Trends in hospital admissions and mortality from asthma and chronic obstructive pulmonary disease in Australia, 1993–2003

David H Wilson, Graeme Tucker, Peter Frith, Sarah Appleton, Richard E Ruffin and Robert J Adams

ABSTRACT

Objective: To examine evolving changes in asthma and chronic obstructive pulmonary disease (COPD) in South Australia and Australia as a whole from the perspective of hospital admissions, ventilatory support and mortality data.

Design: Retrospective analyses, for the period 1993–2003, of hospital separations data from the Australian Institute of Health and Welfare and the Integrated South Australian Activity Collection, and mortality data from the Australian Bureau of Statistics and South Australian hospital morbidity collection.

Main outcome measures: Hospital separations, ventilatory support episodes, mortality rates, burden-of-disease rankings.

Results: Between 1993 and 2003, in SA and nationally, hospital separations for asthma declined but separations for COPD increased significantly. Falling mortality rates from asthma in both men and women, and from COPD in men, contrast with increasing rates of COPD-related hospitalisation and mortality in women.

Conclusions: Hospital admissions and mortality associated with asthma have fallen. Admission rates for COPD are declining for men, but there is no indication that admission rates for women have reached a peak. There is a need for higher prioritisation of COPD, including policies to reduce smoking in women, and medical practice initiatives to support primary and secondary prevention, pulmonary rehabilitation and appropriate drug therapies.

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A number of studies have identified a trend towards increasing prevalence of both asthma[1,2] and chronic obstructive pulmonary disease (COPD) in recent years.[3-5] Asthma has been declared a national priority area, but COPD, which is reported to be the fourth most important cause of death in Australia, just behind cancer,[6] is comparatively neglected as a health priority in terms of policy and interventions to support education and management. Asthma has also commanded a major intervention focus in general practice through the "Asthma 3+ Visit Plan", providing more management time through extended consultations for at-risk asthma patients[7] — but no such attention has been given to COPD.[8] This is despite the fact that both conditions have long-term impacts and costs,[5] together account for the bulk of chronic respiratory disease, and have been the subject of comprehensive international guidelines and discussion.

In this article we examine the comparative impact and changing nature of both asthma and COPD from the perspective of hospital admissions, management data and mortality trends over the period 1993–2003. The changing pattern of each condition is examined in South Australia and compared with Australia as a whole.

METHODS

Our data sources for hospital admissions for asthma and COPD for the financial years 1993–04 to 2003–04 were:

- the Australian Institute of Health and Welfare (AIHW) website,[9] for Australia as a whole; and
- the Integrated South Australian Activity Collection (ISAAC) inpatient separations database, for SA (unpublished data).

Diagnoses of asthma or COPD were determined based on the principal International classification of diseases (10th revision) (ICD-10) diagnosis code. Secondary diagnoses were not considered.

For the SA data only, we determined whether a patient had received ventilation support by intubation or ventilation in an intensive care unit on the basis of all procedures coded for asthma and COPD. The same analysis could not be done with national data, as the AIHW website gives this information for all combined conditions but not asthma and COPD separately. Separations for people aged under 15 years were excluded, to focus on adult asthma and COPD.

Mortality data for Australia and SA were obtained from the Australian Bureau of Statistics for the period 1993–2003 (unpublished data).

National data on the burden-of-disease ranking of asthma and COPD (in terms of years lost to disability) were obtained from the AIHW.[10] Equivalent SA data were obtained from an SA government report.[11]

Statistical methods

The data analysed were time series, but the series were not long enough to use established time series techniques in assessing trend. The models used in our analyses tested for a linear relationship between the age- and sex-standardised rate of separations per 100 000 population and time. This was done by fitting a simple linear regression of the series against the year and examining whether the coefficient of year was statistically significant at the 5% level. Our model used the calculation of robust estimators of standard errors (SEs) provided by Stata software, release 9 (StataCorp, College Station, Tex, USA). The Huber–White sandwich robust variance estimator produces consistent SEs for ordinary least squares regression coefficient estimates in the presence of heteroskedasticity (ie, unequal variance in the regression errors).

As the data were time series, it was possible that they were auto-correlated. Accordingly, errors in the regression model were tested for auto-correlation using the alternative Durbin–Watson test for first-order serial correlation in the disturbance. Where auto-correlation in the errors was detected, the model was refit using the Newey–West variance estimator, which handles auto-correlation up to and including a specified lag, as well as the presence of heteroskedasticity. The Newey–West model produced variance estimates that were exactly the Huber–White sandwich robust variance estimates calculated by the robust regression estimator (above) when no lag was included in the model. Thus, the two models used to assess linear trend were entirely consistent. Only first-order correlation was allowed for in the fitting of the models.

