Falling rates of hospitalization and mortality from abdominal aortic aneurysms in Australia

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Background: **Studies of the population trends for abdominal aortic aneurysms (AAAs) in the period 1970 to 2000 all indicated that the incidence of AAAs was increasing. It is not known whether this increase has continued. We hypothesized that the incidence of AAAs has begun to fall in Australia.**

Methods: **Age-standardized national trends in mortality from AAAs were estimated for the period 1999 to 2006, and hospital separations (deaths or discharges) for AAAs were estimated for the period 1999 to 2008. Poisson regression models were constructed to estimate the relative change over time.**

Results: **The age-standardized mortality rate from AAAs fell by an average of 6.0% (95% confidence interval [CI], 4.7-7.3) per annum in men and 2.9% (95% CI, 1.0-4.7) in women. After adjusting for age, hospital separations for men decreased by an average of 2.3% (95% CI, 1.4-2.7) per annum for nonruptured AAAs, and 5.9% (95% CI, 5.0-6.6) for ruptured AAAs and for women decreased by an average of 2.2% (95% CI, 1.4-3.0) per annum for nonruptured AAAs, and 5.1% (95% CI, 3.7-6.5) for ruptured AAAs. Ruptured, compared with nonruptured, AAAs were proportionally more common in women compared with men. The age-specific trends in separations from hospital were all downward apart from nonruptured AAAs in individuals aged 80 years and over.**

Conclusions: **The rates of separation from hospital and mortality for AAAs in Australia have fallen since 1999. This suggests a true fall in incidence of AAAs. Although the reasons for this are unknown, it has implications for policy decisions about screening. (J Vasc Surg 2011;53:274-7.)**

Randomized controlled trials of screening men aged 65 to 74 years for abdominal aortic aneurysms (AAAs) have all demonstrated that screening results in a significant reduction in the mortality from AAAs.[1-4] As a result of these trials, screening using various eligibility criteria is being introduced in the United Kingdom, United States, and parts of Europe. Despite the evidence in favor of screening, debate continues with a number of unresolved issues. One of the World Health Organization criteria for screening is that the disease should be an important health problem. This has never been questioned for AAAs. However, even among older men, AAAs are only responsible for 1% to 2% of all deaths.[4] The trials report impressive relative risk reduction for mortality from AAAs of at least 40%, but as death from AAAs is rare, the absolute risk reduction is only about 0.4%.[1-4] Not all cost-benefit analyses have been favorable.[5] This is further complicated by the emerging role of endovascular repair, which is safer (more early benefit) but more expensive (less cost benefit).[6] It is also unknown whether the relatively high participation rate achieved in the trials (65%-80%) can be replicated, particularly in lower socioeconomic catchments.[7,8]

The high prevalence of AAAs among men over 65 years of age (5%-7%) contributed to the case in favor of screening. In a chronic condition such as AAA, incidence drives prevalence and, in the two decades prior to the trials, the incidence of AAAs appeared to be rising in most Western countries.[9-11] However, it cannot be assumed that this trend would continue. Indeed, when last reviewed in Western Australia (just prior to the local trial of screening), there was evidence that rates of mortality from AAAs were beginning to fall.[12] We hypothesized that the incidence of AAAs has continued to fall in Australia and assessed this by examining recent national trends in mortality and hospital separations (deaths or discharges) for AAAs.

METHODS

All data were obtained from the Australian Institute of Health and Welfare (AIHW), an independent agency responsible for reporting to the nation on the state of its health and welfare.[13] The single principal diagnosis codes I71.3 for ruptured AAAs and I71.4 for nonruptured AAAs in the International Classification of Disease-10-Australian Modification (ICD-10-AM) were used. It was not possible to identify whether open or endovascular repairs were performed. Mortality data were obtained from the General Record of Incidence of Mortality (GRIM) Books Version 9 (2008).[14] Separations (deaths or discharges from hospital) data were extracted from the AIHW National Hospital Morbidity Database, which is a summary compilation of principal diagnoses for patient separations from all public and private hospitals.[15]

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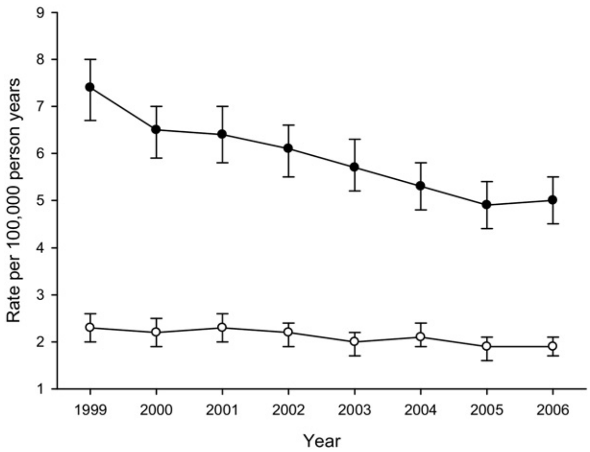

Fig 1. Age standardized mortality rates for abdominal aortic aneurysms (AAAs) in men (*filled circles*) and women (*open circles*): 95% confidence intervals are indicated by error bars, and the Australian 2001 population was used as weights.

