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Original article

Cronic obstructive pulmonary disease mortality in Spain between 1999 and 2019

Gema Ramírez-Rodríguez [a,*], Antonio Menéndez-Lobo [b], Alejandro Romero-Linares [a],
Miriam Bernabéu-Fernández de Liencres [b], Pedro Jose Romero-Palacios [b],
Bernardino Alcázar-Navarrete [a,b,c,d], on behalf of "Spanish COPD mortality study group" [◊]

[a] Respiratory Department, Hospital Universitario Virgen de las Nieves, Granada, Spain
[b] Medicine Department, Universidad de Granada, Granada, Spain
[c] IBS Granada, Granada, Spain
[d] CIBER Enfermedades Respiratorias, Instituto de Salud Carlos III, Madrid, Spain

A B S T R A C T

Introduction: Mortality from COPD has decreased in Spain in recent years, but it is unknown whether this decline has been homogeneous among the different regions.
Methods: From the Statistical Portal of the Ministry of Health of Spain we obtained the age-adjusted mortality rates/100,000 inhabitants for men and women in Spain and the Autonomous Communities for the years 1999–2019, using the coding of the International Classification of Diseases (ICD 10, sections J40–J44). With the adjusted rates we performed a jointpoint regression analysis to estimate an annual percentage change (APC), as well as identify possible points of trend change. Statistical significance was considered for a value of $p < 0.05$.
Results: During the study period, COPD mortality rates adjusted in Spain decreased from 28.77 deaths/100,000 inhabitants in 1999 to 12.14 deaths/100,000 inhabitants in 2019. We observed a linear decline in COPD mortality in men at national level of −3.67% per year (95% CI −4.1 to −3.4; $p < 0.001$), with differences between the Autonomous Communities. Mortality in women also experienced a decrease in mortality in two phases, with a first period from 1999 to 2006 with a fall of −6.8% per year (95% CI −8.6 to −5.0; $p < 0.001$) and a second period from 2006 to 2019 with a decrease in mortality of −2.1% (95% CI −2.8 to −1.3; $p < 0.001$), with again differences between the Autonomous Communities.
Conclusion: Mortality rates from COPD have decreased heterogeneously among the different Autonomous Communities in both men and women.

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Mortalidad por enfermedad pulmonar obstructiva crónica en España entre 1999 y 2019

R E S U M E N

Introducción: La mortalidad por EPOC ha disminuido en España en los últimos años, pero se desconoce si esta caída ha sido homogénea entre las diferentes comunidades autónomas.
Metodología: consultando el Portal Estadístico del Ministerio de Sanidad de España obtuvimos las tasas ajustadas por edad/100.000 habitantes para hombres y mujeres de España y las CCAA para los años 1999 a 2019, utilizando la codificación de la Clasificación Internacional de Enfermedades (CIE 10, secciones J40 a J44). Con las tasas ajustadas realizamos un análisis de regresión de jointpoint con el objetivo de estimar un porcentaje anual de cambio (APC), así como identificar posibles puntos de cambio de tendencia. Se consideró la significación estadística para un valor de p < 0.05.

* Corresponding author.
  E-mail address: gemaramirezrodriguez@hotmail.com (G. Ramírez-Rodríguez).
◊ Please see a list of the members of the Spanish COPD mortality study group in Appendix A.

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Resultados: Durante el periodo de estudio, las tasas de mortalidad global ajustada por EPOC en España pasaron de 28.77 muertes/100.000 habitantes en 1999 a 12.14 muertes/100.000 habitantes en 2019. Observamos una caída de la mortalidad por EPOC en varones a nivel de España lineal del -3.67% anual (IC 95% -4.1 a -3.4; p < 0.001), con diferencias entre las CCAA. La mortalidad en mujeres también experimentó una disminución de mortalidad en dos fases, con un primer periodo de 1999 a 2006 con caída del -6.8% anual (IC 95% -8.6 a -5.0; p < 0.001) y un segundo periodo de 2006 a 2019 con un descenso de la mortalidad del -2.1% (IC 95% -2.8 a -1.3; p < 0.001), encontrando diferencias entre las CCAA.

