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Recent trends in COPD prevalence in Spain: a repeated cross-sectional survey 1997 - 2007

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ABSTRACT (maximum 200 words):

We aimed to describe changes in the prevalence of COPD in Spain by means of a repeated cross-sectional design comparing two population-based studies conducted ten years apart.

We compared participants from the IBERPOC study (n=4,030), conducted in 1997, with those of the EPI-SCAN study (n=3,802) conducted in 2007. Poorly reversible airflow obstruction compatible with COPD was defined according to the old ERS definitions.

COPD prevalence in the population between 40 to 69 years of age dropped from 9.1% (IC 95% 8.1-10.2) in 1997 to 4.5% (IC 95% 2.4-6.6), that is a 50.4% decline. The distribution of COPD prevalence by severity also changed from 38.3% mild, 39.7% moderate and 22.0% severe in 1997 to 85.6% mild, 13.0% moderate and 1.4% severe in 2007; and in the 40-69 yr EPI-SCAN sub-sample to 84.3% mild, 15.0% moderate and 0.7% severe. Overall, underdiagnosis was reduced from 78% to 73% (p n.s.) and undertreatment from 81% to 54% ($p < 0.05$) within this ten-year frame.

The finding of a substantial reduction in the prevalence of COPD in Spain is unexpected, as well as the observed changes in the severity distribution, and highlight the difficulties to compare repeated cross-sectional surveys of spirometry in the population.

Abstract word count: 199 words

Keywords: COPD; IBERPOC; EPI-SCAN; prevalence; Spain.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a leading but under-recognised cause of morbidity and mortality worldwide. No other disease that is responsible for comparable burden worldwide is neglected by healthcare providers as much as COPD.[1] [2] The Global Burden of Disease Study from the World Health Organization (WHO) has been systematically assessing worldwide statistics on mortality and prevalence by disease since 1990,[3] and their 30-yr. projections for the global increase in COPD are startling. COPD is projected to move from the currently fourth to third position in terms of morbidity before 2020,[4] [5] mainly due to the worldwide epidemic of smoking and the changing global demographics, with more people in developed and developing countries living longer and therefore, being at risk of COPD for longer. Spain is currently experiencing an epidemiological transition. Although smoking prevalence in Spain is decreasing, current estimates still show one of the highest prevalences within Western Europe,[6] estimated in 2006 as 30.0% of the adult population, that is 35.8% of men and 24.3% of women.[7] Additionally, the Spanish population is ageing, with a maximal growth expected by 2050 with 53 million inhabitants, and maximal ageing expected by 2060.[7] Therefore, Spain is a country where the population burden of COPD, and other chronic conditions associated with smoking, are expected to surge in the next years,[8] although the recent reductions in overall smoking deserve reassessment. The available epidemiologic data in Spain has been recently reviewed elsewhere.[9] The *Estudio epidemiológico de EPOC en España* (IBERPOC) study, a landmark prevalence survey conducted in 1997,[10] reported that 9.1% of the general

Spanish population between 40 and 69 years had COPD.[11] IBERPOC was the first, large population survey to use post-bronchodilator spirometry to ascertain the prevalence of COPD, and its results on underdiagnoses and undertreatment have also been identified in more recent international surveys elsewhere.[12 13] The EPIdemiologic Study of COPD in SpAiN (EPI-SCAN) study is a new, more recent evaluation of the population distribution of COPD in Spain,[14] and recently reported that currently 10.2% of the general Spanish population between 40 and 80 years of age has COPD.[15] However, the comparison of results of EPI-SCAN versus IBERPOC, cannot be straightforward. By using the individual, patient-level data of these two studies, we report the changes in COPD prevalence in Spain in 1997 and 2007, and illustrate the difficulty of comparing population estimates of COPD measured by spirometry between different surveys.

