Physical activity behaviour in people with asthma and COPD overlap residing in Spain: A cross-sectional analysis

Sheila Sanchez Castillo[1], Lee Smith[2], Arturo Diaz Suarez[1], Guillermo Felipe Lopez-Sanchez[1]

1. Faculty of Sport Science, University of Murcia
2. The Cambridge Centre for Sport and Exercise Sciences, Anglia Ruskin University, UK, CB1 1PT

Objectives: The present study aimed to identify levels of physical activity (PA) among the Spanish population with asthma and chronic obstructive pulmonary disease (COPD) overlap (ACO). A further aim was to analyse differences in PA levels by sex, age, education, marital status, cohabiting, smoking habits, alcohol consumption and body mass index (BMI).

Methods: In this cross sectional study, data from the Spanish National Health Survey 2017 were analysed. A total of 198 people with ACO aged 15-69 years were included in the analyses. The short version of the international physical activity questionnaire (IPAQ) was used to measure total PA (MET·min/week). PA was further classified as low, moderate and high, and analysed according to sample characteristics. Data were analysed using the Mann-Whitney U test, Kruskal-Wallis H test and chi squared test. Statistical significance was set at $p<0.05$.

Results: People with ACO engaged in a mean volume of 2038.1 MET·min/week. Those aged 30-60 years and those with normal weight were significantly more active than those aged ≥60 and those with obesity. When classifying PA level in low, moderate and high, results showed no significant differences between sample characteristics. Overall, moderate and high levels of PA were the most and least frequent levels (48.0% and 16.2%, respectively).

Conclusions: More than three out of ten Spanish adults with ACO do not achieve PA recommendations. Therefore, it is recommendable to implement programs to raise awareness of the importance and benefits of PA among the Spanish population with ACO, and such programs should focus on older adults with ACO who are obese.

Keywords: epidemiology, obesity, physiological disorders, prevention, quality of life

Introduction

Asthma and chronic obstructive pulmonary disease (COPD) are two of the five major respiratory diseases, established by the Forum of International Respiratory Societies (FIRS) (1). Both of these conditions are important public health problems owing to their increasing prevalence, high morbimortality and socioeconomic burden (2,3). In 2019, the Global Burden of Disease (GBD) study found a worldwide prevalence of asthma and COPD in the general population of 3.50% (3.40% males, 3.60% females) and 2.85% (2.85% males, 2.86% females), respectively (4). A previous analysis of the GBD study in 2015 (5) identified a 44.2% increased prevalence and an 11.6% increased risk or mortality from COPD between 1990 to 2015. In relation to asthma, the prevalence increased by 12.6% but mortality decreased by 26.7% between 1990 to 2015. Moreover, both asthma and COPD showed a decrease in age-standardised death and prevalence during this time-period.

These diseases are characterized by chronic respiratory symptoms and airflow limitation, but there are some differences between them. Symptoms of asthma vary over time in intensity and improve with the use of bronchodilators or even spontaneously, so expiratory airflow limitation is variable (2). COPD is characterized by persistent expiratory airflow limitation and respiratory symptoms with or without bronchodilator reversibility (3). Moreover, the onset of asthma tends to be before the age of 40 years while COPD is normally after 40 years and generally in those who have history of smoking or other toxic exposure. A systematic review and meta-analysis on the global burden of COPD found a prevalence of COPD of 9.7% in people aged 40 or over, while people younger than 40 revealed a prevalence of 2.7% (6). However, some patients have

persistent airflow limitation and clinical features of both diseases (2). Previous studies have used the term ACOS (Asthma COPD Overlap Syndrome) to describe these patients (7,8), but the latest updates of the Global Initiative for Asthma (GINA) (2) and the Global Initiative for Chronic Obstructive Pulmonary Disease (GOLD) (3) used the term Asthma-COPD overlap (ACO) or asthma + COPD. It is important to underline that these terms do not mean a new single disease but a term to describe the combination of both asthma and COPD.

The prevalence of ACO in Italian and North Carolina general populations has been identified to be approximately 2% (9,10), while a prevalence of approximately 21% has been identified for asthma patients and COPD patients (11). However, it should be noted that it is difficult to distinguish ACO patients from COPD patients, especially in smokers and older adults, and thus in these prevalence statistics some ACO patients may be categorised as having COPD.

Patients with ACO are more likely to have respiratory symptoms (12,13), worse lung function (13), more frequent exacerbations and hospitalizations (12–14) and worse general health status (13), compared with those with only COPD. Therefore, the risk of mortality is higher in those with coexisting asthma and COPD.

Regular and sustained participation in physical activity (PA) is beneficial in both primary and secondary prevention of several chronic diseases (15–17). However, there is a lack of evidence in relation to the potential health impact of PA among ACO patients. Importantly, PA has been shown to be beneficial in asthma control (18,19) and also improving quality of life and reducing exacerbations in people with COPD (20,21).

Literature surrounding PA behaviour in people with ACO is scarce. One study among Canadian adults found that ACO patients engaged in lower levels of PA than their healthy peers and were more likely to engage in no PA (22). Another investigation found

that Spanish adults (aged 40-80 years) with ACO exhibited lower levels of PA in comparison to adults with COPD only (12); however, only 67 subjects with ACO participated in this study and thus the representation of the findings is limited.

