Asthma in Australia

2008

Suggested citation

Australian Institute of Health and Welfare

Foreword

The Australian System for Monitoring Asthma was established in 2001 in response to the declaration of asthma as the sixth National Health Priority Area by the Australian Health Ministers. At that stage, the epidemiology of asthma in Australia was not clear and we needed to develop reliable statistics to describe the extent of the problem. There was a need to work with researchers and policy makers to put the monitoring of asthma on a firm footing. With that in mind, the Australian Institute of Health and Welfare established the Australian Centre for Asthma Monitoring as one of its collaborative units. The intention was to bring together its own data expertise and collections with clinical and epidemiological research expertise of the Woolcock Institute of Medical Research in Sydney. As this report shows, the synergy brought together by this collaboration has given asthma monitoring a clear direction in Australia. The model and quality of the work of the System is now acknowledged internationally.

Asthma in Australia 2008 is the third report in the series from the Australian System for Monitoring Asthma. The first report released by the Australian Institute of Health and Welfare in 2003 provides baseline information about the disease, its risk factors and its complications. One of the important steps in disease monitoring is to standardise data definitions and to raise data quality. The use of non-standard definitions can lead to incomparable, sometimes conflicting, information about disease epidemiology. The second report published in 2005, builds upon the first by putting data and definitional issues into better perspective and providing a clearer view of the extent of the problem, the underlying trends and clarification of various population health issues.

The third report in any disease monitoring series creates the opportunity to provide unambiguous answers about the extent of the problem and the policy issues that can be addressed using the information generated. While asthma remains a large problem in Australia, and Australia remains a high prevalence country by international standards, the adoption of a rigorous approach to monitoring of asthma has allowed us to gain a clear understanding of the issues surrounding this disease.

The prevalence of asthma among children in Australia is now plateauing, if not declining. Asthma mortality in Australia is also lower than it was a few short years ago. There is now general acceptance of the overlapping nature of asthma and chronic obstructive pulmonary disease (COPD) in older people.

Having settled some of the epidemiological issues in asthma monitoring, this report focuses its attention on asthma in Aboriginal and Torres Strait Islander Australians. A special chapter deals with the extent of the problem in this most disadvantaged population group. Unfortunately, the picture for asthma is no different among Indigenous Australians than for other health issues.

I would like to take this opportunity to congratulate the authors of the report, in particular Professor Guy Marks and Ms Leanne Poulos of the Australian Centre for Asthma Monitoring, in the preparation of this report. The advice and guidance of the Steering Committee in putting together this report is also gratefully acknowledged.

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This section presents selected findings from the report. Also, each chapter begins with its own lists of key points.

Asthma in Aboriginal and Torres Strait Islander Australians

- Asthma represents the second most common self-reported illness affecting the Indigenous population.
- Compared with non-Indigenous Australians, Aboriginal and Torres Strait Islander Australians:
  - have a higher prevalence of asthma, particularly among older persons, children and those living in non-remote localities
  - have a higher rate of mortality due to asthma
  - have higher rates of hospitalisation for asthma
  - have almost double the rate of smoking
  - have relatively high rates of exposure to passive smoke as children, both before and after birth
  - are less likely to use inhaled corticosteroids for asthma, at least among children
  - are more likely to have diabetes and mental and behavioural disorders as a comorbid condition with asthma.

Prevalence

- Asthma remains a significant health problem in Australia, with prevalence rates that are high by international standards.
- In 2004–05, the prevalence of asthma in Australia was 10.2% (equivalent to 2,010,212 people).
- Compared with 2001, the prevalence of asthma in 2004–05 decreased slightly in children and young adults but remained unchanged in older adults.
- Among those aged 0–14 years, the prevalence of asthma is higher among boys than girls, but among those aged 15 years and over, asthma is more prevalent in females than males.
- The gap in prevalence between the least disadvantaged and most disadvantaged localities increased between 2001 and 2004–05.
- The majority of children with asthma in Australia have infrequent episodic asthma while very few (less than 5%) have persistent asthma.
- The majority of adults with asthma have mild or very mild forms of the condition.
- Asthma commonly coexists with other chronic conditions.

Mortality

- There were 402 deaths attributed to asthma as the underlying cause in 2006. This represents 0.30% of all deaths in that year.
- There was a 69% decrease in the mortality attributed to asthma between 1989 and 2006.
- The rate of mortality due to asthma in Australia is high on an international scale.
- The risk of dying from asthma increases with age but the rate of increase is less than for all-cause mortality.
- People living in more socioeconomically disadvantaged areas have a higher risk of dying from asthma than people who live in more advantaged areas.

Use of health-care services

General practice encounters

- There has been a decrease in the rate of general practice encounters for asthma among adults (–24%) and children (–37%) between 1998 and 2008.
- Inhaled corticosteroids are prescribed at more than half of asthma-related general practice encounters.
- Lung function testing and provision of asthma action plans occur in less than 10% of general practice encounters for asthma.
- Claims for completed Practice Incentives Program Asthma Cycle of Care:
  - are highest among boys aged 0–14 years and women aged 65 years and over
  - are lower among people aged 15–34 years, people living in remote areas and people living in areas of a relatively higher socioeconomic status
  - tend to peak in the winter months.

Hospitalisations and emergency department visits

- Children have higher rates of hospitalisation for asthma than adults.
- There has been a reduction in the rate of hospital admissions for asthma between 1993–94 and 2006–07 among both adults (–45%) and children (–42%).
- Hospital admissions for asthma are higher among:
  - adults living in remote areas than those residing in major cities
  - people living in socioeconomically disadvantaged areas compared with those living in the least disadvantaged areas.
- Peaks in hospital admissions for asthma vary by age, with rates highest in February and May among children and highest in the winter months among adults.
- In 2006–07, 11.7 out of every 1,000 hospitalisations for asthma included a period of mechanical ventilation (that is, on a 'life-support machine').

Health-care expenditure

- Health expenditure on asthma was $606 million in 2004–05.
- Asthma expenditure accounted for 1.2% of total allocated health-care expenditure in 2004–05.
- When compared with total allocated health expenditure, less asthma expenditure can be attributed to admitted patient hospital care but a substantially higher proportion of asthma expenditure is attributable to prescription pharmaceuticals.

Key points—*Asthma in Australia 2008*

Management

Asthma action plans

- The majority of people with asthma do not have a written asthma action plan, despite national guidelines recommending their use for the management of asthma for nearly 20 years.
- Young men and those living in socioeconomically disadvantaged areas are less likely to possess a written asthma action plan than others.

Medication use

- The use of almost all medications for asthma increases with age.
- As expected, use of inhaled corticosteroids is less common in children than in adults with asthma.
- Children are more commonly prescribed the less potent formulations of inhaled corticosteroids while prescriptions for combination formulations containing long-acting beta-agonists are relatively uncommon in children.
- Among adults, the majority of inhaled corticosteroids are prescribed in combination with long-acting beta-agonists.
- There has been a recent reduction in prescribing the most potent formulations of inhaled corticosteroids.
- Intermittent use of inhaled corticosteroids is the most common mode of use in adults and children, despite treatment guidelines recommending regular use in people with persistent asthma.