METHODS

We applied a repeated cross-sectional study design to compare the COPD prevalences in Spain in 1997 and 2007. Both studies[10,14] have been described in full elsewhere, and their main similarities and differences are compared in Table 1. Briefly, on the one hand IBERPOC was a population survey conducted in seven areas of Spain in 1996-1997. The study randomly identified population participants aged 40 to 69 years, and invited them to perform pre- and post-bronchodilator spirometry. Recommendations for lung function and thresholds to define and stage COPD were according to the old European Respiratory Society (ERS) guidelines,[16] and COPD was defined by a post-bronchodilator ratio FEV_1/FVC<88% predicted in men and <89% in women; similarly, COPD severity was staged as mild if FEV_1 ≥70%, moderate if FEV_1 50-69% and severe if FEV_1 <50%. On the other hand, EPI-SCAN was another population survey conducted in eleven areas of Spain ten years later.[14] The study randomly identified population participants aged 40 to 80 years, and also invited them to perform pre- and post-bronchodilator spirometry. Recommendations for lung function and thresholds to define and stage COPD were according to current Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines.[17] So, COPD was defined by a post-bronchodilator ratio FEV_1/FVC <0.70, and severity was staged as mild FEV_1 ≥80%, moderate FEV_1 50 - 80%, severe FEV_1 30-50%, and very severe FEV_1 <30%.

For the purpose of these analyses, the old ERS recommendations have been used to define and stage COPD,[16] and the predicted reference values were re-calculated according to Roca et al.[18] for the Spanish population. Comparison of

IBERPOC results are presented with all, and with the subsample of 40-69 yr participants in EPI-SCAN. Participants reporting a previous asthma diagnosis were excluded from the analyses as per the IBERPOC protocol.[10]

Questions on previous medical diagnosis compatible with COPD, and on prescribed respiratory treatments, were the same/similar in both surveys and they were used to determine changes in underdiagnosis and undertreatment.

Both studies received approval by an Ethics Committee and all subjects provided written informed consent to participate in the studies. [10,14]

Statistical analysis

A descriptive and comparative analysis of socio-demographic and clinical variables between both study samples has been performed. The EPI-SCAN sample has been described including all subjects and defining the same age group (40 to 69 years) than the IBERPOC study. Data is presented as mean and standard deviation (±SD) for continuous variables, or percentage for qualitative variables, as appropriate. Prevalences are presented as percentages and their 95% confidence interval by gender, age and area. In order to compare the prevalence between studies data from the EPI-SCAN study has been adjusted by age and gender using indirect method. Differences within groups were compared with Chi^2 tests for categorical variables and Student t test for continuous variables. A p value lower than 0.05 was considered statistically significant.

RESULTS

A flowchart of participation according to IBERPOC is presented (Figure 2). The demographic and clinical characteristics of both surveys are summarised in Table 2. The characteristics of the subgroup of EPI-SCAN participants with ages 40 to 69 years old are presented as an additional column in Table 2. When comparing this EPI-SCAN subgroup with the IBERPOC participants, they had no significant differences in the age and gender distribution. But, 2007 participants were taller (161.8 cm vs. 164.7 cm) but with an identical mean BMI of 27, were more often current- or ex-smokers, and more often had a higher degree of education (all $p<0.05$). The average pack-years in IBERPOC participants was 27.8 ± 22.9, while in EPI-SCAN participants it was 26.0 ± 21.5), that is very similar although IBERPOC included older participants 70 to 79 yrs. Whenever those 70 years or older were excluded, pack-years went down to 24.4 ± 19.9 ($p < 0.001$ *in* Table 2). In IBERPOC the average distribution of pack-years by centre ranged from the highest in Caceres 34.1 ± 25.7 to the lowest in Manlleu 25.0 ± 21.2; while in EPI-SCAN the average distribution of pack-years by centre ranged from the highest in Vic 29.2 ± 24.1 to the lowest in Huesca 22.3 ± 18.9. There were significant differences in all forced spirometry measurements. Mean FEV_1% predicted was 87.8±17.0 vs. 100.8±17.4, and FVC% predicted was 88.4±14.6 vs. 98.7±15.3, in 1997 vs. 2007, respectively. From now onwards, all comparison with IBERPOC are based on the latter subgroup of EPI-SCAN aged 40-69 yr.

