**Lower physical activity is associated with higher odds of chronic conditions among the Spanish workforce**

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**Availability of data and materials**

Data are free available from https://www.mscbs.gob.es/estadEstudios/estadisticas/encuestaNacional/home.htm

**Lower physical activity is associated with higher odds of chronic conditions among the Spanish workforce**

**Abstract**

**Introduction**

Prevention of chronic conditions among the workforce is a major public health challenge, and achieving minimum recommended levels of physical activity (PA) aids in this objective. The aim of the present study was to investigate if levels of PA were associated with the prevalence of common chronic conditions among the workforce.

**Methods**

We retrieved data from the Spanish National Health Survey 2017 (n = 9695) in which mean age of participants was 44.4 (SD, 10.4) years and 47.4% were women. Workers self-reported a set of six chronic conditions (i.e. chronic low-back pain, chronic neck pain, diabetes, hypertension, depression, and anxiety), whereas the International Physical Activity Questionnaire (IPAQ) short form served to estimate PA. Multivariable logistic regression adjusted for possible confounders was performed to assess associations between PA and chronic conditions.

**Results**

The final adjusted model showed that performing less than 600 MET-minutes/week of PA was associated with significantly higher odds for chronic conditions (aOR = 1.18; 95% CI, 1.07-1.30). Of the sex and age subgroups analyzed, this association was significant in men aged 17 to 44 years (aOR = 1.21; 95% CI, 1.00-1.46). Among chronic conditions, low-back pain and anxiety were associated with lower levels of PA, whereas covariates such as body mass index, smoking habits, educational level, and occupational class had an important influence on the association between PA and chronic condition.

**Conclusion**

The results suggest that achieving sufficient PA could play an important role to prevent lower chronic conditions among a Spanish population of workers.

**KEYWORDS** occupational health, workplace, physical activity, public health, non-communicable disease

**Introduction**

One key indicator related to the health status of a country is the health of its workforce. A higher prevalence of chronic diseases and conditions in a working population can lead to a set of undesirable consequences ranging from sickness absenteeism to a rise in disability pension as well as lower productivity (1,2). In addition, the national financial cost due to sickness absence related to chronic musculoskeletal disorders in countries such as Holland amounted to €1.3 billion annually (3); thus,acquiring knowledge related to health behaviours of working populations can aid in the implementation of successful strategies to improve health, and to reduce related cost. Particularly, chronic diseases are the leading cause of death among the Spanish population, whereas chronic conditions such as low-back pain and neck pain are the primary reasons for disability-adjusted life years (DALYs) (4). On the other hand, healthy habits such as regular physical activity (PA) have been usually associated with a longer lifespan; for instance, altogether work and household PA have been observed to reduce mortality risk in Spanish men and women, while similar mortality risk reductions for leisure-time PA have been solely shown in Spanish women (5); such distinction among PA domains as well as between genders is worth-noting, since PA during leisure has been usually linked to lower risk of mortality in both men and women, and differently, higher levels of occupational PA have been observed to increase the mortality risk only in men (6,7). Furthermore, higher leisure-time PA was associated with lower prevalence of hypertension, diabetes, hypercholesterolemia, depression and anxiety, as well as lower use of prescription medication in a dose-response fashion among a general population of Spanish adults (8). Contrarily, occupational PA has been observed to increase both, the risk for disability pension, and the risk for long-term sickness absence (9,10).