Smoking and occupational exposures

- People with asthma continue to smoke at least as commonly as people without asthma, despite the known adverse effects.
- The prevalence of smoking is higher among younger people with asthma than older people with asthma.
- Socioeconomic position is an important determinant of the risk of smoking among people with asthma.
- An estimated 11% of children with asthma reside in homes where smoking occurs inside the home.
- Nearly 10% of adult-onset asthma is caused by occupational exposures and, hence, could be avoided if exposure to triggering agents in the workplace was eliminated.

Quality of life

- Asthma is associated with poorer quality of life.
- People with asthma rate their health worse than people without asthma.
- People with asthma report a substantially higher proportion of days of reduced activity than those without the condition.
- Most of the impact of asthma is on physical functioning and on the ability to perform social roles.
- Australians with asthma report worse psychological health than those without asthma, and the difference is more pronounced in females and in older persons.

1. Introduction

Asthma is a common chronic inflammatory condition of the airways which presents as episodes of wheezing, breathlessness and chest tightness due to widespread narrowing of the airways. Among those with the condition, airway narrowing and symptoms can be triggered by viral infections, exercise, air pollutants, tobacco smoke or specific allergens such as house dust mites, pollens and animal danders. The symptoms of asthma are usually reversible, either spontaneously or with treatment.

While the underlying causes of asthma are still not well understood, there is evidence that environmental and lifestyle factors, as well as genetic factors such as an allergic tendency, may increase the risk of developing asthma.

Asthma affects people of all ages and is associated with a substantial impact on the community. While there is currently no cure for asthma, there are effective management strategies available to control the disease and prevent the worsening of asthma symptoms. However, there is evidence that the uptake of these strategies has not been optimal among people who could benefit greatly in terms of reducing the impact of asthma on both themselves and the community. For these reasons, it is important to continue to monitor the prevalence of asthma, its distribution within the community, markers of asthma exacerbations and the uptake of effective clinical management practices.

This report, the third in the *Asthma in Australia* series, describes the status of asthma in Australia in 2008 using a range of data sources. It aims to provide a wide audience, including health professionals, policy makers, health planners, academics, consumers and interested readers, with up-to-date summaries of data and trends for asthma in Australia.

As with the previous editions of *Asthma in Australia* published in 2003 and 2005, the scope of this report is based on the indicator framework for asthma, initially proposed in August 2000 (AIHW 2000) and then revised by ACAM (AIHW: Baker et al. 2004). This version of *Asthma in Australia* provides updates to data presented in the previous two editions and also includes new information. For example, we discuss occupational asthma and provide a detailed analysis from the Pharmaceutical Benefits Scheme data to describe the use of medications for the treatment of asthma in the Australian population. In this report, we have included a focus chapter on asthma in Aboriginal and Torres Strait Islander Australians (Chapter 2). This draws together asthma-related information from a range of sources to describe the impact of this condition on our Indigenous population.

The remainder of the report contains data on disease prevalence (Chapter 3), mortality (Chapter 4), health-service utilisation and health-care expenditure for asthma (Chapter 5), asthma management, including the possession of asthma action plans and the use of pharmaceuticals (Chapter 6), selected risk factors contributing to asthma, including smoking, exposure to passive smoke and occupational asthma (Chapter 7), and quality of life and markers of asthma control (Chapter 8). The report describes the recent time trends and seasonal patterns in these indicators and, where data are available, examines differences between age groups, between males and females, between socioeconomic groups and between urban, rural and remote populations. Finally, for some of the indicators, comparisons among states and territories and with selected overseas countries are described.

2. Asthma in Aboriginal and Torres Strait Islander Australians

Key points

- Asthma represents the second most common self-reported illness affecting the Indigenous population.
- Compared with non-Indigenous Australians, Aboriginal and Torres Strait Islander Australians:
  - have a higher prevalence of asthma, particularly among older people, children and those living in non-remote localities
  - have a higher rate of mortality due to asthma
  - have higher rates of hospitalisation for asthma
  - have almost double the rate of smoking
  - have relatively high rates of exposure to passive smoke as children, both before and after birth
  - are less likely to use inhaled corticosteroids for asthma, at least among children
  - are more likely to have diabetes and mental and behavioural disorders as a comorbid condition with asthma
  - have poorer self-assessed health.

Introduction

The gap in mortality and morbidity between Aboriginal and Torres Strait Islander peoples and non-Indigenous Australians is glaringly obvious (Oxfam Australia 2007). In terms of life expectancy, this gap (17 years) is increasing in Australia, which is in contrast to Indigenous populations in other affluent countries where the gap is narrowing (Oxfam Australia 2007). Poor health outcomes in Indigenous communities reflect the combined impact of specific diseases, such as asthma, and adverse socioeconomic circumstances (Oldenburg et al. 2000).

For Indigenous communities, the problem of asthma exists within a broader public health context in which appropriate delivery of health-care services is an important issue. A consensus view on this, included in a statement on the management of bronchiectasis, is that successful management of any chronic disease amongst Indigenous populations will only be achieved by delivering comprehensive health care accompanied by improvements in housing, education, employment and poverty levels (Chang et al. 2002). No single model of health-care delivery can be used for all Indigenous communities. However, there are some common principles underlying most models. A comprehensive and competent primary health-care service is a prerequisite for the effective delivery of any treatment and disease control program. Delivering optimal health care in a setting of entrenched poverty and major social disadvantage is difficult for both primary and hospital-based health providers. Nevertheless, the limited but definite benefits of optimal care cannot be underestimated. The challenge for health service systems is to find ways to deliver effective, competent and high-quality health care despite problems that include remoteness, endemic poverty, poor housing, severe educational disadvantage, dysfunctional communities and comorbidities in children, adults and their carers.

Asthma is a designated National Health Priority Area and as such, national policies on asthma form part of the national policy framework for chronic disease care which consists of the National Chronic Disease Strategy (NHPAC 2006a) and the National Service Improvement Framework (NSIF) (NHPAC 2006b). The NSIF pays particular attention to the health service delivery needs of Indigenous Australians, stating as its guiding principle:

> *All health services need to provide effective and appropriate services to Aboriginal and Torres Strait Islander people using the Australian Health Ministers' Advisory Council's Aboriginal and Torres Strait Islander Cultural Respect Framework as a guide. Particular attention needs to be given to physical, economic, cultural or other barriers which may limit equitable access. The needs of Aboriginal and Torres Strait Islander people need to be addressed at all levels of health policy development and implementation. Health service providers should consider the development of effective data systems that enable monitoring and improvement of both accessibility and effectiveness of health care provided to Aboriginal and Torres Strait Islander Australians.* (DoHA 2006)

The purpose of this chapter is to focus on the impact of asthma on Aboriginal and Torres Strait Islander peoples in Australia. Here we bring together data on the prevalence, health service utilisation and management of asthma specifically relating to Indigenous Australians. Information on quality of life, mortality and comorbidities is also presented. Comparisons, where available, are made with non-Indigenous Australians.