The prevalence of COPD according to the old ERS guidelines dropped from 9.1% (IC 95% 8.1-10.2) in 1997 to 4.5% (IC 95% 2.4-6.6) in 2007, that is a

50,4% decline (Figure 3). The distribution of COPD prevalence by severity according to the old ERS criteria changed to a milder population distribution, from 38.3% mild, 39.7% moderate and 22.0% severe in 1997 to 85.6% mild, 13.0% moderate and 1.4% severe in 2007; and in the 40-69 yr EPI-SCAN sub-sample to 84.4% mild, 15.5% moderate and 2.2% severe (all $p < 0.05$) (Figure 3). Interestingly, recalculation of patient-level data, with all combinations of thresholds (old ERS and current GOLD) and restriction to the 40-69 yr sample or all participants, would have produced a different interpretation of changes in prevalence and severity distribution among both surveys (additional columns in Figure 3).

The decline in COPD prevalence was observed in all age strata and in both genders, except for a non-significant increase from 2.8% to 4.2% in COPD prevalence in 50-59 yr old women ($p > 0.05$) (Figure 4).

As five areas in IBERPOC were also surveyed in EPI-SCAN (Burgos, Madrid, Oviedo, Sevilla and Vic-Manlleu), changes in local COPD prevalence were explored. It can be seen that in all repeated areas there is a substantial decrease in local COPD prevalence, ranging from a 85% to a 94% decrease in Manlleu and Burgos to a 46% decrease in Oviedo, applicable specially to women in Burgos, where a 94.8% was observed (Table 3). These standardised observed reductions were of -72.4% in men and -67.9% in women. Similar significant reductions were observed if the current GOLD recommendations were applied to both surveys (data not shown).

Finally, changes in underdiagnosis, undertreatment, and smoking, among participants with spirometrically confirmed COPD of IBERPOC and EPI-SCAN were explored. There was a non-significant decrease in underdiagnosis, from

78% in 1997 to 73% in 2007. However, there was a significant decrease in undertreatment, from 81% in 1997 to 54% in 2007, which was even greater (50% vs 10%) in those with severe COPD (those with a percent predicted FEV_1 <50%). Lung function was indeed more frequently tested now (16.5% vs 58.5%), but more smokers reported never trying to quit smoking (34.9% vs 88.7%), both $p<0.05$ (Table 4).

DISCUSSION

By repeating a cross-sectional survey ten years apart, we report in here a substantial decrease of 50.4% in COPD prevalence in Spain in the population between 40 to 69 years of age within ten years from 1997 to 2007. This is a surprising, unexpected finding. Due to the cumulative history of exposure to cigarette smoking in Spain, we were actually expecting to find an increase in COPD prevalence in Spain,[14] particularly in women,[9] rather than the current observed decrease. After careful review of all implemented quality control procedures in IBERPOC and EPI-SCAN, and recalculation of all statistics independently, our conclusion is sustained. To our knowledge, ours is the first repeated survey of COPD using post-bronchodilator spirometry conducted in adults and elderly from the general population.

Review of previous literature

Numerous indirect assessments concur that the population burden due to COPD, worldwide and in Spain, are set to increase in the near future. The global estimates of mortality and morbidity per a given disease made in 1990, were recently updated and confirmed a significant upward trend for COPD.[5] In Europe, the COPD mortality rates range from <25 to >75 per 100,000 inhabitants within the various European countries with data, and its prevalence ranges from less than 2% to more than 10%, also with an expected increase.[19] Both PLATINO and BOLD results identified substantial variability of COPD prevalence within centres. This evidence, together with the unstabilty of results by time reported in here, points to the difficulties of applying current spirometric

definitions of COPD.[20]. Both the PLATINO and BOLD surveys have identified a significant burden and undetected COPD in most areas, but their cross-sectional nature prevents any conclusion regarding temporal changes regionally or locally.[12,13] In asthma, repeated cross-sectional studies, conducted in the same areas by the same authors, and using an identical/similar protocol, have reported the transition to the current, expanding asthma epidemic.[21 22 23 24] Such an evidence is scarce in adults from the population with post-bronchodilator forced spirometry and COPD, with repeated surveys just available from Finland,[25] and Sweden.[26] Both countries identified increases in the population burden of COPD thirty years after initiation, but did not use post-bronchodilator spirometry, a factor that can modify any final COPD assessment.[27]