Overall, World Health Organization (WHO) recommends that adults perform at least 150 minutes of moderate-intensity PA, or 75 minutes of vigorous-intensity PA, or an equivalent combination of moderate- and vigorous-intensity PA achieving at least 600 MET-minutes/week. Because higher PA has been associated with lower prevalence of chronic diseases and conditions in general populations of adults and workers from other countries (8,11), it is reasonable to expect that achieving recommended PA guidelines could be associated with lower prevalence of several of the most common chronic diseases and conditions among the Spanish workforce. A recent study by López-Sánchez et al. (12) has estimated that 30.2% of the Spanish population are not achieving current international guidelines regarding weekly PA, hence, there is still a chance that insufficient PA will also be a critical issue concerning chronic conditions among the general working population; further, such PA levels could substantially vary depending on gender and age (i.e. higher percentage of men and younger achieve PA guidelines) (13). Besides, since most of the studies involving workers and health habits are referred to populations from different countries, little is known about how PA may affect chronic conditions in a population of workers from Spain with different working conditions and lifestyle (14,15). Thus, the present study aimed to investigate the association between PA and chronic conditions among Spanish workers; an inverse association between PA and a set of the most prevalent chronic conditions in the workforce was hypothesized.

**Methods**

**Study design and population**

Data from the Spanish National Health Survey 2017 (ENSE 2017), a regular survey assessing general health among the Spanish population of both children and adults each five years, were retrieved for this study. The data collection was carried out through a survey set in Spain from October 2016 to October 2017 under the responsibility of the Ministry of Health, Social Services and Equality, and the National Statistics Institute; data series from the current and previous rounds of the survey are shown anonymized in a publicly available dataset from an institutional web server (16). A computer-assisted personal interview (CAPI) was conducted in the homes of the selected participants, who were assisted by trained interviewers. A stratified three-stage sampling considering census sections, family dwellings and participants (≥15 years) was respectively implemented. The dwellings were selected using systematic sampling, and the random Kish method was used to select the participants who were going to complete the questionnaire. The sample was distributed throughout all the Spanish regions assigning both a uniform part and other variable part according to proportional regional size, and accounting for studied characteristics, type of respondent, and information regarding other additional surveys . The sections were selected within each stratum with probability proportional to their size. In each section, the dwellings were selected with equal probability by systematic sampling, prior arrangement by size of the dwelling. This procedure leads to self-weighting samples in each stratum. The random Kish method was used for the selection of the person who had to complete the questionnaire; this assigns equal probability to all potential participants in the household (16).

The original sample comprised 37500 dwellings distributed in 2500 sections, in which 30.1% (n = 11287) of the selected dwellings did not reply to the survey due to several reasons (i.e. absence, empty dwelling, refusal or inability to answer). As a result, a representative sample of the Spanish adult population comprising 23089 participants aged 15-103 years (i.e. a survey response rate of 69.9%) was collected.

Since the International Physical Activity Questionnaire (IPAQ) short form was not included in the questionnaires for participants aged ≥70 years, those participants were excluded from the study analyses (n = 5310). Of the remaining population, those below the legal working age (i.e. under 16) or unemployed participants were also excluded (n = 7894). Overall, data from 22 survey questions were retrieved for the purpose of this study: 7 questions regarding PA, 1 question each regarding age, sex, height, weight, educational level, occupational class, occupational PA, smoking status, and fruit consumption, and 6 regarding chronic conditions. In addition, those remaining participants presenting missing values in any of the study variables (n = 190) were also removed from the statistical analyses. Therefore, a total of 9695 participants from a general working population were included in the present study.

Data were reported in adherence to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [16]. All the participants gave signed consent before completing the survey.

**Chronic condition (Outcome)**

For the purpose of this research, we identified several of the most prevalent chronic conditions among the workforce (1). Measures on chronic conditions were obtained through the following question: ‘‘Have you suffered from hypertension within the last twelve months?” Participants answering “yes” to this question were considered to have experienced hypertension during that term. The same procedure was used for assessing the prevalence of the remaining chronic conditions from the study set (i.e. diabetes, chronic neck pain, chronic low back pain, depression and anxiety). Finally, an outcome variable concerning the experience of having suffered from, at least, one of the mentioned chronic conditions was created; those participants answering “yes” to one or more chronic condition were included in the chronic condition category.