2.1 Prevalence

The 2004–05 National Aboriginal and Torres Strait Islander Health Survey provides the most recent nationwide data on the prevalence of asthma among Indigenous Australians. This survey found that asthma (defined as a doctor- or nurse-diagnosed long-term condition) was the second most common illness affecting 26% of the Indigenous population (ABS 2006d). The most common illness was eye or sight problems, which affected 30% of Indigenous Australians.

Ever diagnosed with asthma

The prevalence of ever being diagnosed with asthma is higher in Indigenous adults than non-Indigenous adults (Table 2.1).

Table 2.1: Prevalence of ever being diagnosed with asthma by Indigenous status, Australia, 2004–05 (per cent)

Age group	Indigenous (95% CI)	Non-Indigenous (95% CI)
0–17 years	24.0 (21.5–26.6)	21.3 (19.9–22.7)
18 years and over	27.1 (24.6–29.6)	19.8 (19.1–20.6)
All ages	**26.4 (24.4–28.3)**	**20.2 (19.6–20.8)**

Note: Age-standardised to the Australian population as at June 2001; CI = confidence interval.

Source: Australian Bureau of Statistics (ABS) National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) and National Health Survey (NHS) 2004–05, expanded confidentialised unit record files, Remote Access Data Laboratory.

However, most estimates of the prevalence of ever being diagnosed with asthma among Indigenous children are similar to those observed in non-Indigenous children (Table 2.1 and Table 2.2). In 2004–05, the National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) estimated that the prevalence of ever being diagnosed with asthma was 24.0% among Indigenous Australian children, which was not significantly different to the prevalence (21.3%) among non-Indigenous Australian children ($p = 0.15$).

2. Asthma in Aboriginal and Torres Strait Islander Australians

Table 2.2: Prevalence of ever being diagnosed with asthma among Aboriginal and Torres Strait Islander children, 1999–2003

Location (source)	Year	Population	Age range	No. in survey	Rate (%)	95% CI
Ever had asthma						
Western Australia (1)	2001–2002	Indigenous	0–3 years		16.8	14.3–19.5
			4–11 years		25.6	23.2–28.0
			12–17 years		24.4	21.4–27.6
			0–17 years	**5,513**	**23.2**	**21.6–24.9**
Australian Capital Territory (2)	1999–2001	Indigenous primary school entrants[a]	4–6 years	203	27.6	21.8–34.2
Ever had wheezing or whistling in chest						
Western Australia (1)	2001–2002	Indigenous	0–3 years		32.5	29.5–35.8
			4–11 years		28.4	25.9–31.1
			12–17 years		24.0	21.0–27.3
			0–17 years	**5,513**	**28.0**	**26.2–29.9**
Ever had asthma ('short wind')						
Remote communities, North Queensland (3)	1999	Indigenous	0–17 years	1,650	15.8	14.0–17.6
Ever had short wind (asthma)						
Torres Strait region, Qld (4)	2003	All persons[b]	5–17 years	315	12.2	8.5–15.8

(a) In comparison, the prevalence of 'ever had asthma' among non-Indigenous primary school entrants was 23.5% (95% CI = 22.7–24.3%).

(b) 95.3% of the sample population were Indigenous and the remaining 4.7% were non-Indigenous.

Sources: (1) Western Australian Child Health Survey, Zubrick et al. 2004; (2) Glasgow et al. 2003; (3) Valery et al. 2001; (4) Valery et al. 2008.

Current asthma

The prevalence of current asthma among Aboriginal and Torres Strait Islander Australians in the 2004–05 NATSIHS was 16.5% (Table 2.3), with a lower prevalence in males (12.5%) than females (19.9%) ($p < 0.0001$).

The age-adjusted prevalence of current asthma was higher among Indigenous Australians (16.5%) than other Australians (10.2%) in 2004–05 (Table 2.3).

Table 2.3: Prevalence of current asthma by Indigenous status, Australia, 2004–05 (per cent)

Age group	Indigenous (95% CI)	Non-Indigenous (95% CI)
0–17 years	13.5 (11.9–15.1)	11.2 (10.1–12.3)
18 years and over	17.5 (15.4–19.5)	9.8 (9.3–10.4)
All ages	**16.5 (14.9–18.1)**	**10.2 (9.7–10.7)**

Note: Age-standardised to the Australian population as at June 2001; CI = confidence interval.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of the Australian Bureau of Statistics (ABS) National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) and National Health Survey (NHS) 2004–05, expanded confidentialised unit record files, Remote Access Data Laboratory.

Indigenous males had a higher prevalence of current asthma (12.5%) than non-Indigenous males (9.0%), and Indigenous females reported a higher prevalence (19.9%) than their non-Indigenous counterparts (11.4%) (ABS 2006c).

Although the difference in prevalence of current asthma exists across all age groups, it is more prominent in older adults, especially females. Among those aged 35 years and over, the prevalence of asthma among Indigenous Australian females was double that observed for other Australian females in the same age group (22% versus 11%). In contrast to the age trend in non-Indigenous people, among Aboriginal and Torres Strait Islander Australians, the prevalence of current asthma was considerably higher in older adults than in children (Figure 2.1; see also Appendix 2, Table A2.1).

Note: Age-standardised to the Australian population as at June 2001.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of the Australian Bureau of Statistics (ABS) National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) and National Health Survey (NHS) 2004–05, expanded confidentialised unit record files, Remote Access Data Laboratory.

Figure 2.1: Prevalence of current asthma, by age, sex and Indigenous status, 2004–05

2. Asthma in Aboriginal and Torres Strait Islander Australians

The explanation for the relatively high prevalence of asthma among older Indigenous people, compared with non-Indigenous people of the same age and compared with younger Indigenous people, is not certain. Possible factors include the cumulative impact of life-long exposure to environmental factors adversely affecting the airways (such as tobacco smoke and infections) and long-term under-treatment of asthma. Misdiagnosis of other chronic respiratory diseases, such as chronic obstructive pulmonary disease and bronchiectasis, may also play a role.

Overall, the prevalence of current asthma was similar among Indigenous children (13.5%) and other children (11.2%) (p = 0.1) in the NATSIHS (see also Appendix 2, Table A2.2). However, among infants aged 0–1 year, the prevalence of asthma was higher among Indigenous infants than non-Indigenous infants (Figure 2.2). This is an age at which the diagnosis of asthma is uncertain. It is possible that some of these infants have been diagnosed with asthma and treated for asthma when they are, in fact, suffering from bronchiolitis. Indigenous populations are known to have significantly higher rates of bronchiolitis (Bolisetty et al. 2005; Whitehall et al. 2001). Furthermore, the number of Indigenous respondents included in the survey was small. Hence, conclusions on the prevalence of asthma in Indigenous children, based on the NATSIHS, need to be treated with some caution.