Limitations

Apart from the advantages of similar researchers and areas, and closely similar protocols whose differences were taken into account in our analysis, there are some limitations of our research that deserve further discussion. As mentioned above, protocols were not exactly the same and COPD guidelines and forced spirometry recommendations have changed during this relatively short period. We have ensured that re-calculation of individual data from both surveys was conducted consistently, and that similar definitions, thresholds and exclusions were applied. However, the subtle effect of differences in the sampling frame and recruitment, and slight technical changes in spirometry recommendations and/or tools cannot be ruled out to explain, totally or partially, our findings. Without an intention to be cumbersome, a long list of methodological issues are

presented next. Spirometers used in both surveys differed (Table 1). In IBERPOC it was a turbine spirometer, while in EPI-SCAN a neumotacograh spirometer with high sensitivity was used. It has been reported that turbine spirometers create greater internal resistance to flow, sometimes failing the standards recommended by the ATS at high flows.[28] The manufacturer of the neumotacograh spirometer Datospir-200 reports a maximum resistance of 0.12 kPa/l/sec and the turbine MasterScope 0.05 kPa/l/sec. Buess et al. suggested that the relationship between the internal resistance of a spirometer and the resistance of the respiratory system should be between 5-10%.[29] For a range of resistance of the respiratory system of 0.5-1 kPa/l/s and according to data provided by manufacturers, the neumotacograh MasterScope meets that criterion, while the turbine spirometer would exceed it by 12-24%. An increase in internal resistance of neumotacograhs can produce an underestimation of expiratory volumes, detecting more COPD, which could have occurred in the IBERPOC study. As this effect occurs early in the expiratory manouvre, since most resistance occurs at high flows, it appears that the measure should affect FEV_1 more than the FVC, the latter being more dependent on the completion of the maneuvre. Consequently, an increase of internal resistance of the spirometer could result in an underestimation of the ratio FEV_1/FVC. To our knowledge, there is no data in the literature comparing the Datospir 200 spirometer versus neumotacographers. Accordingly, we reanalyzed data considering an underestimation by 6% in the FEV_1/FVC due to turbine spirometers, producing a prevalence of COPD according to the old ERS criteria in EPI-SCAN of 10.6% (95% CI 9.6-11.5). In the subgroup of individuals 40-69

years, the estimated prevalence of COPD would then be 9.2% (IC95%: 8.2-10.2), virtually identical to the 9.1% reported in the IBERPOC study.

A final limitation limitation to consider is the often arbitrary decission when applying reference equations to estimate predicted lung function. We used Roca et al.,[18] as they are preferred to other available equations for being locally produced and therefore more representative, as recommended elsewhere.[17] But, they were obtained in the mid 80s. As the Spanish population has grown taller and leaner 21 years later, their ongoing validity might be debatable, as their application produced an observed mean percent predicted FEV_1 of 87.8% in 1997 and 100.8% in 2007 (see Table 1). Therefore, additional caution in the interpretation of changes in results of any spirometric survey should be granted when repeated, as changing lung reference equations might have a major effect. Only a re-analysis of raw data, as applied in here, would identify this problem.

The use of lower limit of normal (LLN) to define and stage COPD has been postulated as more advantageous than previous and current recommendations, all based on fixed spirometry ratios,[30] which may misdiagnose large segments of the very young and the very old.[31 32] In a way, the old ERS definition of COPD used in this study, with its variable post-bronchodilator ratio FEV_1/FVC percent lower than a predicted value by gender, is already a type of LLN. However, to compare LLN to current thresholds was not the aim of our study, and we doubt our data will help to settle this controversy.