Conclusiones: Las tasas de mortalidad por EPOC han disminuido de forma heterogénea entre las diferentes CCAA.

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is one of the most prevalent diseases today and its impact on the population is expected to continue to grow in the coming years.[1] According to the World Health Organization (WHO), it is the third leading cause of death worldwide, accounting for 6% of all deaths, only behind coronary heart disease and cerebral vascular disease.[2] In 2016 it is estimated that more than 28,000 people in Spain died from COPD, 58.8% of whom were men. In addition, 92% of deaths from this disease occurred in people over 70 years of age.[3]

Being the third leading cause of death worldwide, the evolution of mortality rates from this disease shows different trends, with a progressive increase in developing countries and a tendency to decrease in developed countries.[4–7] The reasons for these different tendencies have been correlated to trends in the use of cigarettes and other tobacco-related products as well as improvements in health care for these patients.[8] At European level, that mortality rates from COPD have suffered a progressive decrease globally in recent decades, with heterogeneity between countries and decreases experienced by both men and women.[9]

In Spain, the most recent data available show a progressive decrease in mortality since the end of the last century, both in men and women, with a progressive lengthening of the age of death.[9] These data have been observed in the same way at the level of some region of Spain such as Galicia.[10]

However, although the national trend in COPD mortality are recognized, we do not know if this trend has been homogeneous among the different Spanish autonomous communities, as well as the years in which trend changes have been observed, information that could be of high interest when identifying those regions that have improved COPD care and being able to benchmark the successful activities established at that time.

This study aims to analyze the temporal trends in COPD mortality in men and women in the autonomous communities of Spain between 1999 and 2019 using public data from death certificates.

Methods

Study design

This is an ecological study that uses data from the national database of mortality by cause of death that collects from Spanish death certificates the deceases due to COPD notified and coded according to the ICD-10 between 1999 and 2019, using the public database of the statistical portal from the Ministry of Health of Spain.

Study population

From the statistical portal of the Ministry of Health of Spain (available in https://www.sanidad.gob.es/estadEstudios/portada/home.htm) the age-adjusted mortality rates per 100,000 inhabitants related to COPD (ICD-10 J40-J44 diagnostic codes) were selected, splitting them by each autonomous community of residence and sex, from 1999 to 2019.

Statistical analysis

Data on age-adjusted mortality rates for COPD for each autonomous community and at the national level from the years 1999 and 2019 were compared to analyze the percentage change during those two decades. In the same way, the variation of each autonomous community was compared with the variation experienced at the national level to obtain the relationship between regional and national decline.

We performed a *jointpoint* regression analysis to identify the years in which changes occurred in the linear slope of the time trend. The best fit points (the so-called jointpoint) were chosen when the rate changed significantly. This approach has two main advantages: it identifies the time when there are changes in trend and estimates the magnitude of the increase or decrease observed in each interval by estimating the annual percent change (APC). The statistical software The Surveillance Epidemiology and End Results (Joinpoint Regression Program, version 3.5.1) was applied to calculate APC, trends and graphs, and the statistical significance of changes. Segmented Poisson regression models were built to estimate trend changes over time. In this model, age-adjusted standardized rates were employed as the dependent variable and the year of death as the independent variable. To identify the point in time at which trends in men and women converge, a model equation was built to estimate annual death rates for both sexes until the projected death rate for men equaled that of women. In all analyses, a *p*-value less than 0.05 was considered statistically significant.

Ehtical aspects

Due to the nature of the study, with data that are in the public domain and do not refer to patients, approval by an ethics committee and informed consent were not necessary.

Role of the funding source

There was no external funding for this study. The authors had full access to the study data and had ultimate responsibility for the decision to submit the paper for publication.