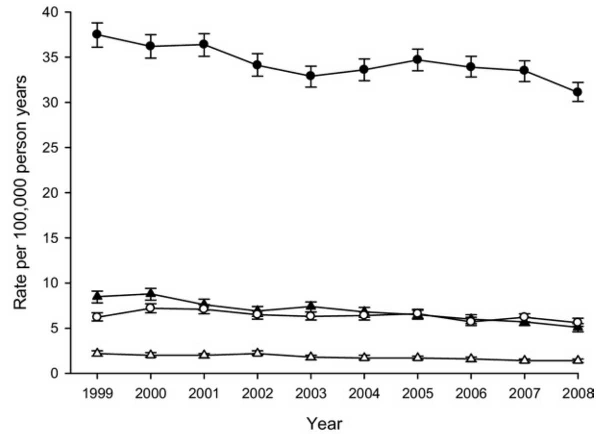

Fig 2. Age standardized rates of hospital separation for nonruptured abdominal aortic aneurysms (AAAs) in men (*filled circles*) and women (*open circles*); and ruptured AAAs in men (*filled triangles*) and women (*open triangles*): 95% confidence intervals are indicated by error bars.

Mortality data were available for the period 1999 to 2006, and separation data for the period 1999 to 2008 in gender-specific 5-year age strata. Population estimates by age, gender, and calendar years 1999 to 2008 were obtained from the Australian Bureau of Statistics. Age-standardized rates with 95% confidence intervals (CIs) were calculated using the Australian 2001 population as weights. Poisson regression models were constructed to estimate the relative change in incidence of hospital separations for AAAs and their association with age, gender, and calendar period. Analyses were performed in Stata (Version 11; College Station, Tex).

RESULTS

The age standardized mortality rate from AAAs fell by an average of 6.0% (95% CI, 4.7-7.3) per annum in men and 2.9% (95% CI, 1.0-4.7) in women (Fig 1). After adjusting for age, hospital separations for men decreased by an average of 2.3% (95% CI, 1.4-2.7) per annum for nonruptured AAAs and 5.9% (95% CI, 5.0-6.6) for ruptured AAAs, and for women decreased by an average of 2.2% (95% CI, 1.4-3.0) per annum for nonruptured AAAs and 5.1% (95% CI, 3.7-6.5) for ruptured AAAs (Fig 2).

Ruptured AAAs compared with nonruptured AAAs were proportionally more common in women compared to men. After adjusting for age and year, the average rate of separation for nonruptured AAAs was 5.2 (95% CIs, 5.0-5.3) times higher than the rate for ruptured AAAs in men but only 3.3 times higher (95% CIs, 3.1-3.5) for women.

The age-specific rates of hospital separations for nonruptured and ruptured AAAs for men are shown in Figs 3 and 4, respectively. The trends are all downward apart from nonruptured AAAs in men aged 80 years and over. A similar pattern was seen for women (data not shown).

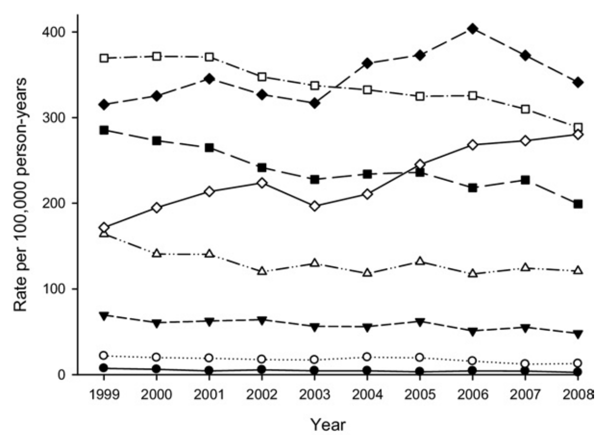

Fig 3. The age-specific rates of hospital separation for nonruptured abdominal aortic aneurysms (AAAs) in men aged 50 to 54 (*filled circles*), 55 to 59 (*open circles*), 60 to 64 (*filled inverted triangles*), 65 to 69 (*open triangles*), 70 to 74 (*filled squares*), 75 to 79 (*open squares*), 80 to 84 (*filled diamonds*), and 85+ (*open diamonds*).

DISCUSSION

This study has shown that there have been significant falls in the rates of hospital separations and mortality for both nonruptured and ruptured AAAs in men and women in Australia since 1999. This raises the possibility that the incidence of AAAs is falling.