Prevalence of current asthma (per cent)

Note: Age-standardised to the Australian population aged 0–17 years as at June 2001.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of the Australian Bureau of Statistics (ABS) National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) and National Health Survey (NHS) 2004–05, expanded confidentialised unit record files, Remote Access Data Laboratory.

Figure 2.2: Prevalence of current asthma, by age and Indigenous status, children aged 0–17 years, 2004–05

Several other surveys have measured the prevalence of asthma in Indigenous children (Table 2.4). These have used various definitions and age groups and have been conducted in a variety of settings, which makes it difficult to draw confident conclusions about the prevalence of asthma in Indigenous children. Most estimates are at least as high if not higher (ABS 2006d; Zubrick et al. 2004) than those observed in non-Indigenous children.

Table 2.4: Prevalence of current asthma among Aboriginal and Torres Strait Islander children, Australia, 1999–2004

Location (source)	Year	Age range	Indigenous		Non-Indigenous	
			No. in survey	Rate (95% CI)	No. in survey	Rate (95% CI)
Does your child have asthma?						
Australian Capital Territory (1)	1999–2001	4–6 years	204	24% (18.1–29.9)	10,070	15.1% (14.4–15.8)
Victoria, School Entrant Health Questionnaire (2)	1998–2004	4–6 years	6,657	26.5% (25.4–27.6)	363,207	20.0% (19.9–20.1)
Wheeze in the past 12 months						
Remote communities, North Queensland (3)	1999	0–17 years	1,650	12.4% (10.8–14.0)	n.a.	n.a.

n.a. Not available

Sources: (1) Glasgow et al. 2003; (2) Griffin et al. 2006; (3) Valery et al. 2001.

Among Aboriginal and Torres Strait Islander Australians aged less than 55 years, the prevalence of current asthma was significantly lower among those living in remote areas than among those living in non-remote areas (Figure 2.3). This regional difference was not evident among Aboriginal and Torres Strait Islander Australians aged 55 years and over. Overall, the prevalence of current asthma among Indigenous Australians was higher in those living in non-remote areas (17.7) than in remote areas (12.2%) of Australia.

Note: Age-standardised to the Australian population as at June 2001.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of the Australian Bureau of Statistics (ABS) National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) 2004–05, expanded confidentialised unit record files, Remote Access Data Laboratory.

Figure 2.3: Prevalence of current asthma among Aboriginal and Torres Strait Islander Australians, by age and remoteness, 2004–05

2. Asthma in Aboriginal and Torres Strait Islander Australians

Similar findings have been reported in a Western Australian study of 5,513 children, where the prevalence of asthma was four times as high among those living in non-isolated areas, such as the Perth metropolitan areas, compared with those living in extreme isolation within Western Australia (Zubrick et al. 2004).

Among Aboriginal and Torres Strait Islander Australians, the prevalence of current asthma has remained relatively constant in recent years. In contrast, the prevalence in non-Indigenous Australians has reduced significantly (Robertson et al. 2004). The overall prevalence of current asthma among Aboriginal and Torres Strait Islander Australians was 16.5% in 2004–05 compared with 17.7% in 2001 (p = 0.4). Using the same methodology over 2 time periods, a North Queensland study described that asthma prevalence in school age children remained high but stable (Valery et al. 2008).

2.2   Mortality

While, in general, the Australian population enjoys good health on an international scale, there is a disparity in mortality rates among Indigenous Australians compared with other Australians (ABS 2005). Between 1999 and 2003, there were almost three times more deaths among Indigenous males and females than expected, based on the rates for non-Indigenous Australians (ABS 2005). Furthermore, the estimated life expectancy for Indigenous Australians is low and attributed to relatively high and early adult mortality, more so than high infant mortality (ABS & AIHW 2008). Between 2001 and 2005, 71% of deaths of Indigenous Australians occurred among those aged less than 65 years compared with 21% of all deaths among other Australians (AIHW 2008a). The life expectancy for Indigenous Australians is 17 years less than that observed for all Australians (ABS & AIHW 2008).

Data from a Northern Territory study showed that the gap in life expectancy between Indigenous and non-Indigenous residents was wide and had not narrowed between 1981 and 2000 (Zhao & Dempsey 2006). However, the contribution of asthma and chronic obstructive pulmonary disease to the gap in life expectancy had halved in females and was reduced by two-thirds among males during the study period.

We examined mortality due to asthma among Indigenous Australians using data from the National Mortality Database (AIHW). The analysis was limited to Queensland, Northern Territory, Western Australia and South Australia because these are the only jurisdictions in which the completeness of recording of Indigenous status on death certificates is considered to be adequate for reporting statistics on Indigenous mortality (ABS 2005). Rates in Indigenous Australians were compared with rates in other Australians. This latter group comprised people who were classified as non-Indigenous as well as those for whom Indigenous status was not stated. Of all deaths from asthma between 2002 and 2006, 95% occurred among other Australians, including 1.7% among people whose Indigenous status was not known. Rates were compared after adjusting for differences in the age structure of the two populations.

Mortality due to asthma is higher among Indigenous Australians than other Australians. Over the five-year period between 2002 and 2006, there were 3.15 (95% confidence interval [CI] 2.09–4.56) times more deaths due to asthma among Indigenous Australians than expected, based on age-specific mortality rates among other Australians.

2.3   Use of health services

Approximately 30% of Aboriginal and Torres Strait Islander Australians usually access their health care through state or federally funded Aboriginal Medical Services while 60% usually go to a private GP (AHMAC 2006). Of the Aboriginal Medical Services, about half are Aboriginal community controlled health services (ACCHSs) funded directly by the Australian Government and half are funded by states and territories. All GPs in ACCHSs are able to bill Medicare Australia for asthma care under normal Medicare Benefits Schedule (MBS) attendance items, and they are able to bill the MBS chronic disease management items for asthma care. ACCHSs are primary health-care services which are governed, planned and managed by local Indigenous communities. Their aim is to deliver holistic and culturally appropriate health and health-related services to the Aboriginal community.

There were earlier reports of limited uptake of the Asthma 3+ Visit Plan (now the Asthma Cycle of Care) in the Indigenous community. The importance of this barrier was confirmed in a 2004 National Aboriginal Community Controlled Health Organisation survey of barriers experienced by ACCHSs, conducted as part of a national evaluation of the Asthma 3+ Visit Plan (Couzos & Davis 2005). The survey found that Aboriginal people were limited in their capacity to benefit from the Asthma 3+ Visit Plan because of significant barriers for ACCHSs to access the funding initiative. Around one-third of ACCHSs were ineligible for the Practice Incentive Program since many ACCHSs did not employ a medical practitioner and only medical practitioners (and not Aboriginal health workers) could claim the incentive payments. Only half of eligible services reported using this initiative (Couzos & Davis 2005). This evaluation has not been repeated since the replacement of the Asthma 3+ Visit Plan with the Asthma Cycle of Care.

Hospitalisations

This section presents data on hospitalisations for asthma from the National Hospital Morbidity Database, maintained and held at the AIHW. The quality of data relating to Indigenous status in this database is variable. From 1998–99 onwards, the information provided for Indigenous status from the Northern Territory (public hospitals only), South Australia, Queensland and Western Australia is considered acceptable for analytical purposes. From 2004–05 onwards, data from New South Wales and Victoria are also considered acceptable for analytical purposes. We have included data for these periods for these six states and territories in the analyses presented here.

