

MORBIDITY

Trends of Asthma Mortality in Galicia from 1993 to 2007

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Introduction. In the past few years, deaths due to asthma appear to decrease at least in Western countries; but there are significant variations between populations. The aim of this study is to describe the trends in deaths due to asthma between 1993 and 2007 in our community and to analyze any factors associated with this. **Methods.** All cases, which had asthma as a cause of death, were included in the study. The mortality data were obtained from the official death certificate from the Deaths Register. Mortality relative risk, based on the calendar year, sociodemographic variables (age and gender), seasons, and days of the week, were estimated using a Poisson generalized linear model with a log-link. **Results.** In the 15 years of the study period, a total of 1180 people had died due to asthma, mainly in winter (34.5%), women (64.5%), and advanced age (65 years or above; 84.6%). A tendency of decreased mortality in all age groups was observed during the period of the study, which was significant in both the sexes in the 35- to 64-year-old age group, and in males above 65 years. **Conclusion.** Death due to asthma is changing favorably in our community, with a tendency to decrease in the past few years. Advanced age, being female, and the winter period are associated with a higher mortality rate due to asthma.

Keywords age, asthma, gender, mortality, risk, season, trends

INTRODUCTION

Asthma is one of the most common chronic diseases in the world (1). In Spain, the prevalence of asthma appears to be increasing in both children and adults (2, 3). This incurs increased health costs in Spain, as more than 25% of asthma sufferers have some period of work incapacity throughout the year (4). A gradual increase in hospital admissions due to asthma, particularly in women above 60 years, has also been observed in our community (5).

In the past few years, deaths due to asthma appear to decrease, at least in Western countries (6–9); but there are significant variations between countries even with similar socioeconomic levels (1). Thus, in 2001, in the 5- to 34-year-old age group, the mortality rate per 100,000 inhabitants was 0.08 in Holland and 0.55 in Canada, which is seven times higher than that in Holland (8). Annual worldwide deaths from asthma have been estimated to be 250,000 and the mortality rate does not appear to correlate well with prevalence and high variability between and within countries (1). Furthermore, preventing asthma mortality is still within the goals for the successful management of asthma (1).

The analysis of epidemiological data can help to identify the significant variations in some health characteristics, depending on the research needs, as happened in the epidemics of deaths to asthma in the 1960s and 1970s, enabling some causes to be identified and to establish strategies (8, 10).

The aim of this study is to analyze the trends in deaths due to asthma between 1993 and 2007 in our community and to analyze any factors associated with this.

METHODS

This study was performed using the data of mortality due to asthma in the whole population of our community, which in the year 2000 had 2,731,900 inhabitants, of which 52% were female (11).

The mortality data were obtained from the official death certificate from the Deaths Register of the Department of Public Health of the Regional Government of Galicia. All cases which had asthma as a cause of death were included in the study.

The total population of Galicia, for each year of the study, was obtained from the data published by the National Statistics Institute. Using these data, the annual death rates per 100,000 inhabitants were calculated (11).

Age, sex, month, and day of death were recorded for each individual.

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The three age groups established were 5–34 years, 35–64 years, and 65 years and above. Children under 5 years were excluded due to the difficulty of diagnosing asthma at these ages (12).

To analyze the period of death, the groups were established according to the seasons of the year. They are winter (January–March), spring (April–June), summer (July–September), and autumn (October–December).

The days of the week were classified into two categories, during the week (Monday–Friday) and weekend (Saturday and Sunday).

Statistical Analyses

Crude mortality rates, based on age and gender, were calculated to obtain the estimated risk of death due to asthma for each year between 1993 and 2007. The 95% confidence intervals (CIs) were calculated based on the Poisson distribution.

Mortality relative risks (RRs), based on the calendar year, sociodemographic variables (age and gender), seasons, and days of the week, were estimated using a Poisson generalized linear model with a log-link. The multivariate analysis was performed in two steps. First, the age, gender, and season variables were included in the multivariate model. The two-way interactions were tested on the basis of the likelihood ratio test. The results of the final model were summarized by presenting the relative risk of death due to asthma in each age group separately. Temporal trends in RRs were explored further, with adjustment for age and gender. In this case, specific counts for each calendar year, age, and gender were used as the unit of observation. A possible non-linear effect of calendar year was investigated using a Poisson generalized additive model. The two- and three-way interactions were also tested on the basis of the likelihood ratio test. The results of the final model assuming a linear change over time were summarized by presenting the relative risk of death due to asthma in each age group separately.