**Physical activity (Exposure)**

The IPAQ short version embedded in the survey (i.e. the questions of the IPAQ short-version were included in the healthy habits section of the survey) was used to estimate PA (17). The IPAQ has shown to be a valid and reliable PA estimation when tested in different adult populations worldwide presenting sufficient validity (ρ = 0.30; 95% CI, 0.23-0.36) and reliability (Spearman’s ρ = 0.81; 95% CI, 0.79-0.82) (17). Overall PA MET (Metabolic Equivalent of Task, i.e. a caloric expenditure unit) minutes/week were estimated using the formula: *sum of Vigorous + Moderate + Walking MET-minutes/week scores* (18). Following the analysis protocol of the IPAQ, PA was categorized into METS regarding WHO guidelines: “1) fewer than 600 MET-minutes/week” and “2) at least 600 MET-minutes/week” (18).

**Covariates**

According to prior work, the present study was controlled for sociodemographic factors (age, sex, educational level and occupational class), and lifestyle factors (body mass index, occupational PA, fruit consumption and smoking status) (19–22).

Educational level was divided into three categories regarding the highest educational achievement, corresponding the highest rank to holding a university degree (i.e. primary or lower, secondary, and tertiary or higher). The categorization of occupational class (168 different groups) into six different groups was conducted using the Spanish national list of occupations (23); occupational class I included executive managers and academics; occupational class II consisted of middle managers, technicians, athletes and artists; occupational class III comprised white-collar and self-employed workers, and occupational class IV covered supervisors and skilled blue-collar workers from the secondary sector. Finally, occupational class V consisted of skilled blue-collar workers from the primary sector, whereas occupational class VI only included unskilled workers.

Body Mass Index (BMI) was derived from self-rated height and weight (i.e. weight in kilograms divided by height in squared meters) with categories set according to WHO guidelines as follows: BMI ≥30 kg/m2 (obese), overweight (25-29.9 kg/m2), normal (18.5-25 kg/m2) and underweight (<18.5 kg/m2). According to the findings of a study with industrial workers and cardiovascular risk factors, fruit consumption was divided into two groups regarding those who reached a weekly consumption of, at least, one piece of fresh fruit (excluding juices) a week, and those who do not (24).

Occupational PA was estimated through the following question: “Which of the following better describes your main activity during the working hours?”. Possible answers comprised: “sit most of the working hours” (sedentary), “standing up most of the working hours without performing high efforts” (low), “walking, carrying any weight, with frequent displacements” (moderate) and “performing high physically demanding tasks” (high).

Finally, the smoking status was categorised as “current smoker”, “former smoker”, and “never smoker”.

**Statistical analyses**

Statistical analyses were carried out using SPSS 22.0. Differences in the prevalence of chronic conditions among subgroups within each variable were assessed by Chi-squared tests. The association between PA (exposure) and chronic condition (outcome) were estimated through multivariable logistic regression analysis conducted for the whole sample as well as by sex and age subgroups. To ensure sufficient statistical power when comparing groups regarding age, the mean age of the sample was set as cut-off point. Sex and age-segmented analyses were adjusted for educational level, occupational class, occupational PA, BMI, fruit consumption and smoking status, while the analysis for the overall sample was also adjusted for sex and age. All covariates were included in the models as categorical variables. Associations were calculated between having one or more of the six chronic conditions examined and PA as well as between each of the chronic conditions and PA.

Participants with missing data (2%) were discarded from the analyses. We calculated adjusted odds ratios (AORs) with 95% confidence intervals (CIs) through logistic regression analyses. The level of statistical significance was set at P<0.05.

**Results**

Table 1 shows the characteristics of the study sample (n = 9695). It comprises a general population of Spanish workers (56.6% men) with a mean age of 44.4 years (SD, 10.4).

A majority of the workers (69.6%) reached the WHO guidelines regarding weekly PA (≥600 MET-minutes/week of PA). Significant differences among subgroups in relation to prevalence of chronic conditions were found for most of the covariates: age, sex, BMI, smoking status, educational level, occupational class, and occupational PA.