In 2006–07, the rate of hospital separations for asthma was 2.1-fold higher among Aboriginal and Torres Strait Islander Australians (384.4 per 100,000 population; 95% CI 362.6–406.9) than other Australians (179.3 per 100,000 population; 95% CI 177.4–181.2).

In comparison, admissions with a principal diagnosis of diabetes in 2004–05 were 6 times higher among Indigenous Australians than other Australians (AIHW 2008c). Furthermore, in 2006–07, diseases of the circulatory system accounted for 3.2% of all Indigenous Australian separations and 6.3% of all hospital separations for other Australians, while diseases of the respiratory system accounted for 6.0% of all Indigenous separations and 4.3% of all hospital separations among other Australians (AIHW 2008b).

The higher rate of asthma separations among Indigenous Australians (2.1 times) is similar to the 2.8-fold excess in hospital separations for all causes in 2006–07. However, the finding that hospital separations for asthma represented a higher proportion of all admissions among Indigenous Australians (0.74%) compared with other Australians (0.48%) indicates that asthma or asthma-like symptoms contributed disproportionately to excess admissions in Aboriginal and Torres Strait Islander Australians.

Among Aboriginal and Torres Strait Islander Australians, the rate of hospital separations for asthma was highest in children aged 0–4 years (Figure 2.4). Indigenous Australians had higher rates of hospital separations for asthma than other Australians across all age groups but the difference was most pronounced in those aged 35 years and over (see also Appendix 2, Table A2.3). Data for hospital patient-days for asthma reflected a similar pattern (see Appendix 2, Table A2.4).

The relatively high rate of hospital separations for asthma among Indigenous adults compared to other Australian adults aged 35 years and over is consistent with the high rates of all-cause hospitalisation in this community (AIHW 2007a). In fact, all-cause hospitalisation rates are higher among Aboriginal and Torres Strait Islander Australians than other Australians across every age group and for both sexes.

Hospital separations per 100,000 population

Notes

1. Age-standardised to the Australian population as at June 2001.

2. Data are included only for those states/territories for which the Indigenous identifier was considered reliable, that is, New South Wales, Victoria, Queensland, Western Australia, South Australia and the Northern Territory (public hospitals only for the Northern Territory). The data are not necessarily representative of the jurisdictions excluded. 'Other Australians' include people classified as non-Indigenous plus those who did not state their Indigenous status. People who did not state their Indigenous status comprised 1.2% of hospital separations among 'other Australians'.

3. Separations for which the care type was reported as Newborn with no qualified days, and records for *Hospital boarders and Posthumous organ procurement* have been excluded.

4. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46.

Sources: AIHW National Hospital Morbidity Database; Australian Bureau of Statistics.

Figure 2.4: Hospital separations for asthma per 100,000 population, by age and Indigenous status, 2006–07

The median length of stay (length of hospital stay for 50% of people) was the same for Indigenous and other Australians (2 days).

Indigenous children aged 0–18 years had a higher hospital separation rate for asthma (485.9 per 100,000 population; 95% CI 456.8–516.3) than other Australian children (436.3 per 100,000 population; 95% CI 430.4–442.3) ($p < 0.0001$). While hospital separation rates for asthma were higher among Indigenous children than other Australian children across most age groups (Figure 2.5), the disparity was greatest amongst those aged 0–1 year where the rate was 1,068.0 per 100,000 population among Indigenous children versus 895.1 per 100,000 population among other Australian children ($p < 0.01$).

Hospital separations per 100,000 population

Notes: Age-standardised to the Australian population as at June 2001. 'Other Australians' include people classified as non-Indigenous plus those who did not state their Indigenous status. Rates for this figure are based on different estimated populations than Figure 2.4 and Figure 2.6 since 1-year age groups were required. Populations for this figure are 2006 projected Aboriginal and Torres Strait Islander population estimates based on the 2001 census. Data are included only for those states/territories for which the Indigenous identifier was considered reliable, that is, New South Wales, Victoria, Queensland, Western Australia, South Australia and the Northern Territory (public hospitals only for Northern Territory). The data are not necessarily representative of the jurisdictions excluded. Separations for which the care type was reported as Newborn with no qualified days, and records for *Hospital boarders and Posthumous organ procurement* have been excluded.

Sources: AIHW National Hospital Morbidity Database; Australian Bureau of Statistics.

Figure 2.5: Hospital separations for asthma per 100,000 population, by Indigenous status, children aged 0–18 years, 2006–07

2. Asthma in Aboriginal and Torres Strait Islander Australians

In 2006–07, Indigenous children under 15 years from the Northern Territory had a lower hospital separation rate for asthma than the average of the six jurisdictions (Figure 2.6). This may reflect the lower prevalence of asthma as a long-term condition in the Northern Territory compared with the other states (ABS 2006d).

Among Indigenous Australians aged 15 years and over, the rate of hospital separations for asthma in Western Australia was significantly higher than the average and the rate in Victoria was significantly lower than the average of the six jurisdictions.

Hospital separations per 100,000 population

Children (0–14 years)

Hospital separations per 100,000 population

Adults (15 years and over)

Notes

1. Age-standardised to the Australian population as at 30 June 2001.
2. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46. Data are included only for those states/territories for which the Indigenous identifier was considered reliable, that is, New South Wales, Victoria, Queensland, Western Australia, South Australia and the Northern Territory (public hospitals only). The data are not necessarily representative of the jurisdictions excluded.
3. Separations for which the care type was reported as Newborn with no qualified days, and records for *Hospital boarders and Posthumous organ procurement* have been excluded.
4. Different scale for each age group.

Sources: AIHW National Hospital Morbidity Database; Australian Bureau of Statistics.

Figure 2.6: Hospital separations for asthma per 100,000 population among Indigenous Australians, by broad age group and state and territory, 2006–07

Comorbid conditions in people hospitalised with asthma

Comorbidity among Indigenous and other Australians hospitalised with a principal diagnosis of asthma—according to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46—in Queensland, South Australia, Western Australia and the Northern Territory (public hospitals only) over the period 2003–04 to 2005–06, and in New South Wales and Victoria between 2004–05 and 2005–06, was examined by investigating additional diagnoses of other respiratory conditions as well as other chronic conditions.

Among Indigenous Australians hospitalised with a principal diagnosis of asthma in the period 2003–04 to 2005–06, after adjusting for age, 56.1% had at least one comorbidity associated with their hospital stay. For other Australian patients with asthma, the corresponding proportion was 52.7%.

Among children, Aboriginal and Torres Strait Islander Australians were just as likely as other Australians to have respiratory infections, non-infectious upper respiratory conditions or mental and behavioural problems while being hospitalised for asthma (Table 2.5). Among people aged 15 years and over hospitalised with asthma, the likelihood of having diabetes listed as an additional diagnosis was 2.4 times as high among Aboriginal and Torres Strait Islander Australians than other Australians. Indigenous Australian adults hospitalised with asthma also experienced more heart, stroke and vascular disease than other Australians, but less arthritis, osteoporosis and mental and behavioural disorders than other Australian adults hospitalised with asthma.