Results

Fig. 1 shows the trends for age-adjusted mortality rates per 100,000 inhabitants for COPD in both men and women between 1999 and 2019. There is a lineal reduction in mortality rates in men during these two decades at the national level by −3.67% per year (95% CI −4.1 to −3.4; p < 0.001). Regarding the data in women, mortality also showed a decrease in two phases, with a first period from 1999 to 2006 with a decrease of −6.8% per year (95% CI −8.6 to
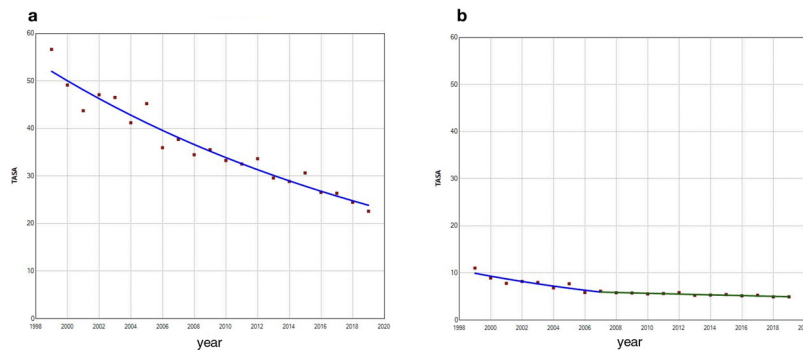
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Fig. 1. Trends in age-adjusted COPD mortality from 1999 to 2019 in Spain for (a) men; (b) women.
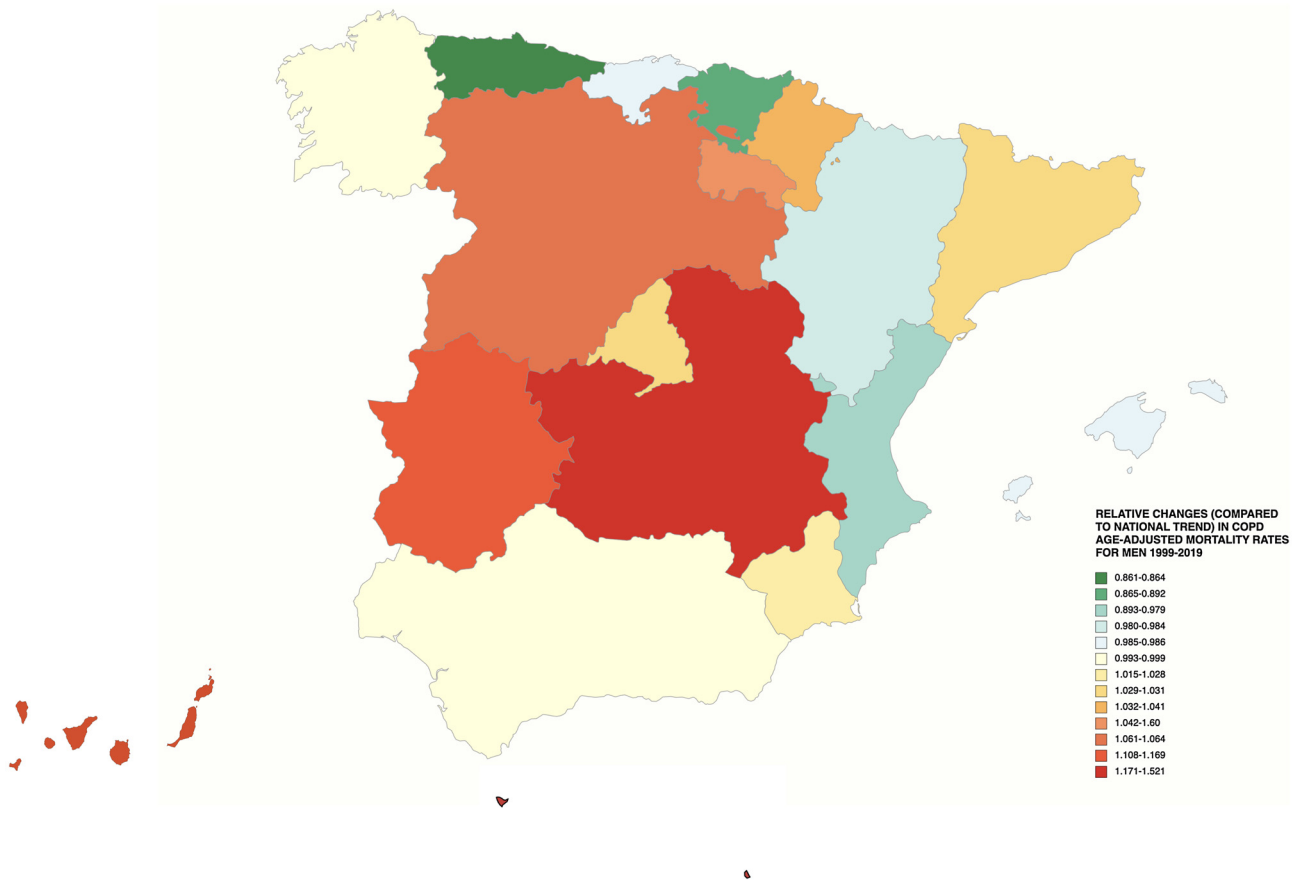