The final adjusted model on the entire study sample showed that less than 600 MET-minutes/week of PA was associated with significantly higher odds for chronic condition (aOR = 1.18; 95% CI, 1.07-1.30) (Table 2). Women, higher age, former and current smoker, primary and secondary education, obesity and overweight condition, and no weekly fruit consumption subgroups were also associated with significantly higher odds for chronic condition compared with their reference in each covariate, whereas the contrary, significant lower odds for chronic condition occur with the occupational class subgroup I when compared with its reference (Table 2).

In sex and age segmented and adjusted analyses (Table 3), the association between PA and chronic conditions remained significant among the subgroup formed by men aged 17 to 44 years (aOR = 1.21; 95% CI, 1.00-1.46).

Finally, table 4 shows associations between PA and each of the examined chronic conditions; achieving recommended PA guidelines associate with significant lower odds for low-back pain (aOR = 0.80; 95% CI, 0.70-0.91) and anxiety (aOR = 0.67; 95% CI, 0.54-0.84).

**Discussion**

The present study suggests that performing less than 600 MET-minutes/week of PA is associated with significantly higher odds for chronic conditions among a general population of Spanish workers. When stratified by sex and age, men aged 17 to 44 years not achieving 600 MET-minutes/week of PA had more odds for chronic conditions than the other subgroups. In addition, those participants reporting less than 600 MET-minutes/week of PA were found to have significant higher odds for experiencing low-back pain and anxiety. These results are consistent with our hypothesis as well as with previous research, which has observed significant associations between lower PA and chronic conditions among a Spanish adult population (8). The present study adds to the existing literature the importance to achieve PA international guidelines in order to prevent some of the most prevalent chronic conditions usually experienced by working populations.

Because chronic conditions have been identified as major causes for sickness absenteeism and disability pension (25,26), it is of upmost importance to implement strategies in order to reduce the current figures, and this study suggest that perform the recommended values of PA could be a way forward. Both sickness absenteeism and disability pension entail a substantial economic cost to society (27), and constitute a public health issue (28,29).

Interestingly, findings from the present study also suggest that older workers not performing current PA guidelines are more likely to experience chronic conditions that their younger counterparts. The aging process itself is usually related to a higher probability of experiencing chronic conditions (30); however, as observed in our results, healthy habits such as performing regular PA could contribute to reduce the prevalence of chronic conditions in this specific age range. As suggested by Brawner et al. (11), there is still a chance that such association were bidirectional, since older adults with chronic conditions have been associated with lower PA levels. Particularly, our study found PA significantly linked with lower prevalence of low-back pain and anxiety, which supports the results of previous studies specifically focused on these conditions; a meta-analysis of prospective cohort studies found risk of chronic low-back pain reduced by 11%-16% with leisure-time PA, whereas other observational study found that meeting PA guidelines was associated with 13.5% lower odds of anxiety (31,32).

Although our study did not discriminate among PA domains, previous research has underscored the benefits of both leisure-time and commuting PA, whereas the opposite has been observed for occupational PA (9,33). Thus, because differences regarding PA levels and domains have been observed among European countries (14), generalizations over working populations from other countries might be mediated for these variations. Furthermore, the strong influence that both higher occupational class and lower education level had over the relationship between PA and chronic conditions suggest that other socioeconomic characteristics could also exacerbate these variation; previous research has already appointed the strong association between PA and both occupational class and educational level (i.e. those from lower occupational classes and educational levels tend to perform lower levels of PA and have worse health-related habits and, consequently, more likely to suffer from chronic condition) (34,35).