Table 2.5: Selected comorbidities among patients admitted to hospital with a principal diagnosis of asthma, by Indigenous status and age, 2003–04 to 2005–06

Age group/comorbidity	Proportion of all asthma separations (%) (95% CI)		Rate ratio (95% CI)
	Indigenous	Other	Indigenous vs other
0–14 years			
Respiratory infections	33.6 (30.9–36.4)	35.1 (34.4–35.8)	1.0 (0.9–1.0)
Chronic obstructive pulmonary disease (COPD) and bronchiectasis	. .	. .	. .
Non-infectious upper respiratory conditions	0.6 (0.2–1.3)	0.6 (0.5–0.7)	1.1 (0.5–2.4)
Diabetes mellitus	n.p.	0.2 (0.1–0.2)	n.p.
Heart, stroke and vascular disease	n.p.	n.p.	n.p.
Arthritis and osteoporosis	n.p.	n.p.	n.p.
Mental and behavioural disorders	0.7 (0.3–1.4)	0.5 (0.4–0.6)	1.5 (0.6–3.4)
Cancer	n.p.	n.p.	n.p.
15 years and over			
Respiratory infections	27.1 (24.9–29.4)	28.7 (28.2–29.3)	0.9 (0.9–1.0)
COPD and bronchiectasis	2.3 (1.7–3.0)	2.3 (2.2–2.5)	1.0 (0.7–1.3)
Non-infectious upper respiratory conditions	n.p.	1.3 (1.2–1.5)	n.p.
Diabetes mellitus	19.7 (18.0–21.6)	8.3 (8.0–8.6)	2.4 (2.1–2.7)
Heart, stroke and vascular disease	5.0 (4.0–6.1)	3.2 (3.1–3.4)	1.5 (1.2–2.0)
Arthritis and osteoporosis	0.7 (0.4–1.2)	1.9 (1.8–2.0)	0.4 (0.3–0.5)
Mental and behavioural disorders	2.3 (1.8–3.0)	4.1 (3.9–4.3)	0.6 (0.5–0.7)
Cancer	n.p.	0.4 (0.4–0.5)	n.p.

n.p. Not published (numbers too small to produce a reliable estimate

. . Not applicable

Notes

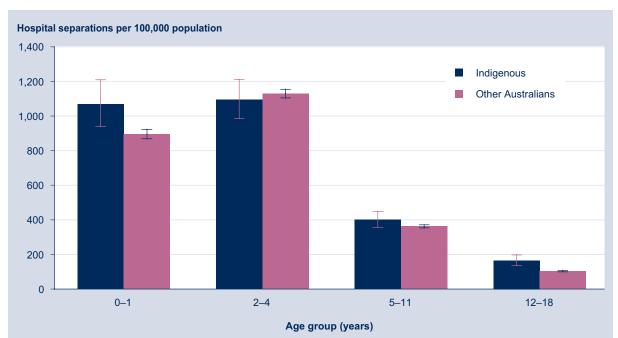1. Data are included only for those states/territories for which the Indigenous identifier was considered reliable, that is, Queensland, Western Australia, South Australia and the Northern Territory (public hospitals only) (all years) and New South Wales and Victoria (2004–05 and 2005–06 only).

2. Asthma was classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46.

3. Separations for which the care type was reported as Newborn with no qualified days, and records for *Hospital boarders and Posthumous organ procurement* have been excluded.

4. Comorbidities were classified as follows: respiratory infections (J0–J22); COPD and bronchiectasis (J40–J44, J47); non-infectious upper respiratory conditions (includes rhinitis, sinusitis, laryngitis) (J30–39); diabetes mellitus (E10–E14); heart, stroke and vascular disease (I20–I25, I60–I69, I50, I70–I79); arthritis and osteoporosis (M00–M25, M80–M82); mental and behavioural disorders (F30–F39, F40–F48, F90–F98); and malignant neoplasms (i.e. cancer) (C00–C96).

5. 'Other' includes both non-Indigenous persons and persons for whom Indigenous status was not stated or was inadequately described. Indigenous status was not stated or was inadequately described for 1.9% of hospital separations among other Australians in 2003–04 to 2005–06 where asthma was the principal diagnosis.

6. CI = confidence interval.

Source: AIHW National Hospital Morbidity Database.

2.4   Management and care

Asthma action plans

In 2004–05, 24.9% of Aboriginal and Torres Strait Islander Australians with current asthma possessed an asthma action plan, which was similar to the corresponding proportion for non-Indigenous Australians (22.5%) (*p* = 0.15) (ABS 2006c). Of those Aboriginal and Torres Strait Islander Australians who had a plan, 91.8% were obtained from a doctor.

The Australian Government Department of Health and Ageing recently developed an asthma action plan specifically for Indigenous Australians living in remote areas. The plan incorporates the images from the Short Wind educational materials, developed by the Asthma Foundation of the Northern Territory. Also, terms such as 'whistle breathing', 'blue puffer', 'send someone to health clinic for help' describe symptoms and actions to take in response to these symptoms. It cannot be ascertained from the current data whether or not the plans that survey participants stated that they possessed were tailored to the Indigenous community.

Use of medication for asthma

According to the NATSIHS conducted in 2004–05, 59.2% (95% CI 52.3–66.1%) of Indigenous Australians aged 5 years and over with current asthma reported using pharmaceutical medications for their condition in the last 2 weeks (ABS 2006c). This proportion was similar to the proportion of non-Indigenous Australians with asthma who reported using pharmaceutical medications (56.9%; 95% CI 53.2–60.6%).

Among Aboriginal and Torres Strait Islander Australians, the proportion of people using pharmaceutical medications in the last 2 weeks for their asthma increased with age, from 38% among those aged 5–14 years to 79% among those aged 55 years and over.

However, there is evidence of relative under-use of treatments for asthma among Indigenous children. In a study of children beginning kindergarten in the Australian Capital Territory, 8% of Indigenous children compared with 17% of non-Indigenous children with parent-reported respiratory symptoms in the previous 12 months or asthma diagnosis were using inhaled corticosteroids (p = 0.03) (Glasgow et al. 2003). In the Western Australian Aboriginal Child Health Survey, it was found that 42.0% (95% CI 37.6–46.3%) of children with asthma in the state were managing it without medication (Zubrick et al. 2004). One study in Far North Queensland found a high level (55–88%) of suboptimal asthma therapy and a higher level of persistent symptoms in Aboriginal and Torres Strait Islander Australian children (30%) than non-Indigenous Australian children (5–7%) (Chang et al. 2000). Couzos & Davis (2005) reported that 80% and 48% of ACCHSs indicated a problem in patient access to spacer devices and patient access to asthma medications, respectively. In response to this, the Australian Government introduced the Asthma Spacers Ordering System (ASOS) in July 2006. The system provides spacers to Indigenous communities at a significantly discounted cost (Abbott 2006).