Fig. 2. Relative changes compared to national mean in age-adjusted COPD mortality rates in males from 1999 to 2019.

−5.0; $p < 0.001$) and a second period from 2006 to 2019 with an −2.1% decrease in mortality (95% CI −2.8 to −1.3; $p < 0.001$).

Table S1 shows the age-adjusted mortality rates per 100,000 inhabitants for COPD in men and women and between 1999 and 2019 as well as the trend during this period. Global mortality rates from COPD in Spain have gone from 28.77 deaths/100,000 inhabitants in 1999 to 12.14 deaths/100,000 inhabitants in 2019, displaying a decrease of 57.8% during the study period, with an annual percentage change of −3.8%. Overall, there is only a small increase of 7.69% in mortality in the autonomous city of Melilla; however, when the population is separated by sex, a decrease in mortality is observed in both.

Fig. 2 shows the relationship between the decrease in age-adjusted mortality rates in males compared to the national trend. Fig. 3 shows the relationship between the decline in age-

adjusted mortality rates in women compared to the national trend.

Table S2 shows the APC values with their 95% confidence intervals and the number of jointpoints for each Spanish region for men and women during the study period as well as the parallelism test compared to the national trend. During these two decades mortality from COPD in men at the national level has fallen linearly by −3.67% per year (95% CI −4.1 to −3.4; $p < 0.001$), with differences between the regions. We observed a non-parallel decrease in mortality in Asturias, Aragon, Canary Islands, Castilla La Mancha, Valencia and the Basque Country, compared to the national ones. The regions where we found the most pronounced reductions in COPD mortality were the Basque Country (APC −5.5%, 95% CI −5.0 to −6.0) and Asturias (APC −5.4%, 95% CI −5.9 to −4.9) and those with the least pronounced reductions were Castilla-La Mancha (APC −2.3%, 95%
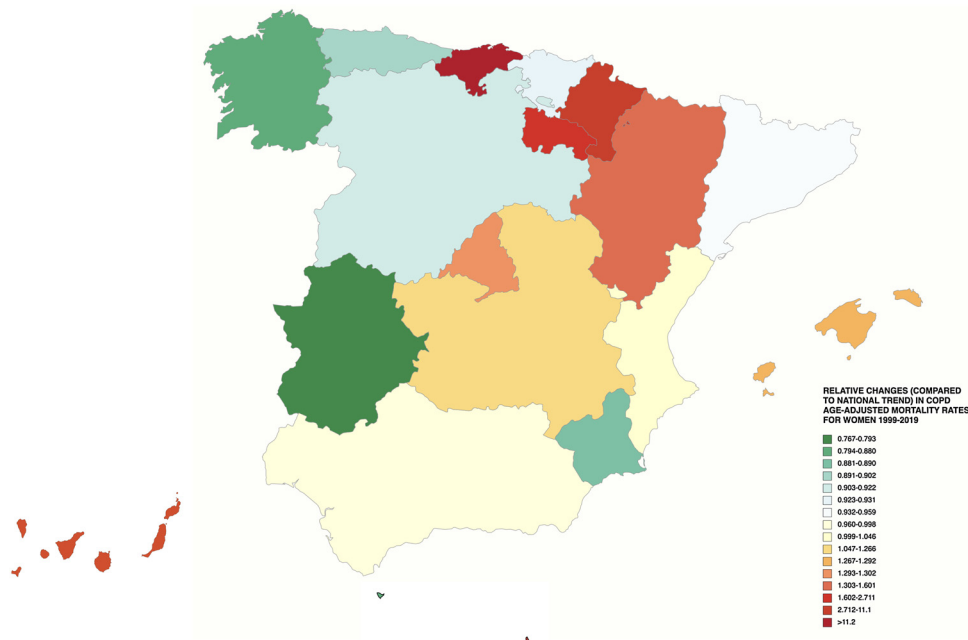
Fig. 3. Relative changes compared to national mean in age-adjusted COPD mortality rates in males from 1999 to 2019.
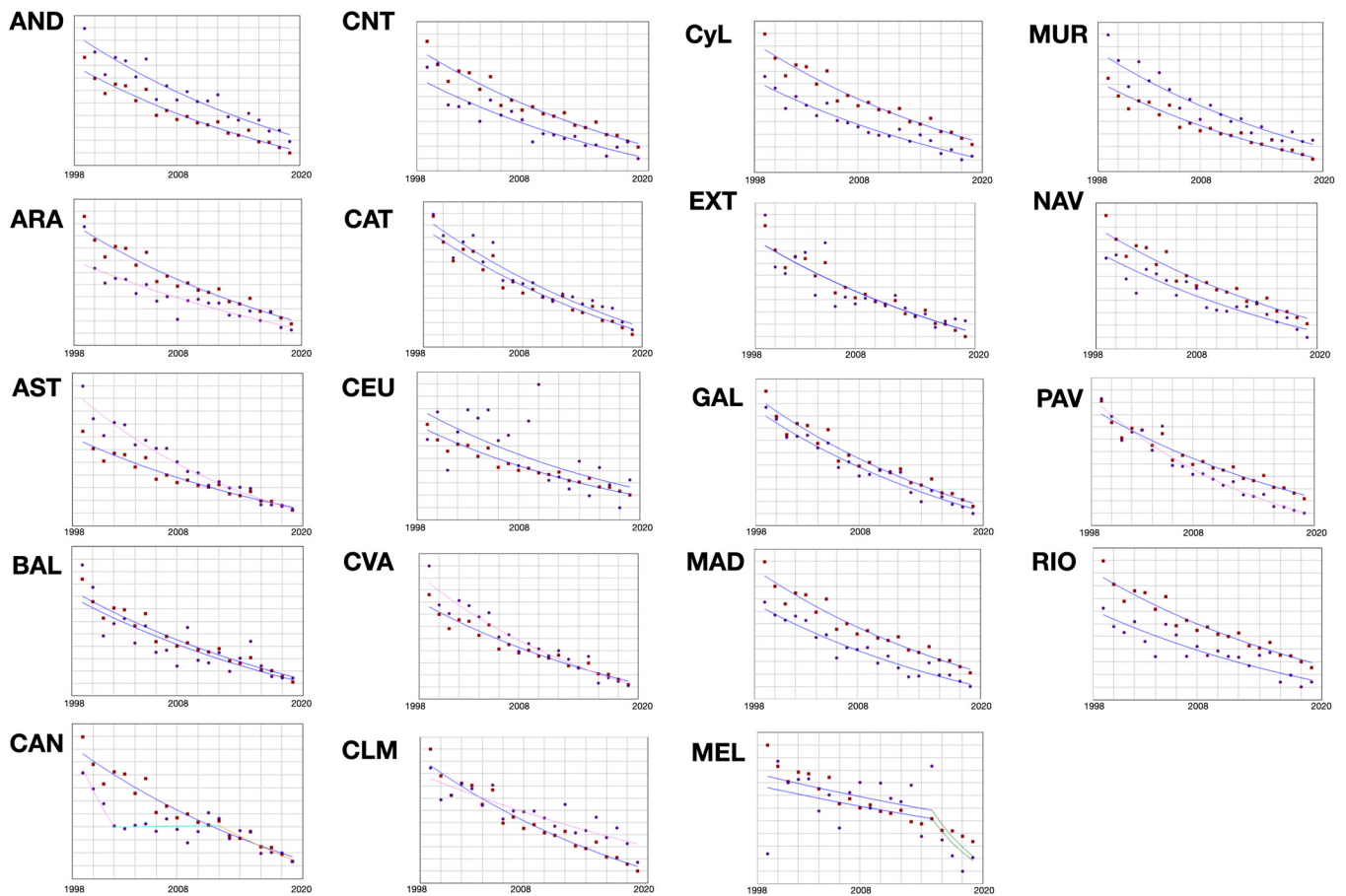