1 Comparison of trends (events per year) in separations for asthma and chronic obstructive pulmonary disease (COPD) per 100 000 population, Australia and South Australia, 1993–04 to 2003–04, by age and sex

	Asthma separations				COPD separations			
	Australia	*P*	SA	*P*	Australia	*P*	SA	*P*
All persons (ASR)	–12.13	< 0.001	–7.23	0.001	13.75	< 0.001	2.78	0.281
Males (ASR)	–9.56	< 0.001	–4.55	0.003	11.40	0.002	–0.50	0.891
Males 15–34 years	–3.29	0.063	–2.40	0.284	–0.06	0.369	–0.16	0.718
Males 35–54 years	–3.07	< 0.001	–1.12	0.224	2.13	0.005	1.16	0.299
Males ⩾ 55 years	–25.56	< 0.001	–10.64	< 0.001	37.28	0.002	0.14	0.989
Females (ASR)	–14.61	< 0.001	–9.80	0.001	16.00	< 0.001	5.92	0.004
Females 15–34 years	–9.72	< 0.001	–13.13	< 0.001	–0.22	0.115	–1.07	0.042
Females 35–54 years	–7.52	< 0.001	–2.49	0.372	3.27	< 0.001	2.89	0.014
Females ⩾ 55 years	–27.41	< 0.001	–13.21	< 0.001	46.34	< 0.001	15.72	0.005

ASR = age-standardised rate. ◆

RESULTS

Trends in hospital separations for asthma and COPD per 100 000 population per year in Australia and in SA over the period studied are summarised in Box 1. Nationally and in SA, for both men and women overall, there was a strong downward trend in hospital admissions for asthma per 100 000 population. At a national level, the downward trend was also seen in each separate age group (except men aged 15–34), whereas at state level, the downward trend was seen only among men and women aged ⩾ 55 and women aged 15–34. The largest annual decline in adult admission rates for asthma at both the national and state levels was found in men and women aged ⩾ 55 years.

In contrast, there was a strong upward trend nationally in separations for COPD per 100 000 population, for men and women overall and for both sexes individually, in age groups 35–54 years and ⩾ 55 years. This contrasts with SA rates, which showed a significant increase for women overall and in the two older age groups but no significant change for men in any age group.

There was a statistically significant fall in asthma patient bed days per 100 000 population per year at both national level (all persons, –89.34 days; $P < 0.001$) and state level (all persons, –67.23 days; $P < 0.001$). By comparison, there was a significant increase in COPD patient bed days at the national level (all persons, +41.46 days; $P = 0.031$) but not at the state level (all persons, –84.63 days, $P = 0.111$).

In SA, there was a small but significant increase in age- and sex-standardised ventilation rates for asthma per 100 000 population over the study period (all persons, +0.09 ventilations/year per 100 000 population; $P = 0.014$). Ventilation rates for COPD per 100 000 population increased overall (+0.96; $P < 0.001$), with the highest increases being in the ⩾ 55-years age group in both men (+5.61; $P < 0.001$) and women (+5.52; $P < 0.001$). Ventilation rates also increased significantly among women aged 35–54 years (+0.68; $P = 0.003$).

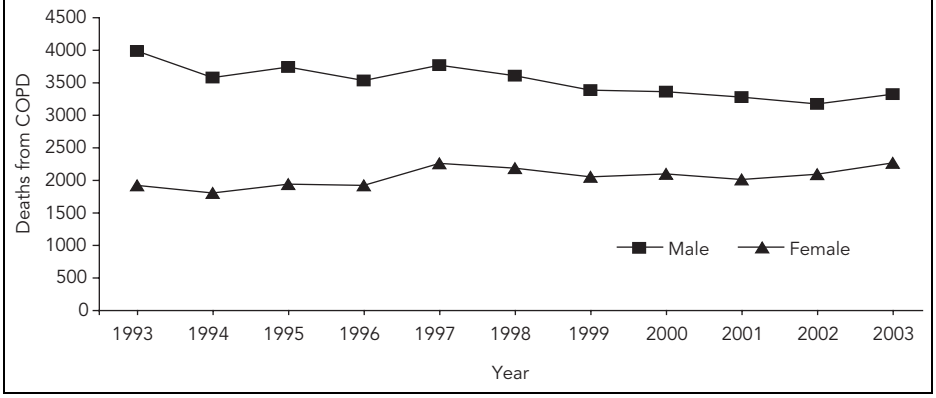
Trends in mortality rates for asthma and COPD over the period studied are shown in Box 2. There was a significant fall in deaths due to asthma at both national and state levels in both men and women. Nationally, the decline was apparent in every age group for both sexes. However, a different picture emerges for COPD. There was a significant fall in COPD mortality overall for men at both the national level (–2.98 events/year per 100 000 population; $P < 0.001$) and state level (–2.64 events/year per 100 000 popu-