Should the findings be true, some factors that might explain, albeit partly, this unexpected finding of a COPD prevalence decrease, can be considered. Changes in tobacco consumption in Spain have been well documented. The

prevalence of smokers in adults in Spain significantly dropped in men from 39.9% in 1999 to 32.1% in 2007, while only from 24.6% to 22.1% in women in the same period.[33] The actual point prevalence of smoking at the time of conducting fieldwork of each study, IBERPOC in 1999 and EPI-SCAN in 2007, should not explain the COPD burden, but the cummulative exposure in this population, so it is hard to understand our finding of a 50.4% decrease in COPD prevalence due to changes in smoking. Although the comparison in pack-years of smoking exposure has to be taken with care (Table 2), the different distribution in pack-years among individuals with/without airflow obstruction was in IBERPOC in 1997 of 47.2 ± 28.7 versus 26.7 ± 19.4,[34] which was largely maintained in EPI-SCAN in 2007, of 36.5 ± 18.6 versus 25.0 ± 17.2 (data not shown).

Of interest, the prevalences of respiratory symptoms in both periods (Table 2), were similar for cough or sputum, and they are only significant for minor decreases in dyspnea and wheezing; therefore it is unlikely they help to explain the magnitude of the differences in spirometric values.

The birth cohort of IBERPOC participants in 1996-97 suffered the consequences of the Spanish Civil War, from 1936 to 1939. During the 1940s, living conditions in Spain were extremely hard, including starvation and virtually universal infections. As the average year of birth of IBERPOC participants was 1942, the Barker hypothesis on the influence of pre-conception and early childhood factors on attaining full lung development,[35] with a population shift on weight and other factors to influence later spirometry findings,[36] and even the effect of tuberculosis,[37] common in Spain at that time, might explain a significant unhealthy “cohort effect” in the IBERPOC participants. Conditions gradually

improved in subsequent years, so EPI-SCAN participants (1952 being their average year of birth) were actually taller, leaner, and better educated (Table 2). A final, relevant factor might be the existence of an outlier centre in the IBERPOC 1997 study; Manlleu participants had a COPD prevalence of 18.0% (95% CI 14.8-21.2), which was 4-fold higher than the lowest participating area, mostly explained at that time by high occupational exposures in actually non-smoking women, which had the mildest COPD.[38] Ten years later in Vic, another rural village in the outskirts of Barcelona, merely 10 km (about 6 miles) from Manlleu, but without any major local industry, we obtained a 4% COPD prevalence.

Finally, of Public Health interest, we have to underline from Table 4 the non-significant drop in COPD underdiagnosis, but the substantial decrease in undertreatment, specially in those with severe COPD. To further reduce underdiagnosis, the implementation and wider use of spirometry screening in all settings, including quality spirometry in primary care,[39] pharmacies,[40] and elsewhere, require further research and resources. [41]

To conclude, we report a substantial reduction of 50.4%in the prevalence of COPD in Spain from 1997 to 2007 in subjects between 40 to 69 years of age, with also an unexpected shift to a milder severity in the population distribution. Reasons remain unexplained, but highlight the difficulty to compare population findings of forced spirometry by time and place. However underdiagnosis and undertreatment was significantly reduced during the same period.

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TITLES AND LEGENDS OF FIGURES

Figure 1. Map of Spain displaying the geographical distribution of participating centres IBERPOC 1997 and EPI-SCAN 2007