Fig. 4. Age-standardized COPD mortality trends in males by Autonomic Region in Spain (1999–2019). Solid lines represent regression lines. Dots represent age-standardized mortality. Blue lines represent national trend and pink lines represent those autonomic regions where regional trends are not parallel to national ones. AND: Andalucia. ARA: Aragón. AST: Asturias. BAL: Islas Baleares. CAN: Islas Canarias. CNT: Cantabria. CAT: Cataluñaa. CEU: Ceuta. CVA: Comunidad Valenciana. CLM: Castilla La Mancha. CyL: Castilla y León. EXT: Extremadura. GAL: Galicia. MAD: Madrid. MEL: Melila. MUR: Murcia. NAV: Navarra. PAV: País Vasco. RIO: La Rioja.

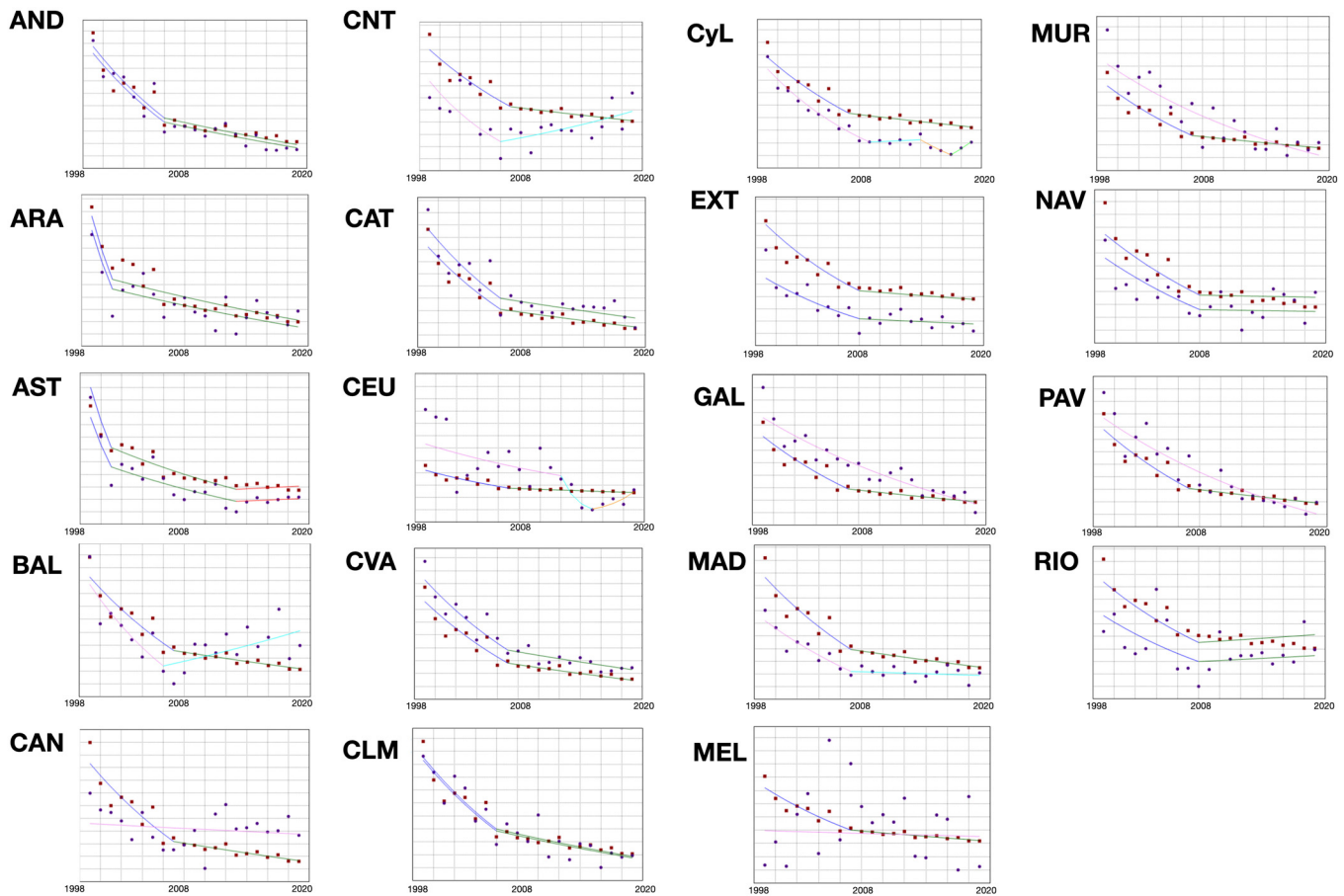G. Ramírez-Rodríguez, A. Menéndez-Lobo, A. Romero-Linares et al.