2 Comparison of trends (events per year) in mortality for asthma and chronic obstructive pulmonary disease (COPD) per 100 000 population, Australia and South Australia, 1993–04 to 2003–04, by age and sex

	Deaths from asthma				Deaths from COPD			
	Australia	*P*	SA	*P*	Australia	*P*	SA	*P*
All persons (ASR)	–0.53	< 0.001	–0.49	< 0.001	–1.65	< 0.001	–1.33	0.001
Males (ASR)	–0.45	< 0.001	–0.51	0.003	–2.98	< 0.001	–2.64	< 0.001
Males 15–34 years	–0.04	0.006	–0.06	0.131	0.00	0.582	0.02	0.454
Males 35–54 years	–0.12	< 0.001	–0.20	0.041	–0.06	0.008	0.12	0.132
Males ⩾ 55 years	–1.18	< 0.001	–1.37	0.004	–7.04	< 0.001	–7.06	0.001
Females (ASR)	–0.60	< 0.001	–0.46	0.005	–0.37	0.068	–0.07	0.635
Females 15–34 years	–0.06	0.009	0.03	0.452	0.00	0.848	0.00	0.902
Females 35–54 years	–0.11	< 0.001	0.12	0.311	–0.01	0.513	0.09	0.436
Females ⩾ 55 years	–1.12	< 0.001	–1.40	0.002	0.18	0.725	0.10	0.905

ASR = age-standardised rate. ◆

3 Deaths from chronic obstructive pulmonary disease (COPD) in Australia, 1993 to 2003, by sex



lation; $P < 0.001$). However, there was no significant decline among women at either national or state level. There were also no age-specific changes in mortality rates for women per 100 000 population at national or state levels.

The trends in COPD mortality rates for men and women have been converging since the beginning of the series (Box 3). This phenomenon is much less pronounced for asthma, especially since 1998 (Box 4).

Burden-of-disease rankings for asthma and COPD for Australia and SA are summarised in Box 5. Overall, in burden-of-disease terms, both asthma and COPD are ranked higher at the national level than at the state level. COPD is ranked higher than asthma at both national and state levels.

DISCUSSION

We have shown that declining mortality rates for asthma and COPD in men contrast with increasing COPD hospitalisations and mortality in women. The greatest increase in burden of COPD hospital separations and deaths in our study was in the ⩾ 55-years age group in women, but there have also been significant increases in admission rates, for both sexes, in the 35–54-years age group, and it may be here that the greatest gains can be made through smoking cessation initiatives and better disease management.

Our results reflect similar findings internationally and provide further evidence of the expanding global burden of COPD.[12] Between 1980 and 2000, deaths from COPD in the United States more than doubled for women and remained consistently higher for men than women.[13] The prevalence of chronic bronchitis in the US has also increased markedly in women and young people of both sexes, as has the number of hospitalisations for this condition, particularly in women.[14]

As COPD is preventable and treatable, a strong public health message and funding commitment are warranted. Given that at least 60% of the risk of COPD is attributable to smoking,[15] reducing smoking prevalence is the key to modifying the future burden of COPD.[16] But there are also sound reasons for promoting earlier diagnosis of COPD. People with undiagnosed COPD have a poorer quality of life and functional status than people with similar lung function who have been diagnosed with COPD and received appropriate treatment.[17] There are effective treatments for COPD that improve outcomes. Treatment with long-acting β-agonists[18] and tiotropium[19] improves exercise duration, reduces breathlessness on exertion, and improves quality of life.[20] Inhaled corticosteroids reduce the frequency and severity of exacerbations and hospitalisations,[21] and pulmonary rehabilitation reduces breathlessness.[22] For these reasons, it is of concern that COPD remains undiagnosed in many Australians of all ages.[23]

