed groups.