All the analyses were performed using the R Software, version 2.14 (R Development Core Team. R: A Language and Environment for Statistical Computing. Vienna: R Foundation for Statistical Computing; 2011).

RESULTS

In the 15 years of the study period, a total of 1180 people had died due to asthma, mainly in winter (34.5%), women (64.5%), and advanced age (more than half of the deceased people were older than 80 years) (Table 1).

It should be pointed out that, in the years 2000, 2003, and 2007, there was no death due to asthma in the 5- to 34-year-old age group.

The highest death rates were found to be 0.37/100,000 inhabitants in 1996 for the 5- to 34-year-old age group; 1.91/100,000 in 1993 for the 35- to 64-year-old group, and 17.64/100,000 in 1995 for the older age group (65 years and above) (Table 2).

TABLE 1.—Asthma mortality, descriptive data.

	n (%)
Gender	
Male	419 (35.5)
Female	761 (64.5)
Age group	
5–34 years	27 (2.3)
35–64 years	155 (13.1)
65–79 years	385 (32.6)
80+ years	613 (51.9)
Season	
Winter	407 (34.5)
Spring	254 (21.5)
Summer	223 (18.9)
Autumn	296 (25.1)

TABLE 2.—Crude mortality rate per 100,000 subjects (95% CI) according to age groups.

Year	Global sample	Age group		
		5–34 years	35–64 years	65+ years
1993	3.442 (2.767, 4.230)	0.349 (0.095, 0.893)	1.909 (1.149, 2.981)	14.168 (10.980, 17.993)
1994	3.328 (2.666, 4.106)	0.265 (0.055, 0.775)	1.100 (0.549, 1.967)	15.121 (11.853, 19.013)
1995	3.830 (3.117, 4.659)	0.180 (0.022, 0.649)	1.095 (0.547, 1.959)	17.643 (14.131, 21.762)
1996	3.684 (2.984, 4.499)	0.366 (0.100, 0.936)	1.488 (0.833, 2.455)	15.282 (12.06, 19.100)
1997	3.345 (2.679, 4.126)	0.186 (0.023, 0.672)	1.286 (0.685, 2.200)	13.981 (10.94, 17.607)
1998	3.235 (2.581, 4.006)	0.284 (0.059, 0.830)	1.678 (0.977, 2.686)	12.150 (9.357, 15.516)
1999	3.702 (2.999, 4.521)	0.096 (0.002, 0.537)	1.083 (0.541, 1.937)	15.589 (12.434, 19.300)
2000	2.503 (1.932, 3.190)	—	1.174 (0.607, 2.051)	9.628 (7.212, 12.594)
2001	2.576 (1.996, 3.271)	0.198 (0.024, 0.715)	0.777 (0.335, 1.530)	10.175 (7.707, 13.184)
2002	2.230 (1.693, 2.883)	0.201 (0.024, 0.726)	1.059 (0.528, 1.894)	7.940 (5.791, 10.624)
2003	3.109 (2.469, 3.864)	—	0.666 (0.268, 1.372)	12.958 (10.175, 16.268)
2004	2.645 (2.058, 3.347)	0.103 (0.003, 0.575)	0.469 (0.152, 1.095)	10.972 (8.431, 14.038)
2005	3.099 (2.461, 3.852)	0.105 (0.003, 0.583)	0.370 (0.101, 0.948)	13.185 (10.388, 16.503)
2006	2.178 (1.650, 2.822)	0.212 (0.026, 0.766)	0.639 (0.257, 1.317)	8.291 (6.113, 10.992)
2007	2.363 (1.812, 3.029)	—	0.361 (0.098, 0.923)	9.953 (7.558, 12.866)

A tendency for decreased mortality in all age groups was observed during the period of the study, which was significant in both the sexes in the 35- to 64-year-old age group and in males above 65 years (Figure 1).

Asthma mortality decreased in the analyzed period, with the relative risk of 0.97 (95% CI: 0.96–0.98) (Table 3). Female gender, advanced age, autumn, and winter season were associated with higher mortality rates (Table 3).

