ORIGINAL ARTICLE

Estimation of bladder cancer projections in Spain

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KEYWORDS
Projections; Cancer; Bladder; Spain

Abstract

Introduction: One of the most frequent cancers in the world is bladder cancer that affects, according to some authors, 5.4 million persons in the most developed countries. Our study has aimed to estimate the impact projections of this disease in Spain between 2007 and 2022.
Material and methods: Mortality data for bladder cancer mortality was used International Classification of Diseases 10th revision (ICD-10 C67), and the population data from 1998 to 2007. The data were obtained from the National Institute of Statistics (INE). Relative survival was obtained from the EUROCare study. The projections of incidence, prevalence, and mortality were estimated using the statistical program Mortality-Incidence Analysis MODel (MIAMOD) and after the jointpoint regression that calculates the Annual Percentage of Change (APC).
Results: Between the years 1998 and 2022, it is foreseen that there will be a decrease in prevalence in the men, from 156.93 (adjusted rate AR = 128.71) to 132.99 (AR = 84.68) cases per 100,000 inhabitants/year in the year 2022. The incidence rate would decrease from 30.2 (AR = 24.93) to 24.87 (AR = 15.88) and mortality from 14.96 (AR = 12.25) to 12.08 (AR = 7.67). In women, an increase is expected in prevalence from 21.18 (AR = 13.23) to 35.6 (AR = 21.46) cases per 100,000 inhabitants/year. The incidence of 4.8 (AR = 2.91) in 1998 to 7.79 (AR = 4.69), Mortality will increase from 2.25 (AR = 1.32) to 3.37 (AR = 1.89) between the years 1998 and 2022. In men, the APCs found for prevalence, incidence and mortality were, respectively, 0.69 (95% CI: −6.9/8.9); 0.69 (95% CI: −6.9/8.95) and −4.18 (95% CI: −11.32/3.51), these not being statistically significant. In women, the APC for prevalence was −4.44 (95% CI: −13.4/5.44) from 19.24 (95% CI: 8.93/30.52) and from −3.28 (95% CI: −20.26/17.20) for mortality.
Conclusions: This cancer should be monitored and in turn prevented based on the controllable risk factors, especially in women.

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Estimación de las proyecciones del cáncer de vejiga en España

Resumen

Introducción: Uno de los cánceres más frecuentes en el mundo es el de vejiga, que afecta según algunos autores a 5.4 millones de personas en los países más desarrollados. El objetivo de nuestro estudio es el de estimar las proyecciones del impacto de esta enfermedad en España, entre los años 2007 y 2022.

Material y métodos: Se han utilizado los datos de mortalidad por cáncer de vejiga de la International Classification of Diseases 10th revision (ICD-10 C67) y los datos de la población entre 1998 a 2007. Los datos fueron obtenidos del Instituto Nacional de Estadística (INE) español. La supervivencia relativa ha sido recogida del estudio EUROCare. Se han estimado las proyecciones de incidencia, prevalencia y mortalidad mediante la utilización del programa estadístico Mortality-Incidence Analysis MODEl (MIAMOD), y posteriormente, la regresión joinpoint que calcula el porcentaje anual de cambio (PAC).

Resultados: Entre los años 1998 y 2022 se prevé en los varones una disminución de la prevalencia de 156,93 (tasa ajustada [TA] = 128,71) a 132,99 (TA = 84,68) casos por 100,000 habitantes/año en el año 2022. La tasa de incidencia disminuiría desde 30,2 (TA = 24,93) a 24,87 (TA = 15,88) y la mortalidad de 14,96 (TA = 12,25) a 12,08 (TA = 7,67). En las mujeres, se espera un incremento de la prevalencia de 21,18 (TA = 13,23) a 35,6 (TA = 21,46) casos por 100,000 habitantes/año. La incidencia de 4,8 (TA = 2,91) en 1998 a 7,79 (TA = 4,69), la mortalidad aumentará de 2,25 (TA = 1,32) a 3,37 (TA = 1,89) entre los años 1998 y 2022. En los varones, los PAC encontrados para la prevalencia, incidencia y mortalidad han sido respectivamente 0,69 (IC 95%: −6,9/8,9); 0,69 (IC 95%: −6,9/8,9) y −4,18 (IC 95%: −11,3/23,51), no son estadísticamente significativos. En las mujeres, el PAC para la prevalencia ha sido de −4,44 (IC 95%: −13,4/5,44) de 19,24 (IC 95%: 8,93/30,52) y de −3,28 (IC 95%: −20,26/17,20) para la mortalidad.

