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Trends in pulmonary embolism morbidity and mortality in Australia

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ABSTRACT

Introduction: Pulmonary embolism (PE) is a common cause of morbidity and mortality. In this study, we investigated patterns of morbidity and mortality from PE in Australia.
Materials & Methods: Australian government databases were used to extract data on age and sex specific rates of mortality between 1997 and 2007, and hospital separations between 1998/9 and 2009/10 to examine changes over time and between age and sex groups.
Results: In 2007, 320 deaths were ascribed to PE in Australia, corresponding to a mortality rate of 1.73 per 100 000 population per year. Between 1997 and 2007, the Australian mortality rate decreased in both sexes, but this was significant only in females. By comparison, in 2009/10 there were 9,847 hospital separations for PE, corresponding to a rate of 53.1 per 100 000 population per year. In contrast to the fall in mortality rates, hospital separation rates significantly increased over the study period. Females had higher rates of morbidity and mortality from PE than males. While the mortality rates among the elderly population decreased significantly (from 48.4 to 34.3 per 100 000 population per year in those aged over 85 years), there were significant increases in PE mortality in the younger female age groups.
Conclusions: Although mortality rates are decreasing, PE remains a significant cause of morbidity and mortality in Australia, especially in females and the elderly. The burden of morbidity and mortality from PE in Australia is comparable to that found in America and a number of European countries.

Introduction

Pulmonary embolism (PE) is a common cause of morbidity and mortality [1,2]. Although it is difficult to accurately assess the burden of disease in different populations, mortality rates are known to vary between countries [3]. While the PE mortality rate in the United States is estimated to be 3.8 per 100,000 [4] and in England 4.2 per 100,000 per year [5] the mortality rate is much lower in Asian countries due, in part, to the lower prevalence of genetic risk factors [6]. Over recent years, PE mortality has decreased in some countries such as England (a decrease of 27.6% between 1996 and 2005) and the United States (9.5% between 1990 and 1999) [3,4,7–9]. Paradoxically hospital admissions for PE have increased over this time in countries such as England, the United States, Denmark and China [5,8,10,11]. To date, such trends have not been investigated in Australia.

Although understanding of the clinical and epidemiological characteristics of PE has increased over recent years, the state of knowledge regarding this important health problem remains incomplete. Analysis of disease-specific causes of morbidity and mortality, within and between countries and population sub-groups, allows clinicians and researchers to develop insights into the aetiology of PE, its clinical burden, and differences in clinical management over time and between groups. In the present study, we examined the patterns of morbidity and mortality due to PE in Australia between 1997 and 2010.

Methods

In Australia, information on all deaths (including age, sex and cause of death) is reported to the Registry of Births, Deaths and Marriages. These are processed, collated, and stored by the Australian Bureau of Statistics (ABS). The Australian Institute of Health and Welfare (AIHW) uses this data to compile tables of age and sex-specific causes of death in the General Record of Incidence of Mortality (GRIM) Books which are classified according to the International Classification of Diseases (ICD) 10 - Australian Modification [12]. In the present study, we extracted the number of deaths from PE by five year age group and sex, using the rubric I26 (Pulmonary Embolism) from 1997 to 2007.

Information on all episodes of hospitalisation (separations) in Australia are collected and stored by the local Health Departments according to the corresponding Australian financial year (July 1 to June 30). Data, which include age, sex, and principal diagnosis are compiled by the AIHW and coded according to the ICD 9 (Clinical Modification) from 1993 to 1998, and the ICD 10 (Australian Modification) from

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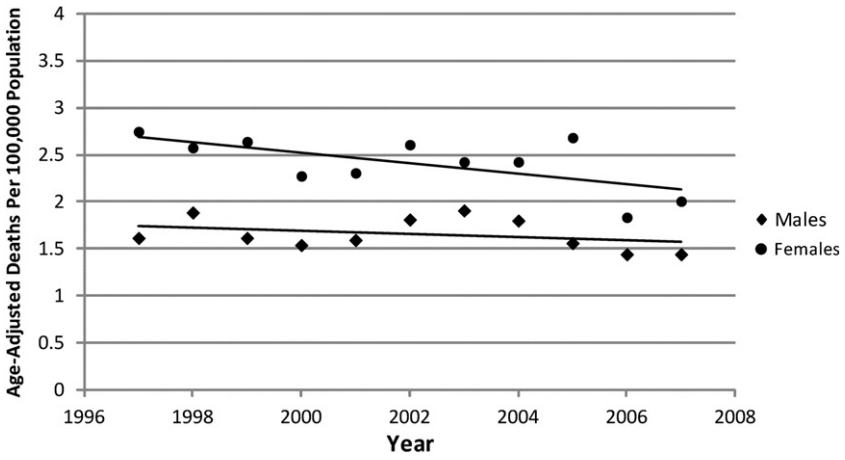

Fig. 1. Age-adjusted pulmonary embolism mortality rates by gender per 100,000 population per year from 1997 to 2007. Males (filled diamond), females (filled circle).