Given this background, the aim of the present study was to determine PA levels in a large representative sample of people with ACO residing in Spain and to analyse the differences according to sex, age, level of education, marital status, cohabiting, smoking habits, alcohol consumption and body mass index (BMI).

It is hypothesized that Spanish ACO patients will participate in low levels of PA and that their total weekly amount of PA will be lower than their peers with only COPD or only asthma. It is also hypothesised that PA will be lower in women, in older adults, in tobacco and alcohol consumers, in those with lower education and in those with a higher BMI.

Methods

Study design

The present study utilized a cross sectional design and was carried out in accordance with the Strengthening the reporting of observational studies in epidemiology (STROBE) statement (23).

Setting

The Spanish National Health Survey was carried out in Spain between October 2016 and October 2017 (24). Details of the survey methods have previously been published elsewhere (25). In brief, a stratified three-stage sampling method was used to select the participants. Firstly, census sections were considered, secondly the family dwellings were selected by systematic sampling, and finally an adult (15 years or more) was randomly selected from each dwelling by using the random Kish method. The

method of data collection was computer-assisted personal interviewing (CAPI), conducted in the participant's dwellings. It consisted of a personal interview in which the interviewer used an electronic device to complete the answers. The present research was performed in compliance with the Declaration of Helsinki of the World Medical Association. Data from the Spanish National Health Survey are public and anonymised and thus ethical approval to analyse the data is not required (25). Nevertheless, the present study was approved by the Ethical Research Committee of the University of Murcia.

Participants

A total of 23,089 people residing in Spain completed the survey, of which 17,777 people answered the PA questionnaire. Those adults older than 69 years were excluded, since they did not complete the International Physical Activity Questionnaire (IPAQ) short form because IPAQ is specific for the age range of 15-69 years. Finally, the 198 people (120 women and 78 men) with ACO residing in Spain that had answered the PA questionnaire were included in the present analyses. The inclusion criteria were: 1) affirmative answer to the question: "Have you ever been diagnosed with asthma by a physician?", 2) affirmative answer to the question: "Have you ever been diagnosed with COPD by a physician?", 3) completion of the PA questionnaire. Self-reported diagnosis of chronic conditions is widely used and accepted in epidemiological studies (26). In particular, self-reported diagnosis of asthma and COPD are valid methods (27,28) and have been frequently used in previous literature (29-31). Before responding to the questions, all participants were informed about the confidentiality of the survey.

Variables

Participants completed a questionnaire that included sociodemographic questions (age, sex, education, marital status, smoking habits and alcohol consumption), physical

characteristics (weight and height) and quantity of PA. The selection of the sociodemographic variables was based on the data available in the survey and on previously identified correlates of PA in the general adult population (32,33).

Physical activity

The IPAQ short form was used to measure PA (full survey https://sites.google.com/site/theipaq/) (34). This instrument was primarily designed for population surveillance of PA among adults, and it has been developed and tested for use in adults (15-69 years), until further development and testing is undertaken, the use of IPAQ with older and younger age groups is not recommended (35). IPAQ has been validated in adult populations from different countries showing acceptable validity (ρ=0.30, 95% CI: 0.23-0.36) and reliability (Spearman's ρ=0.81, 95% CI: 0.79-0.82) (36). PA level was calculated following the formula for computation of MET·minutes/week, established by the guidelines for data processing and analysis of the IPAQ (35). Subsequently, PA level was classified in: low (less than 600 MET·min/week), moderate (at least 600 MET·min/week) and high (at least 3000 MET·min/week), according to the same guidelines.

Sociodemographic variables

Age was divided into three groups: less than 30 years, from 30 to 60 years, and 60 years or older. Education level was based on the highest educational level achieved and was categorized according to the Spanish Classification of Education Levels as level A ($\leq 1^{st}$ period secondary), level B (2^{nd} period secondary and post-secondary -not tertiary-), and level C (tertiary) (37). Marital status was categorised as married and not married (single/widow/divorced/separated). Cohabiting was categorised as living as a couple (yes) or not living as a couple (no). Alcohol consumption was treated as a dichotomous

variable: yes or no, considering as no consumption those who had not drunk alcohol in the last 12 months. Smoking habits were categorized into three groups: never, former and current smoker (38). Height and weight were self-reported and used to calculate BMI as weight in kilograms divided by height in meters squared. BMI was classified as underweight (<18.5 kg/m^2), normal weight (18.5-24.9 kg/m^2), overweight (25-30 kg/m^2) and obesity (>30 kg/m^2), according to the methods established by the Spanish National Health Survey (25).