Fig. 5. Age-standardized COPD mortality trends in females by Autonomic Region in Spain (1999–2019). Solid lines represent regression lines. Dots represent age-standardized mortality. Blue and green lines represent national trend and pink lines represent those autonomic regions where regional trends are not parallel to national ones. AND: Andalucia. ARA: Aragón. AST: Asturias. BAL: Islas Baleares. CAN: Islas Canarias. CNT: Cantabria. CAT: Cataluñaa. CEU: Ceuta. CVA: Comunidad Valenciana. CLM: Castilla La Mancha. CyL: Castilla y León. EXT: Extremadura. GAL: Galicia. MAD: Madrid. MEL: Melila. MUR: Murcia. NAV: Navarra. PAV: País Vasco. RIO: La Rioja.

CI −2.9 to −1.7) and Aragon (APC −3.20%, 95% CI −3.9 to −2.5). Fig. 4 shows trends in COPD mortality in males compared to the national mean and the number of jointpoints.

Regarding the data in women different decline trajectories are also evident. We observed differences in the rates of decline between regions with respect to the national trend with non-parallel decreases for the Balearic Islands, Canary Islands, Cantabria, Castilla y León, Galicia, Madrid, Murcia, Basque Country and Melilla. The regions with the most pronounced reductions in mortality rates were Murcia (APC −4.80%, 95% CI −6.0 to −3.6) and Galicia (APC −4.20%, 95% CI −4.9 to −3.5) and those with less pronounced reductions were the Canary Islands (APC −0.4%, 95% CI −1.5 to 0.7). In addition, in Cantabria and the Balearic Islands COPD mortality rates have increased since 2006. Fig. 5 shows the data for each autonomous community compared to the national trend for women as well as the number of jointpoints.

Discussion

This study shows that age-adjusted COPD mortality rates have decreased heterogeneously between the different regions of Spain during the last 20 years, both in men and women. These data are the first description of COPD mortality rates among the different regions of Spain.