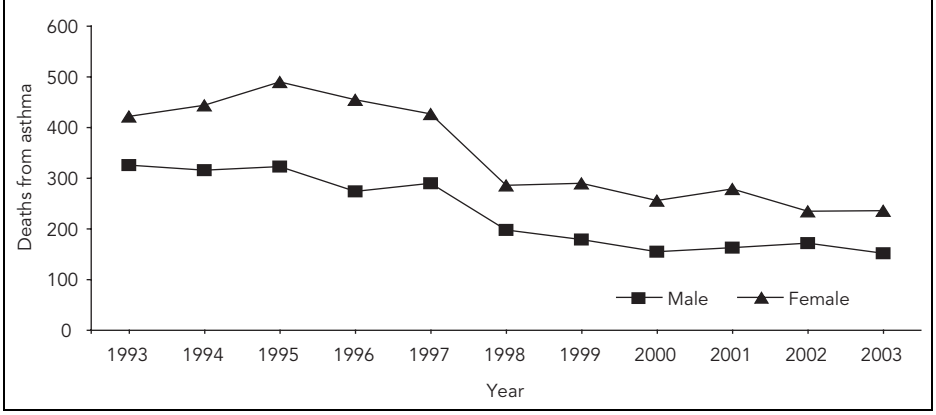
It has been argued that hospitalisations do not accurately represent the burden of a health problem in a community, but, rather, may reflect the availability of care,[5] current management strategies or changes in priority-setting. However, the fact that people hospitalised with COPD have a subsequently increased risk of death over 5 years compared with those not hospitalised suggests the former are an at-risk group.[24]

The considerable increase in COPD admissions over asthma is reflected in the comparative burden-of-disease rankings, but this is not reflected in the priority given to COPD in Australia. Given that Australian COPD mortality rates observed in our study were 14 times that of asthma in 2003, and even allowing for some death certificate misclassification, its priority position needs to be recognised.

The decline in hospital admissions for asthma cannot be explained by a fall in asthma prevalence over this period.[2,25] However, it could be argued that cases of severe asthma are becoming more effectively managed out of hospital.[2]

Smoking remains a major public health issue in both men and women under 40 years of age and in lower socioeconomic groups.[26] In 2004, the overall smoking rate in people aged 20–40 years was 24% for men and 22% for women. In people aged 14–19 years, the prevalence was higher for females (12%) than males (10%).[27] As COPD is increasingly being seen at younger ages in women, who may be more susceptible to the disease than men,[28] and given that hospitalisation rates are increasing, there is a case for targeting health education about COPD specifically at women. Targeting women with additional female-specific programs on smoking and COPD is likely to have greater impact than generalised smoking cessation programs.

4 Deaths from asthma in Australia, 1993 to 2003, by sex



5 Current burden-of-disease rankings (based on years lost to disability) for asthma and chronic obstructive pulmonary disease (COPD) in Australia and South Australia

		Males	Females	All persons
Asthma	Rank in Australia	14	7	9
	Rank in SA	15	9	11
	Severity weight*	0.058	0.058	—*
COPD	Rank in Australia	4	6	3
	Rank in SA	4	7	6
	Severity weight*	0.168	0.159	—*

* For more detail on severity weight, see Mathers et al.[10] As severity weight is sex-specific, none is provided for the "all persons" category. ◆

Our study had a number of limitations. First, there is no "gold standard" of asthma diagnosis and the condition is difficult to diagnose in older people, especially for the first time. Some cases classified as COPD may therefore be asthma or have a component of asthma. Furthermore, there is clear evidence that COPD is under-detected and misdiagnosed as asthma.[29,30] The complexity of diagnosis of respiratory problems in older people means that health professionals may also misclassify asthma or COPD and therefore underestimate mortality from these diseases. However, even if we allowed for a doubling of asthma mortality, the problem would still be overwhelmed by the problem of COPD.

Despite falls in the 1980s and 1990s, smoking rates have been fairly stable since the end of the 1990s. If this stable prevalence continues, COPD will continue to carry a high burden of disease. Future response to COPD needs to occur at both government and health professional levels. Prevention and treatment strategies to reduce the burden of this problem already exist, but need to be applied more widely.

COMPETING INTERESTS

None identified.

AUTHOR DETAILS

David H Wilson, PhD, MPH, BEd, Associate Professor of Medicine[1,2]
Graeme Tucker, BSc, Principal Epidemiologist Biostatistics[3]
Peter Frith, MD, Professor and Director[4]
Sarah Appleton, BA, Research Officer[1]
Richard E Ruffin, MD, Professor of Medicine[1,2]
Robert J Adams, MD, Associate Professor of Medicine[1,2]
1 Queen Elizabeth Hospital, Adelaide, SA.
2 University of Adelaide, Adelaide, SA.
3 Department of Health, Adelaide, SA.
4 Southern Respiratory Care Services, Repatriation General Hospital, Adelaide, SA.
Correspondence:
david.hugh.wilson@adelaide.edu.au

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