Conclusiones: Debe de monitorizarse y a la vez prevenir este cáncer en función de los factores de riesgo controlables, especialmente en las mujeres.

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Introduction

One of the most common cancers in the developed world is bladder cancer, according to some authors affecting 5.4 million people in the most developed countries and 6.7 million in developing countries. Some risk factors persist in the environment and maintain this upward trend that has a serious impact on the population, especially in older people, which is a burden on society. Overall mortality is about 4 per 100,000 in men and 1.1 per 100,000 in women. Its incidence varies considerably among geographic areas, varying the incidence rate among the highest with 89.6 adjusted rates in men and 67 in women, to the lowest areas with adjusted rates of 5.3 in men and 1.6 in women.

The aim of our study is to estimate the future projections of this disease in Spain between 2007 and 2022.

Material and methods

For their study, we used the mortality data from bladder cancer of the International Classification of Diseases 10th revision (ICD-10 C67), as well as the population data by sex, age and year in the period 1998–2007. The data were obtained from the Spanish National Institute of Statistics (INE), since the mortality figures reported in this publication refer to all deaths from bladder cancer and include the usual histopathological types.

The relative survival data, equally necessary for this study, were collected from the EUROCare study which includes a mean survival for bladder cancer in Spain. Estimates and projections of incidence, prevalence and mortality were calculated by using the Mortality-Incidence Analysis MODEl (MIAMOD) statistical program also applying the ‘backwards’ calculation from the mortality and survival data. This method relies on the mathematical relationships between mortality and prevalence, as well as the likelihood of incidence and survival. The incidence is calculated using a Poisson regression which provides maximum likelihood estimates on mortality. The model calculates the crude and adjusted incidence rates (per 100,000 inhabitants/year), using the European population as a reference. The incidence is projected after the last year of observed data based on changes in the age-period-cohort of the observed period. The program uses a Weibull parametric model and relative survival data. The selection of the best model was made based on the likelihood. The model was validated, finding that the estimates obtained retrospectively (years 1998–2007) are comparable to those observed by mortality. The ‘backwards’ calculation model of the MIAMOD program recalculates the mortality data necessary for the start of the program, so that a correlation between the observed and estimated data can be made to assess the validity and reliability of the estimates.

The data estimated by the MIAMOD program have been used to conduct a study of trends using the joinpoint regression program. The objective was to determine whether the
estimated projections are statistically significant or not. The joinpoint analysis identifies the time when the changes occur in the trend and calculates the estimated annual percentage of change (APC) in each segment. The analysis starts with the minimum number of joinpoint (shift points) and tests whether one or more of these are significant to add to the model.

Results

The projections to the year 2022 based on data from 1998 to 2007 reveal different results by sex, in the incidence, prevalence, and mortality rates.

In males, we expect a decrease in the prevalence of 156.93 (adjusted rate [AR] = 128.71) to 132.99 (AR = 84.68) cases per 100,000 inhabitants/year in the year 2022. Similarly, the incidence rate would decrease from 30.2 (AR = 24.93) in 1998 to 24.87 (AR = 15.88) and the mortality rate from 14.96 (AR = 12.25) to 12.08 (AR = 7.67) when comparing the years from 1998 to 2022 (Table 1 and Fig. 1).

In women, we expect an increase in the prevalence from 21.18 (AR = 13.23) to 35.6 (AR = 21.46) cases per 100,000 inhabitants/year. The incidence from 4.8 (AR = 2.91) in 1998 to 7.79 (AR = 4.69) and with regard to mortality, we also expect an increase in the rates from 2.25 (AR = 1.32) to 3.37 (AR = 1.89) between 1998 and 2022 (Table 2 and Fig. 2).

In men, the APC found for the prevalence, incidence, and mortality were respectively 0.69 (95% CI: −6.9/8.9); 0.69 (95% CI: −6.9/8.95) and −4.18 (95% CI: -11.32/3.51) between the years 1998 and 2022, although it should be noted that the increases are not statistically significant.