Data analysis

Descriptive statistics (frequency and percentage) were used to describe sample characteristics. Normality of data were confirmed using chi-squared tests for categorical variables and Kolmogorov-Smirnov tests for continuous variables. The variables sex, age, level of education, BMI, alcohol, quantity of PA and PA classification had a nonparametric distribution, whereas marital status, living in couple and smoking habits had a parametric distribution. To describe the total amount of PA (MET·min/week) according to sample characteristics, descriptive statistics (mean, standard deviation and median) were used. Statistical significance was calculated with Mann-Whitney U test for dichotomous variables (sex, marital status, cohabiting, alcohol consumption) and Kruskal-Wallis H test for polytomous variables (age, education level, smoking habits, BMI) with Bonferroni correction for pairwise comparisons. Significant differences between the different groups of PA and pairwise comparisons were analyzed by chi-squared test. The effect size was calculated using eta squared for Mann-Whitney U test, epsilon squared for Krukal Wallis H test and Cramer's V for chi squared test. The different measures of effect size used were classified as follows: effect size of eta squared was classified as small (0.01), medium (0.06) and large (0.14); effect size of epsilon squared was classified as negligible (0.00-0.01), weak (0.01-0.04), moderate (0.04-0.16),

relatively strong (0.16-0.36), strong (0.36-0.64) and very strong (0.64-1.00); effect size of Cramer's V was classified as small (0.1), medium (0.3) and large (0.5) (39). Pearson Correlation was applied to measure the correlation between PA and age.

Statistical significance was set at $p<0.05$ (CI=95%). Analyses were carried out with the Statistical Package for Social Sciences version 23 (SPSS, International Business Machines Corporation, Armonk, NY, USA).

Results

A total of 198 adults with ACO residing in Spain (120 women and 78 men) participated in this study. Participant's mean age was 50.0 (SD: 14.9, range: 15-69; Mo: 66). Sample characteristics are shown in Table 1.

[Table 1 near here]

The total amount of participants' PA (MET·min/week) is shown in Table 2. Only the variables age and BMI showed significant differences between groups. In relation to age, significant differences were found between participants aged 30-60 and those aged 60 or over, with those aged 30-60 years' the most active. However, when Pearson Correlation was applied, the association between age and total PA was not significant ($r= -0.102$; $p=0.151$).

[Table 2 near here]

According to BMI, people with normal weight were significantly more physically active than those with obesity. Considering the other variables, results showed that men, participants with higher education level, married, living as a couple, current smokers and alcohol consumers were the most physically active in their groups, but these differences were not significant.

Table 3 shows the frequency (percentage) of participants who engage in low, moderate and high PA levels, according to sample characteristics. A low level of PA was most frequent in women, in participants aged 60 and over, in those with level A of education, in those not married, in those who never smoke, in those who drank alcohol and in overweight and obese people. Nevertheless, these differences between subgroups were not significant and the effect size was small for all variables.

Considering the whole sample, differences in PA level categories were significant. Pairwise comparisons established these differences between those who engage in high and moderate levels of PA and between those who participate in high and low levels of PA. Moderate level was the most frequent (48.0%) and high level the least frequent (16.2%).

[Table 3 near here]

Discussion

The present cross-sectional study found in a large sample of Spanish people with ACO that they engaged in an average of 2038.1 MET·min/week of PA, predominantly at a moderate level. Therefore, these participants achieved the PA recommendations of the Centres for Disease Control and Prevention (40) and the World Health Organization (41), 600 MET.min/week. Nevertheless, the quantity of PA in Spanish with ACO is lower than the total amount observed in the reliability and validity study of the IPAQ, where an average of 2514 MET·min/week were found in people aged 18-65 years from 12 different countries (36). Similarly, in a large prospective cohort study among UK adults aged 40-69 years, those with chronic respiratory diseases engaged in significantly less moderate PA than those without chronic diseases (637 min/week vs 705 min/week) (42).

Contrary to our hypothesis, when the total amount of PA of Spanish people with ACO of the present study is compared with their peers with only COPD (29), a higher level is found among those with ACO (2038.1 vs 1684.8 MET·min/week). These results concur with Xavier et al. (43), who found significantly higher levels of total daily life PA in 11 patients with ACO than in 11 patients with COPD (5428 vs 3599 steps/day). These outcomes can be explained based on the results found by Park et al. (44), which determined that patients with ACO had better quality of life, due to a reduction of required hospital admission in comparison with their peers with COPD alone. Therefore, they suggested that ACO was characterized by less severe symptoms, which explained rare severe exacerbation and the possibility of lung function recovery. Contrary, Menezes et al. (45) found that ACO was associated with higher risk for exacerbations, hospitalizations and worse perception of general health status compared with those with only COPD. These findings could explain the results found in Miravitlles et al., where Spanish adults with both asthma and COPD (n=67) exhibited significantly reduced PA than their peers with COPD alone (n=318) (12). Another study carried out in Canadian adults (n=68578) also showed that adults with ACO (n=1569) had a reduced PA level than those with only COPD (n=3118) (22). However, these studies only included participants over 40 years, then, comparisons should be taken carefully.

Nevertheless, in both Spanish with COPD (29) and Spanish with ACO (present analyses), the percentages of participants who engaged in a moderate level of PA were very similar (47.5% vs. 48.0%). However, the percentage of people with ACO who participated in low levels of PA was slightly higher than in those with only COPD (37.9% vs. 35.9%).