Legend of Figure 1: IBERPOC x, EPI-SCAN O and both ⊗

Figure 2. Flowchart of participants in a) IBERPOC and b) EPI-SCAN

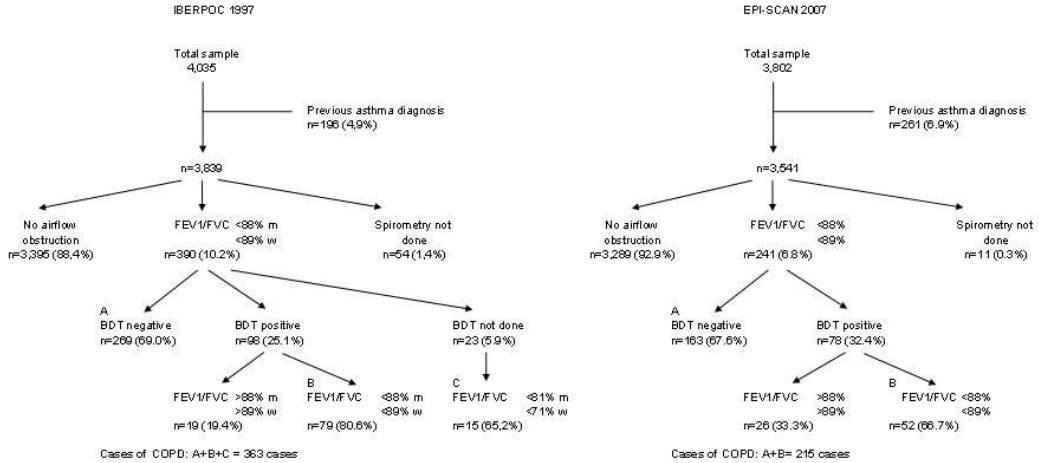

Figure 3. Changes in COPD prevalence and severity (%) from 1997 to 2007. Estimators with 95% confidence intervals