In women, in the period 2007–2022 the APC for prevalence has been −4.44 (95% CI: −13.4/5.44).

Regarding the APC in the incidence rates of bladder cancer in women, we can estimate a large increase during the study period showing 19.24 APC (95% CI: 8.93/30.52). While in mortality a not significant decreased APC is found: −3.28 (95% CI: −20.26/17.20) (Table 3).

Discussion

Among the different histological types causing bladder cancer, we have selected only those that are infiltrating according to the International Classification of Diseases for Oncology (ICD-O-2), excluding carcinoma in situ.

In 2002, Mediterranean Europe showed the highest incidence rates for bladder cancer, and in Italy, according to several cancer registries, there are some crude rates ranging between 76.2 per 100,000 inhabitants in Florence to 89.6 in Torino, in men, although the incidence rates for bladder cancer are consistently lower in women, finding for the same regions crude rates of 19.9 (adjusted: 7.7) and in Florence 19.7 (adjusted: 6.7) in Torino. In the regions of Central and Northern Europe, we observe mean incidence rates in men, and following the same European trend lower in European women; however, on the world stage, the lowest incidence rates are represented by Brazil and Colombia, among cancer registries.
In another different aspect there is the mortality that has been brought under control in developed countries and represents very low rates in all of them. The rates for Europe are estimated at 5.6 in men and 1.6 in women, but in developing countries, they continue parallel to the low incidence rate, between 2.3 and 0.8.\[13\]

According to the North American Association of Central Cancer Registries (SEER),\[14\] it is estimated that 73,510 men and women will be diagnosed with bladder cancer in 2012 and 14,880 will die from it, and the incidence rates will fall between 2007 and 2009 by −2.4% in men and −1.7% in the period 2003–2009 in women, and the death rates will decrease by −0.4% in women and −2% in men over the same period.

This contrasts with the study we have conducted, since in Spain we have managed to reduce mortality in men and women.

**Table 2**  Estimates of the prevalence, incidence and mortality from bladder cancer. Women 1998–2022.

<table>
<thead>
<tr>
<th>Years</th>
<th>Prevalence</th>
<th>Std. prevalence</th>
<th>Incidence</th>
<th>Std. incidence</th>
<th>Mortality</th>
<th>Std. mortality</th>
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<td>6.85</td>
<td>4.09</td>
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<td>7.79</td>
<td>4.69</td>
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</table>

Cases per 100,000 inhabitants.
Std.: standardized.
women, but not the incidence, which has declined slightly in men, although it has increased in women by 19.24%, which seems extremely worrying to us.

The risk factors have been well known throughout the history of cancer. In principle, in Spain, most bladder cancers occurred in the areas of occupational exposure, the highest being in industrial areas such as Catalonia,11–16 and other Spanish regions,17-18 although it should be taken into consideration that in other countries, for example in Chile, they have been associated with arsenic contamination,19 and in a follow-up study with 15 million people in 5 Nordic countries, it is estimated that bladder cancer is one of the most related to the occupational activity,20 for example waiters related with tobacco smoke and chimney sweeps, but also hairdressers due to continuous exposure to dyes containing chemicals. This same risk has been described in other professions.21

The importance of diet regarding bladder cancer has also been studied, and particularly in regard to food contaminants, thus, some authors have attempted to link diet, especially milk consumption with bladder cancer, but they have not reached an obvious or significant conclusion,22-33 and the same happens with fish consumption.24

In general, different diets containing nitrosamines have demonstrated their role in bladder cancer.25

All the studies point to the involvement of tobacco26-28 as a risk factor and it is important to think that in Spain women joined this habit a few decades ago, so the increase seen in the incidence rates is noteworthy.

Scientific studies conducted at worldwide disciplinary level aim to the susceptibility of some genes in bladder cancer and have established associations on the environmental effects and the genes on the impact of cancer in humans.29

We from here insist on the notable increase that this cancer has had in women in Spain, added to other problems such as the frequent association of this cancer with new primary ones30 and the absolute need to monitor these results in the future to see the evolution of it, and to follow the lines of prevention31 and especially the acceptance and compliance with the updated guidelines for diagnosis and treatment.32-34

Conflict of interest

The authors declare that they have no conflict of interest.

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