The strengths of the present study consist of using a large representative sample, as well as estimating PA through a validated tool. In addition, a broad range of covariates were used to control the relationship between the exposure and the outcome variables. Nevertheless, for a better interpretation of the results, several limitations should be considered. First, since answers may have been influenced by common method variance, in which a person’s mood or disease status have affected the answers, the possibility of a recall bias exist. Second, the IPAQ short form do not discriminate PA domains, which could shed more light on the circunstances that PA usually have higher beneficial properties concerning chronic conditions. Last, the cross-sectional study design does not allow causal interpretations, thus, some of the chronic conditions may reduce participation in PA.

In conclusion, the results of this study suggest that achieving WHO guidelines regarding PA might be an essential component to reduce chronic conditions in the studied population. Particularly, older workers and those experiencing either low-back or anxierty were observed to be the most adversely influenced by insufficient PA; thus, strategies aimed at workers with these features could be critical to prevent from experiencing chronic conditions.

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**Summary**

**What is already known on this topic?**

There is high-quality evidence that physical activity reduces risk of the most prevalent chronic conditions.

**What is added by this report?**

Insufficient weekly levels regarding physical activity associates with higher odds of chronic conditions among a Spanish population of workers.

**What are the implications for public health practice?**

Physical activity strategies reaching recommended guidelines might reduce levels of some of the most prevalent chronic conditions among the workforce.

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| --- | --- | --- | --- | --- |
| **Table 1.** Participant Characteristics, 2017 Spanish National Health Survey | | | | |
|  | | | **aHas one or more chronic condition** | |
| **Total (N = 9695)** | **n** | **%** | **%** | ***bP Value*** |
| **Age (years)** |  | | | < .001 |
| 17-44 | 4915 | 50.7 | 20.3 |  |
| 45-69 | 4780 | 49.3 | 44.5 |  |
| **Sex** |  | | | < .001 |
| Men | 5100 | 52.6 | 29.8 |  |
| Women | 4595 | 47.4 | 34.9 |  |
| **Body Mass Index** |  | | | < .001 |
| Underweight | 180 | 1.9 | 25.0 |  |
| Normal | 4556 | 47.0 | 26.1 |  |
| Overweight | 3600 | 37.1 | 35.4 |  |
| Obese | 1359 | 14.0 | 45.0 |  |
| **Smoking status** |  | | | < .001 |
| Never | 4188 | 43.2 | 27.7 |  |
| Former | 2608 | 27.0 | 38.2 |  |
| Smoker | 2889 | 29.8 | 32.7 |  |
| **Educational level** |  | | | < .001 |
| ≤Primary | 950 | 9.8 | 45.6 |  |
| Secondary | 5885 | 60.7 | 33.6 |  |
| ≥Tertiary | 2914 | 29.5 | 24.8 |  |
| **Occupational Class** |  | | | < .001 |
| I | 1299 | 13.4 | 22.4 |  |
| II | 979 | 10.2 | 23.7 |  |
| III | 2210 | 22.8 | 30.5 |  |
| IV | 1018 | 10.5 | 30.2 |  |
| V | 2850 | 29.4 | 32.8 |  |
| VI | 1319 | 13.7 | 34.4 |  |
| **PA weekly METS** |  | | | < .001 |
| ≥ 600 | 6748 | 69.6 | 30.3 |  |
| < 600 | 2947 | 30.4 | 36.6 |  |
| **Weekly fruit consumption** |  |  |  | 0.398 |
| Yes | 9172 | 94.6 | 32.0 |  |
| No | 523 | 5.4 | 33.7 |  |
| **Occupational PA** |  |  |  | < .05 |
| Sedentary | 3180 | 32.8 | 30.4 |  |
| Low | 4179 | 43.1 | 32.6 |  |
| Moderate | 1812 | 18.7 | 33.5 |  |
| High | 524 | 5.4 | 35.2 |  |
| Abbreviations: SD, standard deviation; PA, physical activity.  aHypertension, diabetes, chronic neck pain, chronic low back pain, depression and anxiety.  bChi square test. | | | | |