1998 to the present. To analyse patterns of morbidity, we extracted data from the AIHW on the number of separations due to PE by age group and sex from 1998/9 to 2009/10. PE separations were identified using the following rubrics: 415.0 (Acute cor pulmonale), and 415.1 (Pulmonary embolism and infarction) using the ICD 9 (Clinical Modification); and I26.0 (Pulmonary embolism with acute cor pulmonale), and I26.9 (Pulmonary embolism without acute cor pulmonale) from the ICD 10 (Australian Modification). Ethics approval for the study was obtained from the Human Research Ethics Committee of the University of Notre Dame, Freemantle.

The ABS compiles population statistics for each Australian quinquennial census year and provides population estimates for the inter-censal years. These data were used to calculate crude PE morbidity and mortality rates. In the present study, for the purposes of standardisation, we used the 1997 population estimates as the base population. Proportions based on the 1997 inter-census estimate by sex and five-year age groups were calculated to give the weighted age distributions, and the age-adjusted rates.

Using the method described by Lilienfeld [7] we developed linear regression models to examine the relationship between changes in the rates of morbidity and mortality over time in the total population and within each age and sex group. For each gender, a linear regression equation was developed where the age-adjusted rate was the dependent variable and year of death or separation was the variable of interest. P values of <0.05 were considered significant. All analyses were performed using SPSS 20 (IBM, New York, 2011) and Microsoft Excel (Microsoft Corporation, New York, 2007).

Results

In 1997, there were 405 deaths from PE recorded in Australia, corresponding to an age-adjusted rate of 2.19 per 100,000 population. By comparison, fewer deaths (320) were recorded in 2007, corresponding to an age-adjusted rate of 1.73 per 100,000. More females than males died in 1997 (256 and 149 respectively). While the difference between the sexes remained, there were fewer female and male deaths (187 and 133 respectively) in 2007. After adjustment for age, the female death rate declined from 2.75 to 2.01 per 100,000 between 1997 and 2007. The corresponding rates for males, after adjustment for age differences, were 1.62 and 1.44 per 100,000. The change in age-adjusted rates for males and females over the study period is shown in Fig. 1. Linear regression models demonstrated that the decrease in the age-adjusted rate of PE was significant for females ($R^2 = 0.41$; $\beta = -0.056$; $p = 0.034$), but not males ($R^2 = 0.125$; $\beta = -0.018$; $p = 0.29$). When the age-adjusted rates of the two sexes were combined into a linear regression model, the difference between the sexes over the study period was significant ($R^2 = 0.81$; $\beta = 0.86$; $p < 0.001$).

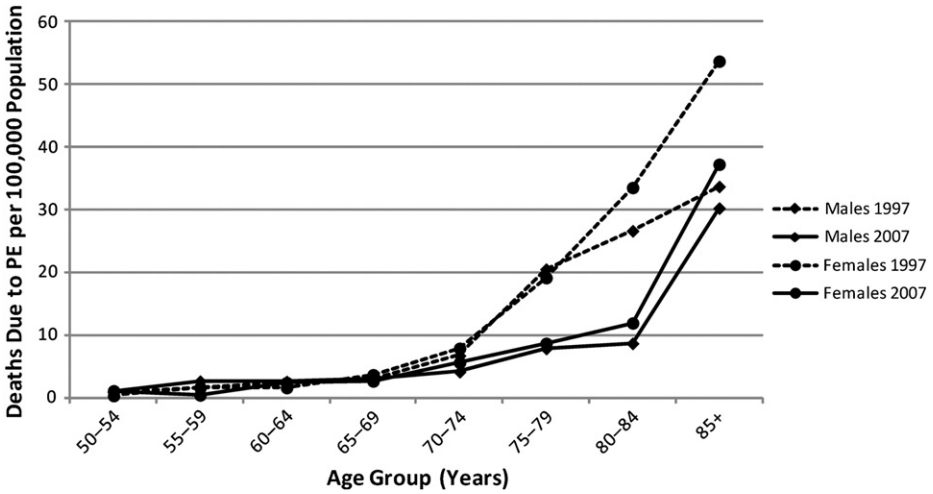

Fig. 2. Pulmonary embolism deaths by age and sex per 100,000 population per year, in 1997 (broken line) and 2007 (solid line) by age group. Males (filled diamond), females (filled circle).