2. Asthma in Aboriginal and Torres Strait Islander Australians

Access to culture-specific asthma education programs

There are no data on the availability of culture-specific asthma education programs for Indigenous Australians with asthma. Asthma education is regarded as an important management step in national asthma guidelines (Coughlan et al. 1999). Racial and socioeconomic factors influence asthma severity and recurrent acute presentations to emergency health facilities (de Oliveria et al. 1999; Sin et al. 2002). The reasons for this are unclear, but contributing factors are likely to include broad health service delivery issues rather than a reflection of intrinsic asthma severity (Enarson & Ait Khaled 1999). Other cultural influences on the management of asthma include symptom perception and understanding of disease and self-management (Enarson & Ait Khaled 1999). An appropriate model of care is important in the successful delivery of services to improve care of people with asthma (Partridge 2000). The model of care should be culturally appropriate (Enarson & Ait Khaled 1999) and one review found that involving trained health workers in asthma programs targeted to their own ethnic group is beneficial and cost-effective, with a cost saving of more than 50% in the Indigenous health worker intervention group (Chang et al. 2007).

Several local and national barriers to effective management of asthma in a rural Aboriginal medical service setting were identified in the Pika Wiya Asthma Innovative Management (AIM) project (Dawson et al. 2003). Local barriers included lack of health worker training, poor patient attendance and lack of management infrastructure. The national barriers identified in the study were inaccessibility of government financial incentive structures, lack of culturally appropriate asthma resources, lack of MBS items that health workers can provide directly and lack of high-quality research.

A recent study funded through the Australian Government's Asthma Management Program (Asthma Community Grants Program) used 'music therapy' to manage asthma in an Indigenous community in Queensland (Eley & Gorman 2008). School-aged boys were taught how to play the didgeridoo and girls had singing lessons in an effort to improve the health of people with asthma and also to increase knowledge of asthma in the local Indigenous community. Respiratory function (measured as peak flow) improved significantly in the boys. Furthermore, high school boys and girls had a noticeable improvement in asthma symptoms.

2.5   Smoking

People with asthma who smoke

Among Indigenous Australian adults aged 18 years and over, 48.2% (95% CI 42.5–53.9%) of those with current asthma and 46.5% (95% CI 43.6–49.4%) of those without asthma reported being smokers (ABS 2006c). These rates were twice as high as those reported for non-Indigenous Australians with (23.8%; 95% CI 21.2–26.4%) and without (22.4%; 95% CI 21.5–23.2%) current asthma.

Up to 60% of young Indigenous Australian adults with asthma reported being current smokers compared to 32% of their non-Indigenous counterparts (Figure 2.7).

Note: Age-standardised to the Australian population as at June 2001.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of the Australian Bureau of Statistics (ABS) National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) and National Health Survey (NHS) 2004–05, expanded confidentialised unit record files, Remote Access Data Laboratory.

Figure 2.7: Prevalence of current smoking by Indigenous status and asthma status, persons aged 18 years and over, 2004–05

Although the rate of smoking among Indigenous Australians with asthma is high, health workers appear unaware of the adverse effects of smoking in people with asthma. In a study of a group of Aboriginal health workers in Adelaide, it was found that most were aware of the association between smoking, lung disease and cancer, but only few were conscious of the links with asthma, diabetes and stroke (Adams & Briggs 2005).

2. Asthma in Aboriginal and Torres Strait Islander Australians

In-utero and passive exposure to smoking among children with asthma

In-utero smoke exposure, that is, exposure to smoke before birth, is a risk factor for the development of asthma and other respiratory problems in children and adults (Skorge et al. 2005). In-utero smoke exposure is higher in Indigenous Australians than non-Indigenous Australians, both in urban (Chan et al. 2001; Eades & Read 1999) and remote areas (ABS 2002). A South Australian study found that Aboriginal women had a higher rate of smoking in pregnancy than non-Aboriginal women (58% versus 24% at the first antenatal visit) (Chan et al. 2001; see Table 2.6). In another large study of Aboriginal children in Western Australia, almost half of the children aged 0–17 years (46%) were exposed to smoking by their birth mother in utero (Zubrick et al. 2004).

Table 2.6: Exposure to passive smoke and in-utero exposure to smoking in Aboriginal and Torres Strait Islander children, 1999–2002

			Indigenous		Non-Indigenous	
Location (source)	Year	Age range	No. in survey	Rate (95% CI)	No. in survey	Rate (95% CI)
Birth mother smoked tobacco during pregnancy						
Western Australia (1)	2001–2002	0–17 years	n.a.	46.5% (43.9–49.0)	n.a.	n.a.
Smoked during pregnancy						
South Australia (2)	Had singleton births in 1998–1999	n.a.	851	57.8% (54.5–61.1)	35,208	24.0% (23.6–24.5)
Anyone living in the house smokes (children with parent-reported asthma or recent respiratory symptoms)						
Australian Capital Territory (3)	1999–2001	4–6 years	67	63.7% (52.2–75.2)	2,292	32.2% (30.3–34.1)

n.a. Not available

Sources: (1) Western Australian Aboriginal Child Health Survey, Zubrick et al. 2004; (2) Chan et al. 2001; (3) Glasgow et al. 2003.

Exposure to environmental tobacco smoke during early childhood is associated with an increased risk of asthma symptoms or the worsening of pre-existing asthma symptoms among children (Alati et al. 2006; Landau 2001; Peat et al. 2001). Exposure to passive smoke is also an important issue among Indigenous children since the prevalence of smoking in Indigenous Australians is relatively high (see previous section). Furthermore, a survey of pregnant women in South Australia found that Indigenous women were heavier smokers than non-Indigenous women (Chan et al. 2001). A study in a remote region of Queensland found that 48% of the children with asthma were exposed to parental tobacco smoke (Chang et al. 2000). Indigenous children with respiratory symptoms in the Australian Capital Territory had a significantly higher rate of passive smoke exposure (64%) than non-Indigenous children (32%) (odds ratio 3.5; 95% CI 2.1–5.9) (Glasgow et al. 2003).

2.6   Self-assessed health status

Among Aboriginal and Torres Strait Islander Australians aged 15 years and over with current asthma, 26% rated their health as excellent/very good, 34% rated it as good and about 41% rated their health as fair/poor (Figure 2.8) (NATSIHS 2004–05). In contrast, more Indigenous Australians without asthma rated their health as excellent/very good (38%) and fewer rated their health as fair/poor (27%).

In general, Indigenous Australians rated their health worse than non-Indigenous Australians. In fact, slightly fewer Indigenous Australians *without* asthma rated their health as excellent/very good than non-Indigenous Australians *with* the condition.

Note: Age-standardised to the Australian population as at June 2001.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of the Australian Bureau of Statistics (ABS) National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) and National Health Survey (NHS) 2004–05, expanded confidentialised unit record files, Remote Access Data Laboratory.