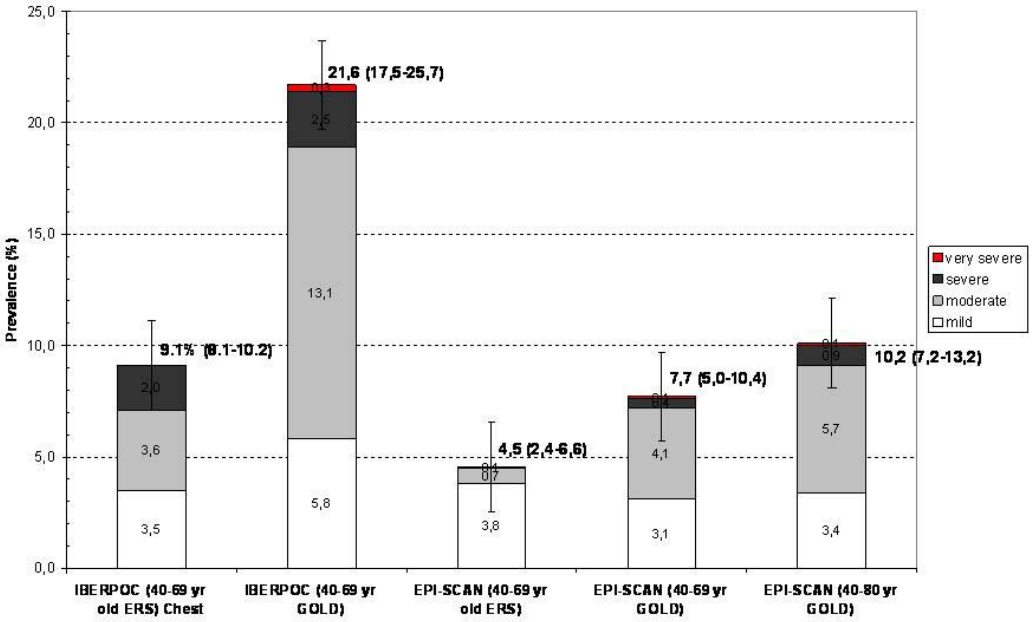

Figure 4. Changes in COPD prevalence (%) from 1997 to 2007, by gender and age

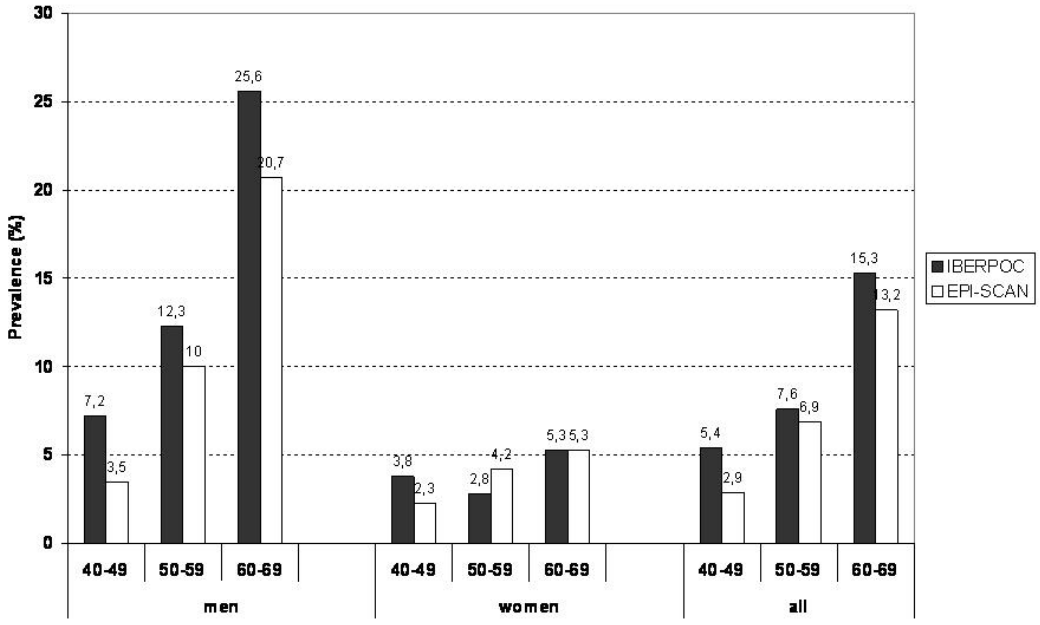
30
25
20
15
10
5
0
Prevalence (%)
25,6
20,7
12,3
10
7,2
3,5
3,8
2,3
2,8
4,2
5,3
5,3
5,4
2,9
7,6
6,9
15,3
13,2
IBERPOC
EPI-SCAN
40-49
50-59
60-69
men
women
all

Table 1. Comparison of study designs, definitions and thresholds originally used in the 1997 and 2007 surveys

	1997 (ref. 11)	**2007** (ref. 15)
Participating areas	IBERPOC: Burgos, Cáceres, Madrid, Manlleu, Oviedo, Sevilla & Vizcaya	EPI-SCAN: Barcelona, Burgos, Córdoba, Huesca, Madrid (2), Oviedo, Sevilla, Valencia, Vic & Vigo
Ages	40-69 yr.	40-80 yr.
Fieldwork	October 1996 - April 1997	May 2006 – July 2007
Sampling source	Random sample of the general population via census	Random sample of the general population via commercially available database
Exclusion criteria	Individuals reporting asthma, and those unable to conduct spirometry	Unability to conduct spirometry
Spirometer	DATOSPIR-200; Sibel S.A; Barcelona, Spain	Master Scope CT; VIASYS Healthcare, Hoechberg, Germany
Spirometry guidelines	ATS 1987 update. Am Rev Respir Dis 1987	ATS/ERS 2005
Reference values	Roca, et al. Bull Eur Physiopathol Respir 1986	ECSC/CECA Quanjer, et al. ERJ 1993
COPD definition	As per old ERS criteria of Siafakas N, et al. ERJ 1995, a post-bronchodilator $FEV_1/FVC<88\%$ predicted in men or <89% predicted in women; or in the few patients in whom BDT had not been performed, an absolute FEV_1/FVC value , 81% and FEV_1 <70% predicted	As per current GOLD criteria, Rabe KF, et al. AJRCCM 2007, a post-bronchodilator FEV_1/FVC <0.70
Bronchodilator test	After two inhalations of salbutamol, and using an inhalation chamber, a difference between FEV_1 or FVC was > 200 mL and its relative increase was > 12%.	As per Pellegrino R, et al ERJ 2005, after two inhalations of salbutamol, an increase in FEV_1 and/or FVC ≥12% of control and ≥200 mL
COPD staging	A pre-bronchodilator percent predicted FEV_1 Mild ≥ 70% Moderate 50 – 69% Severe < 50%	A post-bronchodilator percent predicted FEV_1 Mild ≥80, Moderate 50 – 80% Severe 30 – 50% Very severe < 30%

Table 2: Demographic and clinical characteristics of participants in 1997 and 2007