In contrast, when comparing PA levels in Spanish people with ACO with those with only asthma, ACO patients of the present study exhibited a lower weekly amount of

PA (30) (2038.1 vs 2228.9 MET·min/week). These results verified our previous hypothesis. Moreover, the percentage of asthma patients engaging in low levels of PA was lower (35.9% in ACO vs 31.6% in asthmatics).

To the authors' knowledge, this is the first study that establishes the levels of PA in adults with ACO analysing the differences according to sex, age, marital status, cohabiting, education level, BMI, smoking habits and alcohol consumption. The findings of the present study reveal significant differences in the total amount of PA only between age groups and BMI groups. Those aged 60 or over and those obese were physically less active than their younger and normal weight peers, which verified the initial hypothesis. However, contrary to our hypothesis, no significant differences were found according to sex, tobacco and alcohol consumption. Comparing with other studies analysing only COPD or only asthma, some differences were found. Other studies among Spanish with only COPD (29,46) or only asthma (30), showed that women with COPD or asthma were less active than men. The present study found also found a low level of PA in women, but this difference was not significant. There is no existing literature about why women with only COPD or only asthma practise less PA than men, or why these differences were not significant in ACO patients. However, regarding other diseases, for example diabetes, the barriers to practise PA were lack of time, lack of knowledge and health limitations; importantly, health limitations was identified as the most important barrier in women but not in men (47). Another study focusing on barriers to PA in people with diabetes residing in Spain reported that the barrier of having too much work was significantly more important in women than in men (48).

In relation to age, ACO patients aged 30-60 years were physically more active than those older than 60. Indeed, a recent study which analysed influence of age on level

of PA in Brazilian adults (n=808), concludes that PA level declines with advancing age (49).

Regarding BMI, the present study shows that normal weight participants were significantly more active (3014.7 MET·min/week) than obese participants (1127.1 MET·min/week). This concurs with the results found in other studies among adults with only COPD (29,50) and only asthma (30,51). Therefore, it is necessary to consider BMI when analysing PA level in ACO patients due to the fact that a higher BMI is normally related with other chronic diseases like cardiovascular diseases, diabetes or cancer, and the presence of these comorbidities could be one of the reasons of lower PA levels.

A recent study that compared the effects of a high-intensity exercise training on subjects with COPD and ACO determined that the benefits were similar in both groups, indicating improvements after the 12-week high-intensity training program on exercise capacity assessed by the 6 minute walk test (COPD: 43m; ACO: 52m), peripheral muscle strength (quadriceps femoris improvements: 4kg (COPD), 3kg (ACO); biceps and triceps brachialis improvements: 3kg (ACO), 4kg (COPD)), inspiratory muscle strength (COPD: 7cmH_2O; ACO: 9cmH_2O), functional status (COPD: -3 points; ACO: -4 points) and quality of life (-4.3 points; ACO: -12 points) (52). However, it is important to specify that those with acute exacerbations in the last month were excluded and diagnosis of ACO was adapted from Sin et al. (53), which is different from the present study.

The main strengths of this study are the use of an international and validated questionnaire to evaluate PA level and the use of a representative sample of Spanish population. The Spanish National Health Survey selected a sample of approximately 37,500 dwellings distributed in 2,500 census sections. Thus, estimates with good reliability at national level were guaranteed. However, findings from this study should be considered in light of its limitations. IPAQ is a reference instrument in measuring a

population's PA level, but it is self-reported and people could over or under estimate their PA level. Another potential limitation is the self-reported diagnosis of ACO. We had no access to participant's medical history, we only had the confirmation of the participants of having been diagnosed with asthma and COPD by a physician. Furthermore, as it was a cross-sectional study and not a randomized controlled trial, the association can be demonstrated, but not the causality. In future research, it is recommendable to use accelerometers in order to objectively measure PA and to take into account the unified criteria for the diagnosis of ACO between the Spanish COPD Guidelines and the Spanish Guidelines on the Management of Asthma (54).

Conclusion

On average, Spanish people with ACO have a moderate PA level but, it is important to note that more than three out of ten Spanish people with ACO do not achieve PA recommendations. Therefore, it is recommendable to implement programs to raise awareness of the importance and benefits of PA among those with ACO residing in Spain. These programs should focus on older adults and those who are obese.

Declaration of interest

The authors report no conflict of interest.

References

1. Forum of International Respiratory Societies. The Global Impact of Respiratory Disease. 2nd ed. Sheffield (UK): European Respiratory Society; 2017.

2. Global Initiative for Asthma. Global strategy for asthma management and prevention updated 2020 [Internet]. 2020 [accessed 2020 May 28]. www.ginasthma.org

3. Global Initiative for Chronic Obstructive Lung Disease. Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease. 2020 [accessed 2020 May 27]. www.goldcopd.org

4. Institute for Health Metrics and Evaluation. Global Health Data Exchange (GHDx). [accessed 2020 Dec 8]. http://ghdx.healthdata.org/gbd-results-tool

5. GBD 2015 Chronic Respiratory Disease Collaborators. Global, regional, and national deaths, prevalence, disability-adjusted life years, and years lived with disability for chronic obstructive pulmonary disease and asthma, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet Respir Med. 2017; 5(9): 691-706. doi: 10.1016/S2213-2600(17)30293-X