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| --- | --- | --- |
| **Table 2.** Association of physical activity and covariates with chronic condition (outcome) estimated by multivariable logistic regression (adjusted odds ratios with 95% confidence intervals of chronic condition). | | |
| **Characteristic** |  | **aHas one or more chronic condition** |
|  |  | **baOR (95% CI)** |
| **Physical activity**  **(MET-minutes/week)** | < 600 | 1.18 (1.07-1.30)c |
| ≥ 600 | ref |
| **Age (years)** | 45-69 | 2.92 (2.65-3.21)e |
| 17-44 | ref |
| **Sex** | Women | 1.59 (1.44-1.76)e |
| Men | ref |
| **Educational level** | ≤ Primary | 1.55 (1.27-1.90)e |
| Secondary | 1.24 (1.07-1.43)d |
| ≥ Tertiary | ref |
| **Smoking status** | Current | 1.20 (1.08-1.35)d |
| Former | 1.29 (1.16-1.45)e |
| Never | ref |
| **Body Mass Index (kg·m-2)** | Obese | 2.13 (1.45-3.12)e |
| Overweight | 1.51 (1.04-2.19)c |
| Normal | 1.05 (0.73-1.52) |
| Low | ref |
| **Occupational class** | I | 0.71 (0.56-0.89)d |
| II | 0.94 (0.76-1.18) |
| III | 0.91 (0.77-1.08) |
| IV | 1.02 (0.84-1.24) |
| V | 1.05 (0.91-1.22) |
| VI | ref |
| **Weekly fruit consumption** | No | 1.23 (1.00-1.50)c |
| Yes | ref |
| **Occupational PA** | Sedentary | 0.94 (0.75-1.18) |
| Low | 0.86 (0.70-1.07) |
| Moderate | 0.85 (0.68-1.06) |
| High | ref |
| |  | | --- | | Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; PA, physical activity.  aHypertension, diabetes, chronic neck pain, chronic low back pain, depression and anxiety.  bEach variable has been adjusted for the rest of the variables.  cSignificant at *P* < .05.  dSignificant at *P* < .01. |   eSignificant at *P* < .001. | | |

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| **Table 3.** Association between physical activity (<600 MET-minutes/week) and chronic condition estimated by multivariable logistic regression (adjusted odds ratios with 95% confidence intervals of chronic condition). | | |
| **Sex** | **Age (years)** |  |
|  |  | **aaOR (95% CI)** |
| Men | 17-44 | 1.21 (1.00-1.46)b |
| 45-69 | 1.21 (0.98-1.48) |
| Women | 17-44 | 1.11 (0.93-1.33) |
| 45-69 | 1.22 (0.96-1.56) |
| Abbreviations: aOR, adjusted odds ratio; CI, confidence interval.  aAdjusted for educational level, body mass index, smoking status, occupational class, fruit consumption and occupational physical activity.  bSignificant at *P* < .05. | | |

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| **Table 4.** Association between levels of physical activity and specific chronic diseases estimated by multivariable logistic regression (adjusted odds ratios with 95% confidence intervals for each chronic condition). | |
| **Chronic disease** | **aAssociation between physical activity (**≥ **600 MET-minutes/week) and specific chronic disease** |
|  | **aOR (95% CI)** |
| **Hypertension** | 0.89 (0.76-1.03) |
| **Diabetes** | 1.03 (0.79-1.34) |
| **Low back pain** | 0.80 (0.70-0.91)b |
| **Neck pain** | 0.97 (0.83-1.14) |
| **Anxiety** | 0.67 (0.54-0.84)c |
| **Depression** | 1.10 (0.84-1.44) |
| Abbreviations: aOR, adjusted odds ratio; CI, confidence interval.  aAdjusted for sex, age, education, body mass index, smoking habit, occupational class, fruit consumption and occupational physical activity.  bSignificant at *P* < .01.  cSignificant at *P* < .001 | |