	1997 (n = 4,030)	**2007** (n = 3,802)	**2007 Only 40-69 yr** (n = 3,191)	P value 1997 vs. 2007 Only 40-69 yr
Age, mean ± SD	53.9 ± 8.6	56.6 ± 10,7	53.3 ± 8.2	0.803
Age band, (%)				
-40 to 49 years	(37.4%)	(32.7%)	(39.0%)	
-50 to 59 years	(32.6%)	(29.3%)	(34.9%)	0.701
-60 to 69 years	(35.8%)	(21.9%)	(26.1%)	
-70 to 79 years	(0%)	(16.1%)	(0%)	
Male, n (%)	1,976 (49.0%)	1,797 (47.3%)	1,502 (47.1%)	0.097
Pack-years, mean ± SD	27.8 ± 22.9	26.0 ± 21.5	24.4 ± 19.9	<0.001
Smoker, (%)				
-never	(50.2%)	(43.1%)	(39.7%)	<0.001
-ex	(24.5%)	(30.9%)	(31.3%)	
-current	(25.4%)	(26.0%)	(29.1%)	
Height in cm, mean ± SD	161.8 ± 9.0	164.0 ± 9.2	164.7 ± 9.0	<0.001
Weight in kg, mean ± SD	72.8 ± 12.8	73.9 ± 14.1	73.9 ± 14.4	<0.001
BMI, mean ± SD	27.7 ± 4.3	27.4 ± 4.5	27.2 ± 4.5	<0.601
Primary education, n (%)	2,244 (57.6%)	1751 (46.1%)	1242 (41.7%)	<0.001
Symptoms, (%)				
-cough	(13.5%)	(13.4%)	(12.4%)	0.172
-sputum	(10.7%)	(11.7%)	(10.9%)	0.774
-dyspnoea	(10.4%)	(9.9%)	(7.2%)	<0.001
-wheezing	(40.0%)	(36.0%)	(31.9%)	<0.001
Previous diagnoses, (%)				
-asthma	(4.9%)	261 (6.9%)	---	
-COPD	---	(1.4%)	(0.8%)	<0.001
-chronic bronchitis	(4.8%)	(4.0%)	(3.1%)	
-emphysema	---	(0.5%)	(0.4%)	
FEV_1% (Roca) mean ± SD	87.8 ± 17.0	102.1 ± 19.4	100.8 ± 17.4	<0.001
FVC% (Roca) mean ± SD	88.4 ± 14.6	96.8 ± 16.3	98.7 ± 15.3	<0.001

Table 3: Changes in 1997 to 2007 COPD prevalence in the five repeater areas, total and by gender, crude and adjusted by indirect standardization, according to old ERS thresholds [16]

a)	In 40-69 yr. by old ERS	1997	2007	2007 standardized	% change 1997 to 2007 standardized
All	**Burgos**	11.9	1.9	1.9	-84.0%
	Madrid	11.8	6.0	6.1	-48.3%
	Oviedo	9.5	5.4	5.1	-46.3%
	Sevilla	8.7	3.2	2.1	-75.9%
	Vic-Manlleu	22.3	3.4	3.3	-85.4%
Men					
	Burgos	16.5	3.3	3.5	-78.8%
	Madrid	20.2	8.8	9.1	-55.0%
	Oviedo	12.1	5.1	4.6	-62.0%
	Sevilla	11.5	5.8	3.7	-67.8%
	Vic-Manlleu	28.8	4.0	3.9	-86.5%
Women					
	Burgos	7.7	0.5	0.4	-94.8%
	Madrid	4.1	3.7	3.6	-12.2%
	Oviedo	7.0	5.7	5.7	-18.6%
	Sevilla	5.6	0.9	0.7	-87.5%
	Vic-Manlleu	17.0	2.7	2.8	-83.5%

Table 4: Changes in determinants and attitudes towards COPD and smoking among participants with spirometrically confirmed COPD in 1997 and 2007

	1997	**2007**
Underdiagnosis	78%	73%
Undertreatment	81%*	54%
Undertreatment in severe COPD	50%*	10%
Lung function ever measured previously	16.5%*	58.5%
Have you ever tried to quit smoking?		
Never	34.9%*	88.7%
Yes	65.1%	11.3%
1-3 times	43.6%	N. A.
4 times or more	21.5%	
No answer	4.0%	

* $p < 0.05$; N.A.; not available

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