The results of this study are consistent with other studies that have observed a decreasing trend in COPD mortality rates, both nationally and globally and in other countries such as the United States and Japan.[11,12] A global burden of disease study conducted from 1990 to 2017 suggested that total deaths from chronic respiratory diseases increased by 18.0% (mainly due to the effect of an aging population), but the age-standardized mortality rate decreased by an average of 2.41%.[13]

The data known to date in Spain had shown a fall in mortality rates from COPD in recent decades, although there were no data at the regional level for all of Spain.[9] The only data available at the regional level come from an analysis of data from Galicia that evaluated COPD deaths from 1980 to 2017 showing a steady decline by sex since 1996 and a gradual increase in the age of death.[10]

This work has as strengths the use of a standardized methodology and the use of publicly accessible data with a temporal profile, as well as the homogeneity of health systems within the autonomous communities. However, this type of analysis has weaknesses. Although the mortality rates used come from death certificate data, they do not necessarily capture the exact diagnoses that have led to patients' deaths. In addition, the way in which the cause of death in a certain patient is attributed can vary in different areas.

On the other hand, this work uses a time period that includes the years from 1999 to 2019 in which it is coded according to the ICD-10, which makes it impossible to compare with other published studies that included other time periods.[11,14]

Likewise, we do not know the current impact that the COVID19 pandemic may have caused on these data.[15]

Although this study shows an uneven drop in COPD mortality rates between the different Spanish regions, we have not analyzed the reasons that have led to these results, which may depend on

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the characteristics of the population, lifestyles or health systems that care for these patients.[16] For example, the aging of the general population and the prevalence of smoking may explain some of the results found. Other aspects related to health care as well as geographical dispersion can also explain some observed variability.

In conclusion, our study shows that mortality rates from COPD have experienced a reduction in the last 20 years between the different Spanish autonomous communities in both men and women, and that there is heterogenicity in these trends between the different Spanish regions. These data should be used by health authorities to evaluate and compare COPD care between different health services in Spain, and thus identify health actions and health policies that have been satisfactory in regions where this decrease has been more pronounced.

Ethical considerations

Due to the nature of the study, with data that are in the public domain and do not refer to patients, approval by an ethics committee and informed consent were not necessary.

Funding

This work has been developed without any funding source.

Conflict of interest

GRR has nothing to disclosure. AML has nothing to disclosure. ARL has nothing to disclosure. MBFL has nothing to disclosure. AHA reports non-financial support from Bial and Chiesi. CRR has nothing to disclosure. CHS has nothing to disclosure. DRN has nothing to disclosure. LAM has nothing to disclosure. MIR has nothing to disclosure. PMV has nothing to disclosure. CFH has nothing to disclosure. PRP reports personal fees and non-financial support from GSK, non-financial support from Novartis AG, non-financial support from Boehringer Ingelheim, non-financial support from Chiesi, grants, personal fees and non-financial support from Laboratorios Menarini, personal fees from Esteve, outside the submitted work; In addition, Dr. Romero-Palacios has a patent FIBAO-17006; IPR-661 issued. BAN reports grants and personal fees from GSK, grants, personal fees and non-financial support from AstraZeneca, personal fees and non-financial support from Boehringer Ingelheim, personal fees and non-financial support from Chiesi, grants, personal fees and non-financial support from Laboratorios Menarini, personal fees from Bial, personal fees from Zambon, personal fees from Gilead and personal fees from MSD, outside the submitted work.

Appendix A. Spanish COPD mortality study group

Ramírez-Rodríguez Gema[aa], Menéndez-Lobo Antonio[aa], Romero-Linares Alejandro[aa], Bernabéu-Fernández de Liencres Miriam[ab], Hammadi Ahmed Ayoub[aa], Rodríguez-Rivas Cristian[aa], Hoyas-Sánchez Clara[aa], Romeral-Navarro Dámaris[aa], Álvarez-Muros Lucía[aa], Iñigo-Ramos María[aa], Mengíbar-Vallejo Patricia[aa], Fernandez-Hoene Carolina[aa], Romero-Palacios Pedro Jose[ab], Alcázar-Navarrete Bernardino[aa,ab,ac,ad]

[aa] Respiratory Department, Hospital Universitario Virgen de las Nieves, Granada, Spain

[ab] Medicine Department, Universidad de Granada, Granada, Spain

[ac] IBS Granada, Granada, Spain

[ad] CIBER Enfermedades Respiratorias, Instituto de Salud Carlos III, Madrid, Spain

Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.medcli.2023.07.032.

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