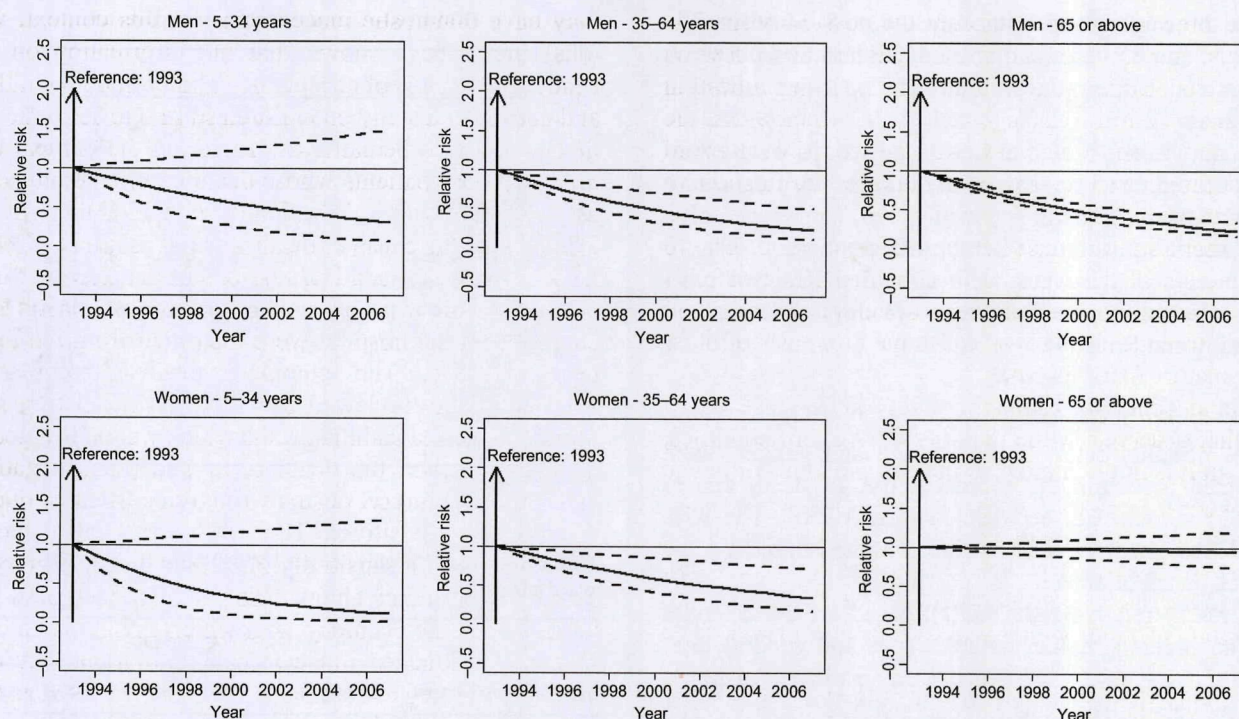


FIGURE 1.—Trends in relative risk of mortality, adjusted by age and gender.

TABLE 3.—Results of the univariate Poisson regression analysis of asthma mortality.

	Crude RR (95%CI)
Gender	
Men	Reference
Women	1.68 (1.49, 1.89)
Age (years)	
5-34	Reference
35-64	5.71 (3.87, 8.78)
65+	70.64 (49.25, 106.11)
Year	0.97 (0.96, 0.98)
Season	
Summer	Reference
Spring	1.14 (0.95, 1.36)
Autumn	1.33 (1.12, 1.58)
Winter	1.83 (1.55, 2.15)

Note: RR: relative risk; CI: confidence interval.

In the multivariate analysis, it could be seen that advanced age, being female (only in the group above 65 years), and in the autumn–winter time period were associated with a higher mortality (Table 4). No differences were observed in the mortality rates between week days and the weekend (data not shown).

DISCUSSION

The trend in mortality due to asthma is favorable in our population, with a gradual decrease being observed in the 15 years analyzed.

This favorable trend seems to be confirmed if our mortality rates are compared with neighboring countries. To do

TABLE 4.—Results of the multivariate Poisson regression analysis of asthma mortality.

Variable	Adjusted RR (95% CI)
Age, by gender	
Male	
5-34	Reference
35-64	4.34 (2.6, 7.26)
65+	42.7 (26.56, 68.63)
Female	
5-34	Reference
35-64	8.45 (4.24, 16.85)
65+	119.38 (61.85, 230.45)
Gender, by age-group	
5-34	
Male	Reference
Female	0.51 (0.23, 1.14)
35-64	
Male	Reference
Female	1.00 (0.73, 1.37)
65+	
Male	Reference
Female	1.44 (1.26, 1.64)
Season	
Summer	Reference
Spring	1.14 (0.95, 1.36)
Autumn	1.33 (1.12, 1.58)
Winter	1.83 (1.55, 2.15)

this, focusing the analysis on the 5- to 34-year-old age group, where deaths due to asthma are considered to be more accurate (13), mortality rates between 0.10 and 0.21 per 100,000 inhabitants are observed, similar to other countries in Western Europe (8).