6. Halbert RJ, Natoli, JL, Gano A., Badamgarav E., Buist AS, Mannino DM. Global burden of COPD: systematic review and meta-analysis. Eur Respir J. 2006; 28: 523-532. doi: 10.1183/09031936.06.00124605

7. Alshabanat A, Zafari Z, Albanyan O, Dairi M, FitzGerald JM. Asthma and COPD overlap syndrome (ACOS): A systematic review and meta analysis. PLoS One. 2015;10(9):e0136065. doi: 10.1371/journal.pone.0136065

8. Tommola M, Ilmarinen P, Tuomisto LE, Lehtimäki L, Haanpää J, Niemelä O, Kankaanranta H. Differences between asthma - COPD overlap syndrome and adult-onset asthma. Eur Respir J. 2017;49(5):1602383. doi: 10.1183/13993003.02383-2016

9. de Marco R, Pesce G, Marcon A, Accordini S, Antonicelli L, Bugiani M, et al. The Coexistence of Asthma and Chronic Obstructive Pulmonary Disease (COPD): Prevalence and Risk Factors in Young, Middle-aged and Elderly People from the General Population. PLoS One. 2013;8(5): e62985. doi: 10.1371/journal.pone.0062985. Cited in:

PMID: 23675448.

10. Pleasants RA, Ohar JA, Croft JB, Liu Y, Kraft M, Mannino DM, Donohue JF, Herrick HL. Chronic obstructive pulmonary disease and asthma-patient characteristics and health impairment. COPD J Chronic Obstr Pulm Dis. 2014;11(3):256–266. doi: 10.3109/15412555.2013.840571

11. Gibson PG, McDonald VM. Asthma-COPD overlap 2015: Now we are six. Thorax. 2015; 70(7): 683–691. doi: 10.1136/thoraxjnl-2014-206740

12. Miravitlles M, Soriano JB, Ancochea J, Muñoz L, Duran-Tauleria E, Sánchez G, Sobradillo S, García-Río F. Characterisation of the overlap COPD-asthma phenotype. Focus on physical activity and health status. Respir Med. 2013;107(7):1053–1060. doi: 10.1016/j.rmed.2013.03.007.

13. Menezes AMB, De Oca MM, Pérez-Padilla R, Nadeau G, Wehrmeister FC, Lopez-Varela MV, Muiño A, Jardim JRB, Valdivia G, Tálamo C, Platino team. Increased risk of exacerbation and hospitalization in subjects with an overlap phenotype : COPD-Asthma. Chest. 2014;145(2):297–304. doi: 10.1378/chest.13-0622. Cited in: PMID: 24114498.

14. Hardin M, Cho M, McDonald ML, Beaty T, Ramsdell J, Bhatt S, van Beek EJR, Make BJ, Crapo JD, Silverman EK, et al. The clinical and genetic features of COPD-asthma overlap syndrome. Eur Respir J. 2014;44(2):341–350. doi: 10.1183/09031936.00216013

15. Haskell WL, Lee I-M, Pate RR, Powell KE, Blair SN, Franklin BA, Macera CA, Heath GW, Thompson PD, Bauman A, et al. Physical Activity and Public Health: Updated Recommendation for Adults From the American College of Sports Medicine

and the American Heart Association. Circulation. 2007;116(9):1081–1093. doi: 10.1161/CIRCULATIONAHA.107.185649. Cited in: PMID: 17671237.

16. Warburton DER, Nicol CW, Bredin SSD. Health benefits of physical activity: the evidence. CMAJ. 2006;174(6):801–809. doi: 10.1503/cmaj.051351. Cited in: PMID: 16534088.

17. Marques A, Peralta M, Sarmento H, Martins J, Gonzalez-Valeiro M. Associations between vigorous physical activity and chronic diseases in older adults: a study in 13 European countries. Eur J Public Health. 2018;28(5):950–955. doi: 10.1093/eurpub/cky086

18. Sobradillo V, Miravitlles M, Jiménez CA, Gabriel R, Viejo JL, Masa JF, et al. Estudio IBERPOC en España: prevalencia de síntomas respiratorios habituales y de limitación crónica al flujo aéreo. Arch Bronconeumol. 1999;35(4):159–166. Doi: 10.1016/S0300-2896(15)30272-6

19. Dogra S, Kuk JL, Baker J, Jamnik V. Exercise is associated with improved asthma control in adults. Eur Respir J. 2011;37(2):318–323. doi: 10.1183/09031936.00182209. Cited in: PMID: 20530042.

20. Cebollero P, Antón M, Hernández M, Hueto J. Walking Program for Copd Patients: Clinical Impact After Two Years of Follow-up. Arch Bronconeumol. 2018;54(8):439–440. doi:10.1016/j.arbres.2017.11.002. Cited in: PMID: 29248261.

21. Garcia-Aymerich J, Farrero E, Félez MA, Izquierdo J, Marrades RM, Antó JM. Risk factors of readmission to hospital for a COPD exacerbation: a prospective study. Thorax. 2003; 58 (2):100-105. doi: 10.1136/thorax.58.2.100. Cited in: PMID: 12554887.