It is possible that some of the fall in rates of separation for nonruptured AAAs was a result of less intervention for small AAAs in response to the publication of the small AAA trials in 2002.[16,17] However, the falling rates were seen before, and were ongoing 5 years after, the publication of these studies. It, therefore, seems unlikely that this explains the trend. Given the high mortality rate from

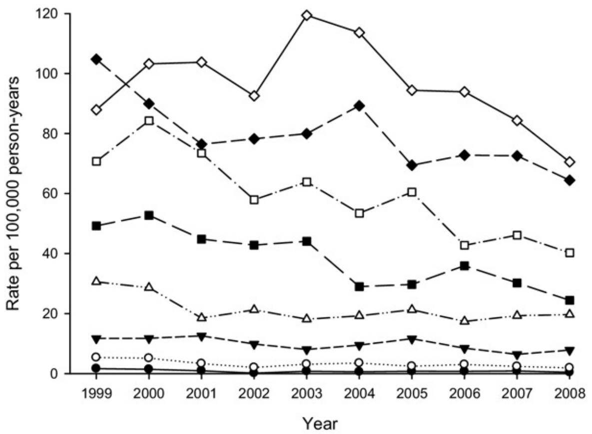

Fig 4. The age-specific rates of hospital separation for ruptured abdominal aortic aneurysms (AAAs) in men aged 50 to 54 (*filled circles*), 55 to 59 (*open circles*), 60 to 64 (*filled inverted triangles*), 65 to 69 (*open triangles*), 70 to 74 (*filled squares*), 75 to 79 (*open squares*), 80 to 84 (*filled diamonds*), and 85+ (*open diamonds*).

ruptured AAAs, the fall in overall mortality from AAAs is probably due to the fall in ruptured AAAs. This decrease in mortality cannot be attributed to a policy of screening for AAAs. Although a large-scale randomized controlled trial of screening for AAAs was undertaken in Western Australia over the period 1996-1999 (n = 12,203 attending for screening),[2] screening has not been introduced in Australia. Furthermore, if the decreasing trend was due to increased rates of diagnosis and successful elective intervention (with or without national screening), one would expect the rates of hospital separation for nonruptured AAAs to have risen. The combination of falls in both nonruptured and ruptured AAAs suggest a fall in true incidence.

If the true incidence of AAAs is falling, we can only speculate as to the cause. The well-documented falls in mortality from coronary heart disease have been largely attributed to improved primary prevention—particularly smoking cessation.[18,19] Given the dominance of smoking as a risk factor for AAAs,[20] it seems likely that a fall in the prevalence of smoking would eventually result in a fall in the incidence of AAAs. Smoking rates in Australia have declined steadily over the last 50 years, particularly in men.[21] The prevalence of adult smoking fell from 35% in 1980 to 23% in 2001 and, for those over 60 years of age, it was only 10% in 2001.[22] The use of statins is likely to have increased substantially over the study period. Although the influence of statins on aneurysmal expansion remains to be established, their increased usage may have influenced trends in AAAs.[23] Given that diabetes is associated with a reduced risk of AAAs, it is possible that the increasing prevalence of diabetes also contributed to the fall in rates for AAAs.[24,25]

The age-specific rates for separations for AAAs all decreased except those for nonruptured AAAs in both men and women aged 80 years and over. This could represent a cohort effect with this age group being the last one to have not embraced smoking cessation although one would expect a similar pattern for ruptured AAAs if this were the case. The more likely explanation is a gradual increase in the rate of intervention in this age group due to the availability of endovascular repair.

Although AAAs are more common in men, the pattern of trends and outcomes was less favorable in women. On average, the rate of separation for intact AAAs was about five times greater in men, yet the overall mortality was only three times greater in men compared with women. This was probably because women were proportionally more likely to present with rupture than men. This observation is consistent with other studies.[26-28] In addition, the magnitude of decline in rate of mortality in men was about twice that seen in women. The cause for this is unknown but is consistent with differential trends seen in the United Kingdom and further highlights the need for greater awareness of AAAs in women.[28]

This study has a number of limitations. The administrative datasets were a summary compilation of separations based on the principal diagnosis and have not been fully validated for completeness or clinical accuracy. The data did not distinguish between possible multiple admissions for the same patient with the same principal diagnosis within any 1 year. Inter-hospital transfers of the same patient may have been counted as two separations for the same diagnosis. A small proportion (4.6%) of private hospital separations was not included for 2000-2001 data, but as these were mainly restricted to small private hospitals and day-patient facilities, it would not include many AAAs. As it was not possible to link procedure codes with diagnosis codes, there is the potential that some hospital separations were not for a procedure for AAA (ie, the primary diagnosis was nonruptured AAA, but no operation took place). Previous validation of similar data in Western Australia suggest this is uncommon.[2] It was not possible to reliably distinguish open from endovascular repair. Taken together, these limitations may have influenced the estimated rates in a small way, but they are unlikely to have caused systemic bias or affected the overall trends observed here.

Regardless of the cause of the trends seen in this study, the frequency of the main outcome by which the clinical utility of screening for AAAs is measured (mortality from AAAs) is becoming less common. This has implications for policy decisions about screening. Should the trend continue, it is possible that the prevalence of AAAs will fall below the threshold needed to make screening effective, let alone cost-effective. Recent trends should probably be examined and monitored in any region where screening is being considered or has been introduced.

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AUTHOR CONTRIBUTIONS

Conception and design: PN, KS
Analysis and interpretation: PN, KS, JS
Data collection: PN, KS
Writing the article: PN, KS, JS
Critical revision of the article: PN, KS, JS
Final approval of the article: PN, KS, JS
Statistical analysis: KS
Obtained funding: PN
Overall responsibility: PN

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