This reduction in the death rate due to asthma, along with the trend observed in our country for an increase in

asthma prevalence (2), reinforces the possibility that the management of asthma is improving, as has been observed in other countries (10, 14). In this context, the publication of guidelines in the management of the disease and the availability of new drugs, seem to have led to an improved asthma prognosis (10, 15). Thus, in a recent prospective study, it was observed that patients with asthma had a lower mortality rate than the general population. Due to this finding, it is suggested that inhaled corticosteroids could reduce pulmonary as well as systemic inflammation, with a subsequent improvement in the prognosis of other inflammatory diseases (16).

This tendency for asthma mortality to decrease agrees with that observed in the majority of Western countries, although it is not homologous in all populations or in age groups (7–9, 17–22).

The higher mortality rate in asthmatics of advanced age is a constant finding in the literature (12, 17, 19, 23), although it is also the group, where more inaccuracies are found in the diagnosis obtained from the death certificate (13, 24).

Mortality due to asthma is significantly higher among older women, while in the 5- to 34-year-old age group, and there is a non-significant higher rate in males.

Different authors report similar findings, with mortality being higher in the young male population (20, 23–26); while at advanced ages, mortality due to asthma is higher in females (6, 7, 9, 17, 20, 23, 27, 28). Although this is not homogeneous between all studies, as some authors report a higher mortality rate in males at any age (24, 29). In a recent study, carried out in five European countries, the mortality due to asthma was higher in males in France, Italy, and Germany and higher in women in Spain and the United Kingdom (19).

The increase in mortality due to asthma in females with the increase in age coincides with the higher prevalence and severity of the asthma in women observed from adolescence (30, 31). Hormonal factors (32, 33), occupational and environmental factors (34), comorbidities such as obesity (35), and even psychological factors (36) have been implicated in this worse progression of asthma with age in females.

In some studies, it has been put forward that the possibility and the management was different, as such, that women were likely to be under-treated and under-diagnosed (Yentl syndrome) more often than males, until they were present with severe forms of the disease (37).

A marked seasonality in deaths due to asthma was also observed in our study. Given that almost 85% of the deaths due to asthma in our population occurred in patients over 65 years of age, it seems reasonable that the peak mortality has reached in the winter period, agreeing with the seasonality observed in acute exacerbations of asthma, which increase significantly in winter, particularly in the population of advanced age (38–40).

As per the studies in other countries, no difference was observed in asthma mortality at weekends (12).

Our study has the intrinsic limitations of data obtained from official sources, where the only information available is that obtained from the death certificate, which

may have diagnostic inaccuracies. In this context, various studies have shown that the information on the death certificate is of acceptable validity in both children and adults. In a study on children from 0 to 19-years old in Finland, five pediatricians reviewed the clinical histories of those patients whose death certificate indicated asthma as the cause of death and concluded that only in 7% of cases the cause of death was not asthma (25). In a UK study on adults, all admissions of patients aged 16–64 years with a primary diagnosis of asthma on discharge from the hospital were identified from the inpatient database. The complete medical records of decedents were reviewed by an expert panel to assess the proportion of asthma deaths which were attributed to another cause on the death certificate (false negative) and, on the contrary, deaths wrongly certified as due to asthma (false positive). The death certificates due to asthma showed a sensitivity of 82% and a specificity of 97% (41). Another study, using similar methodology, has assessed the accuracy with which asthma is entered on death certificates, in New Zealand. In total, 66.9% of all cases certified as asthma deaths were accepted as true asthma deaths. The precision decreased with increasing age, since the acceptance was highest in young age (98.6% in the 15- to 34-year-old age group), and fell progressively with increasing age, being only 38.7% of certified cases in patients above 70 years (13).

CONCLUSIONS

Death due to asthma is changing favorably in our community, with a tendency to decrease in the past few years. Advanced age, being female, and the winter period are associated with a higher mortality due to asthma.

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DECLARATION OF INTEREST

The authors declared that they have no competing interests.

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