22. Jagroop D, Dogra S. Physical activity among Canadian adults with obstructive respiratory diseases. Appl. Physiol. Nutr. Metab. 2018; 43: 1075–1082. doi:10.1139/apnm-2017-0865

23. STROBE Group. STROBE Statement. Bern (CH): Institute of Social and Preventive Medicine - University of Bern; 2009 [accessed 2020 May 14]. https://www.strobe-statement.org/

24. Instituto Nacional de Estadística. Encuesta nacional de salud. [accessed 2020 May 25].https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736176783&menu=resultados&idp=1254735573175#!tabs-1254736195650

25. Ministerio de Sanidad Servicios Sociales e Igualdad, Instituto Nacional de Estadística. Encuesta Nacional de Salud 2017 Metodología. 2017 [accessed 2020 May 15]. https://www.ine.es/metodologia/t15/t153041917.pdf

26. Martin LM, Leff M, Calonge N, Garrett C, Nelson DE. Validation of self-reported chronic conditions and health services in a managed care population. Am J Prev Med. 2000; 18(3): 215-218. doi: 10.1016/S0749-3797(99)00158-0.

27. Torèn K, Brisman J, Jävholm B. Asthma and asthma-like symptoms in adults assessed by questionnaires: a literature review. Chest 1993; 104(2): 600-608. Doi: 10.1378/chest.104.2.600.

28. Barr RG, Herbstman J, Speizer FE, Camargo CA. Validation of self-reported chronic obstructive pulmonary disease in a cohort study of nurses. Am J Epidemiol. 2002; 155(10): 965-971. doi: 10.1093/aje/155.10.965

29. Sánchez Castillo S, Smith L, Díaz Suárez A, López Sánchez GF. Physical Activity Behaviour in People with COPD Residing in Spain: A Cross-Sectional Analysis. Lung. 2019; 197(6):769-775. doi: 10.1007/s00408-019-00287-4. Cited in: PMID: 31686208

30. Sánchez Castillo S, Smith L, Díaz Suárez A, López Sánchez GF. Levels of Physical Activity in Spanish Asthmatics: A Cross-Sectional Study. Medicina. 2020; 56(12), 643. doi:10.3390/medicina56120643

31. Jacob L, López-Sánchez GF, Oh H, Shin J, Grabovac I, Soysal P, Illie PC, Veronese N, Kiyonagi A, Smith L. Association of multimorbidity with higher levels of urinary incontinence: a cross-sectional study of 23 089 individuals aged ≥15 years residing in Spain. Br J Gen Pract. 2020. doi: 10.3399/bjgp20X713921

32. Malambo P, Kengne AP, Lambert EV, De Villiers A, Puoane T. Prevalence and socio-demographic correlates of physical activity levels among South African adults in Cape Town and Mount Frere communities in 2008-2009. Arch Public Heal. 2016 Dec 29;74:54. doi: 10.1186/s13690-016-0167-3. Citen in: PMID: 28042473.

33. Salvo D, Torres C, Villa U, Rivera JA, Sarmiento OL, Reis RS, Pratt M. Accelerometer-based physical activity levels among Mexican adults and their relation with sociodemographic characteristics and BMI: A cross-sectional study. Int J Behav Nutr Phys Act. 2015;12(79). doi:10.1186/s12966-015-0243-z

34. IPAQ Group. International Physical Activity Questionnaire. 2005 [accessed 2020 May 11]. https://sites.google.com/site/theipaq/

35. IPAQ Group. Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire (IPAQ). 2005 [accessed 2020 May 15].

https://sites.google.com/site/theipaq/scoring-protocol

36. Craig CL, Marshall AL, Sjöström M, Sjöstro S, Sjöström S, Bauman AE, Booth ML, Ainsworth BE, Pratt M, Ekelund U, et al. International Physical Activity Questionnaire: 12-Country Reliability and Validity. Med Sci Sport Exerc. 2003;35(8):1381–1395. doi: 10.1249/01.MSS.0000078924.61453.FB. Cited in: PMID: 12900694.

37. Instituto Nacional de Estadística. Clasificación Nacional de Educación 2014 (CNED-2014). Introducción y aspectos generales. 2016 Jun 23 [accessed 2020 May 2]. https://www.ine.es/daco/daco42/clasificaciones/cned14/CNED2014_capitulo0.pdf

38. Soriano JB, Ancochea J, Miravitlles M, García-Río F, Duran-Tauleria E, Muñoz L, Jiménez-Ruiz CA, Masa JF, Viejo JL, Villasante C, et al. Recent trends in COPD prevalence in Spain: A repeated cross-sectional survey 1997-2007. Eur Respir J. 2010;36(4):758–765. doi: 10.1183/09031936.00138409. Cited in: PMID: 19996189.

39. Cohen J. Statistical Power Analysis for the Behavioral Sciences. 2nd ed. New York (NY): Lawrence Erlbaum associates; 1988.

40. U.S. Department of Health and Human Services.Physical Activity Guidelines for Americans. 2nd ed. Washington (DC): U.S. Department of Health and Human Services; 2018

41. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, Carty C, Chaput JP, Chastin S, Chou R, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020; 54(24):1451-1462. doi: 10.1136/bjsports-2020-102955.

42. Barker J, Smith Byrne K, Doherty A, Foster C, Rahimi K, Ramakrishnan R, Woodward M, Dwyer T. Physical activity of UK adults with chronic disease: Cross-sectional analysis of accelerometer-measured physical activity in 96 706 UK Biobank participants. Int J Epidemiol. 2019; 48(4):1167–1174. doi: 10.1093/ije/dyy294. Cited in: PMID: 30721947.

43. Xavier R, Pereira ACAC, Lopes AC, Ramos EMC, Mancini MC, Cukier A, Fernandes-Carvalho CR. Comparison of daily life physical activity in patients with COPD and asthma COPD overlap syndrome. Eur Respir J. 2016; 48: PA1892. doi: 10.1183/13993003.congress-2016.PA1892.

44. Park HJ, Byun MK, Kim HJ, Ahn CM, Lee JH, Shin KC, Uh ST, Ra SW, Yoo KH, Jung KS. Asthma- COPD overlap shows favorable clinical outcomes compared to pure COPD in a Korean COPD cohort. Allergy Asthma Immunol Res. 2017;9(5):431–437. doi: 10.4168/aair.2017.9.5.431. Cited in: PMID: 28677357

45. Menezes AMB, De Oca MM, Pérez-Padilla R, Nadeau G, Wehrmeister FC, Lopez-Varela MV, Muiño A, Jardim JRB, Valdivia G, Tálamo C, et al. Increased risk of exacerbation and hospitalization in subjects with an overlap phenotype: COPD-Asthma. Chest. 2014;145(2):297–304. doi: 10.1378/chest.13-0622. Cited in: PMID: 24114498.

46. Park SK, Richardson CR, Holleman RG, Larson JL. Physical activity in people with COPD, using the National Health and Nutrition Evaluation Survey dataset (2003-2006). Hear Lung J Acute Crit Care. 2013;42(4):235–240. doi: 10.1016/j.hrtlng.2013.04.005. Cited in: PMID: 23726356.

47. López-Sánchez GF, Smith L, Raman R, Jaysankar D, Singh S, Sapkota R, Díaz-Suárez A, Pardhan S. Physical activity behaviour in people with diabetes residing in

India: A cross-sectional analysis. Sci Sports. 2019; 34(1):e59–e66. doi: 10.1016/j.scispo.2018.08.005

48. López JN, González-Carcelén CM, López-Sánchez GF. Barriers to physical activity in people with diabetes residing in Spain. Atena Journal of Public Health. 2020;2 (3):1–20.

49. Martins TCR, de Pinho L, Brito MFSF, Pena GDG, Silva RRV, Guimarães ALS, Silveira MF, Rodrigues JF. Influence of socioeconomic status, age, body fat, and depressive symptoms on evel of physical activity in adults: A path analysis. Cienc e Saude Coletiva. 2020;25(10):3847–3856. doi:10.1590/1413-812320202510.24742018

50. Mesquita R, Spina G, Pitta F, Donaire-Gonzalez D, Deering BM, Patel MS, Mitchell KE, Alison J, van Gestel AJr, Zogg S, et al. Physical activity patterns and clusters in 1001 patients with COPD. Chron Respir Dis. 2017;14(3):256–269. doi: 10.1177/1479972316687207. Citen in: PMID: 28774199.

51. Conroy MB, Rockette-Wagner BJ, Wisnivesky J, Holguin F, Chen S, Federmann E, et al. Physical Activity Patterns Vary by BMI and Asthma Control in Patients with Asthma. Med Sci Sport Exerc. 2019 Jun;51(Supplement):125–126.

52. Rodrigues A, de Oliveira JM, Furlanetto KC, Machado FVC, Belo LF, Schneider LP, Morita AA, Andrelo AC, Fonseca J, Lopes-Brito I, et al. Are the Effects of High-Intensity Exercise Training Different in Patients with COPD Versus COPD+Asthma Overlap? Lung. 2020; 198(1):135–141. doi:10.1007/s00408-019-00311-7. Cited in: PMID: 31873783.

53. Sin DD, Miravitlles M, Mannino DM, Soriano JB, Price D, Celli BR, Leung JM, Nakano Y, Park HY, Wark PA, et al. What is asthma-COPD overlap syndrome? Towards

a consensus definition from a round table discussion. Eur Respir J. 2016; 48(3):664–673. doi: 10.1183/13993003.00436-2016. Cited in: PMID: 27338195.

54. Plaza V, Álvarez F, Calle M, Casanova C, Cosío BG, López-Viña A, et al. Consensus on the Asthma-COPD Overlap (ACO) Between the Spanish COPD Guidelines (GesEPOC) and the Spanish Guidelines on the Management of Asthma (GEMA). Arch Bronconeumol. 2017;53(8):443–449. doi: 10.1016/j.arbr.2017.06.001

Table 1. Sample characteristics

Total sample (n=198)		**N**	**%**
Sex	Women	120	60.61
	Men	78	39.39
Age	<30	23	11.62
	30-60	109	55.05
	≥60	66	33.33
Education level	Level A	121	61.11
	Level B	32	16.16
	Level C	45	22.73
Marital Status	Married	100	50.51
	Not Married	98	49.49
Living in couple	Yes	102	52.04
	No	94	47.96
	Missing	2	
BMI	Underweight	4	2.08
	Normal weight	68	35.42
	Overweight	63	32.81
	Obesity	57	29.69
	Missing	6	
Smoking	Current	60	30.30
	Former	59	29.80
	Never	79	39.90
Alcohol last 12 month	Yes	116	58.89
	No	82	41.41

N: sample size; %: percentage; Level A: 1st period secondary; Level B: 2nd period secondary and post-secondary (not tertiary); Level C: tertiary; BMI: body mass index.

Table 2. Total amount of Physical Activity in Met·min/week, according to sample characteristics.

		n	Av	SD	Med	*p*	*ES*
Sex	Women	120	1813.2	3015.2	990.0	0.645	0.001
	Men	78	2384.2	4852.2	1014.8		
Age	1. <30	23	2309.3	3304.3	1032.0		
	2. 30-60[3]	109	2475.5	4724.0	1386.0	0.040*	0.033
	3. ≥60[2]	66	1221.3	1724.3	693.0		
Education level	Level A	121	2078.3	4581.5	924.0		
	Level B	32	1767.5	2330.8	1386.0	0.118	0.022
	Level C	45	2122.4	2236.3	1386.0		
Marital Status	Married	100	2448.9	4958.5	1308.0	0.506	0.002
	Not Married	98	1318.9	2134.5	858.0		
Living in couple	Yes	102	2448.5	4971.3	1097.3	0.847	0.000
	No	94	1603.3	2016.0	954.8		
Smoking	Current	60	2730.6	5560.1	717.8		
	Past	59	1529.5	1887.9	1230.0	0.981	0.000
	Never	79	1892.1	3269.4	990.0		
Alcohol	Yes	116	2138.1	3765.1	1053.0	0.460	0.003
(last 12 months)	No	82	1896.7	3970.7	990.0		
BMI	1. Underweight	4	3374.3	5222.8	1204.5		
	2. Normal weight[4]	68	3014.7	4777.0	1386.0	0.026*	0.047
	3. Overweight	63	1890.3	4080.9	1155.0		
	4. Obesity[2]	57	1127.1	1504.3	693.0		
Total		198	2038.1	3843.5	990.0		

n: Sample size; Av: Average; SD: Standard Deviation; Med: median; Level A: 1st period secondary; Level B: 2nd period secondary and post-secondary (not tertiary); Level C: tertiary; BMI: body mass index; Superscripts indicate significant differences between groups; p-values was based on Mann- Whitney U test and Kruskal Wallis H test. ES: Effect size was based on eta squared for Mann-Whitney U test and epsilon squared for Kruskal Wallis H test. *Statistical significance at $p<0.05$.

Table 3. Classification of PA level following IPAQ guidelines, according to sample characteristics.

			PA Level				
		n	**Low[1]**	**Mod[2]**	**High[3]**	***p***	***V***
Sex	Women	120	44 (36.7)	58(48.3)	18(15.0)	0.853	0.040
	Men	78	27(34.6)	37(47.4)	14(17.9)		
Age	<30	23	9(39.1)	10(43.5)	4(17.4)		
	30-60	109	32(29.4)	55(50.5)	22(20.2)	0.163	0.128
	≥60	66	30(45.5)	30(45.5)	6(9.1)		
Education level	Level A	121	47(38.8)	58(47.9)	16(13.2)		
	Level B	32	12(37.5)	15(46.9)	5(15.6)	0.411	0.100
	Level C	45	12(26.7)	22(48.9)	11(24.4)		
Marital Status	Married	100	34(34.0)	50(50.0)	16(16.0)	0.831	0.043
	Not Married	98	37(37.8)	45(45.9)	16(16.3)		
Living in couple	Yes	102	37(36.3)	48(47.1)	17(16.7)	0.989	0.011
	No	94	34(36.2)	45(47.9)	15(16.0)		
Smoking	Current	60	21(35.0)	25(41.7)	14(23.3)		
	Ex	59	21(35.6)	32(54.2)	6(10.2)	0.370	0.104
	Never	79	29(36.7)	38(48.1)	12(15.2)		
Alcohol (last 12 m)	Yes	116	40(34.5)	53(45.7)	23(19.8)	0.249	0.119
	No	82	31(37.8)	42(51.2)	9(11.0)		
BMI	Underweight	4	2(50.0)	1(25.0)	1(25.0)		
	Normalweight	68	20(29.4)	30(44.1)	18(26.5)	0.125	0.161
	Overweight	63	24(38.1)	30(47.6)	9(14.3)		
	Obesity	57	21(36.8)	32(56.1)	4(7.0)		
Total		198	71(35.9)[3]	95(48.0)[3]	32(16.2)	<0.001*	-

Values are expressed in Frequency (%). n: Sample size; Level A: 1st period secondary; Level B: 2nd period secondary and post-secondary (not tertiary); Level C: tertiary; V:Cramer's V
*Statistical significance at $p<0.05$