Figure 2.8: Self-assessed health status in people aged 15 years and over, by Indigenous and asthma status, 2004–05

2.7 Prevalence of comorbidities in the community

Having both asthma and another chronic condition is associated with worse quality of life (Adams et al. 2006). This section investigates the prevalence of selected comorbid conditions among Indigenous Australians with and without asthma using data from the 2004–05 NATSIHS. Comparisons of the prevalence of these comorbidities among Indigenous and non-Indigenous people with asthma are also presented.

Compared with Indigenous Australians *without* asthma, the prevalence of chronic obstructive pulmonary disease (that is, emphysema or bronchitis) was 3.6 times as high, the prevalence of sinusitis or rhinitis was 2.6 times as high, the prevalence of mental and behavioural disorders was 1.9 times as high and the prevalence of arthritis or osteoporosis was 1.5 times as high among those with asthma (Table 2.7). Non-Indigenous Australians with asthma were also significantly more likely to have these comorbidities than their counterparts without asthma.

The prevalence of diabetes as a comorbid condition was 3.0 times as high and the prevalence of mental and behavioural disorders as a comorbid condition was 1.4 times as high among Indigenous Australians with asthma compared with non-Indigenous Australians with asthma (Table 2.7). Among Indigenous Australians with asthma in 2004–05, 35% also reported having sinusitis or rhinitis and 25% also reported having arthritis or osteoporosis (Table 2.7).

Table 2.7: Comorbidities among people with and without asthma, by Indigenous status, 2004–05

Comorbidity	Indigenous Australians			Non-Indigenous Australians			Rate ratio Indigenous versus non-Indigenous with asthma (95% CI)
	Current asthma % (95% CI)[a]	No asthma % (95% CI)[a]	Rate ratio asthma vs no asthma (95% CI)	Current asthma % (95% CI)[a]	No asthma % (95% CI)[a]	Rate ratio asthma vs no asthma (95% CI)	
Emphysema or bronchitis	12.5 (9.3–15.7)	3.5 (2.7–4.3)	3.6 (2.3–5.7)	10.0 (8.6–11.5)	2.2 (2.0–2.4)	4.6 (3.4–6.1)	1.2 (0.9–1.7)
Sinusitis or rhinitis	35.1 (29.4–40.9)	13.7 (12.0–15.5)	2.6 (2.0–3.3)	40.0 (36.9–43.1)	19.0 (18.3–19.7)	2.1 (1.9–2.4)	0.9 (0.7–1.0)
Other respiratory conditions (excluding asthma)	1.2 (0.6–1.8)	1.3 (0.9–1.7)	0.9 (0.5–1.6)	1.2 (0.7–1.8)	0.7 (0.6–0.8)	1.8 (1.0–3.2)	1.0 (0.5–1.8)
Heart, stroke, and vascular disease	7.4 (4.9–9.9)	5.6 (4.0–7.2)	1.3 (0.8–2.1)	4.9 (3.9–5.8)	3.6 (3.3–3.9)	1.4 (1.1–1.7)	1.5 (1.0–2.4)
Diabetes and high sugar levels	14.5 (10.0–18.9)	12.2 (10.6–13.8)	1.2 (0.8–1.7)	4.8 (3.8–5.8)	3.5 (3.2–3.8)	1.4 (1.1–1.8)	3.0 (1.8–5.1)
Arthritis and osteoporosis	24.9 (19.5–30.4)	17.2 (14.6–19.7)	1.5 (1.1–1.9)	22.4 (20.2–24.7)	15.4 (14.9–15.9)	1.5 (1.3–1.6)	1.1 (0.9–1.4)
Mental and behavioural disorders	19.0 (15.8–22.1)	10.2 (8.9–11.4)	1.9 (1.5–2.4)	13.6 (12.0–15.3)	8.1 (7.6–8.5)	1.7 (1.4–2.0)	1.4 (1.1–1.7)
Cancer	2.2 (1.1–3.4)	1.1 (0.7–1.6)	2.0 (0.9–4.3)	3.3 (2.4–4.2)	1.8 (1.6–2.0)	1.9 (1.3–2.7)	0.7 (0.4–1.2)

(a) Age-standardised to the Australian population as at June 2001.

Note: CI = confidence interval.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of the Australian Bureau of Statistics (ABS) National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) and National Health Survey (NHS) 2004–05, expanded confidentialised unit record files, Remote Access Data Laboratory.

The presence of one or more comorbid conditions, whether they are associated with asthma or unrelated to asthma, is likely to impact on disease management, treatment and outcomes. In Indigenous children, asthma is a common complication of chronic suppurative lung disease (Chang et al. 2003b). Indeed, acute asthma may be the first manifestation of chronic suppurative lung disease (Chang et al. 2003a) as cough is usually under-reported in Indigenous children (Chang et al. 2008). Comorbidities make asthma care more complex and chronic suppurative lung disease more difficult to manage. Obstructive sleep apnoea is also associated with asthma in Torres Strait Islander Australians (Valery et al. 2004). In adults, significant other comorbidities—such as diabetes, heart and kidney disease—result in reduced attention to and uptake of good asthma treatment (J Saunders, Asthma Foundation of Northern Territory, personal communication).

Obesity is associated with increased severity of asthma as well as persistence of asthma symptoms (Chinn 2003; Guerra et al. 2004). Obesity is a problem in Indigenous peoples aged over 15 years (ABS 2002) and this may contribute to increased morbidity due to asthma among Indigenous people.

Conclusions and summary

Asthma has consistently remained the second most common self-reported long-term illness in Indigenous Australians. There are some discrepancies among the published survey data but, overall, it seems likely that asthma or asthma-like symptoms are more common in older Indigenous people and among young Indigenous children than their non-Indigenous counterparts. The differences are greater in those living in non-remote localities and, among adults, are greater in females than males. Smaller differences are seen in older children and young adults. As asthma is most difficult to diagnose accurately in young children and older adults, it is possible that the differences in the reported prevalence of asthma and asthma-like symptoms are, in fact, attributable to related diseases such as bronchiolitis, chronic obstructive pulmonary disease and chronic suppurative lung disease.

Rates of hospitalisation and impaired quality of life are worse for Indigenous Australians than for non-Indigenous Australians. Reasons for this are unclear although there is some evidence that Indigenous Australians with asthma have poorer access to health-care services and use medications suboptimally. In addition, they have increased exposure to risk factors for more severe disease including tobacco exposure (in-utero and ex-utero), obesity and socioeconomic disadvantage.

The recommended management of asthma in Indigenous Australians is identical to that in non-Indigenous Australians, that is, use of appropriate asthma medications and devices, education and an asthma action plan, as well as managing generic health-care issues such as mental health status and other comorbidities, reducing exposure to tobacco smoke and optimising a healthy diet. However, Indigenous programs need to be culturally appropriate in order to maximise effectiveness. Based on international data, it is most likely that specifically designed asthma programs are necessary in order to be effective for Aboriginal and Torres Strait Islander Australians with asthma.

3. Prevalence

Key points

- Asthma remains a significant health problem in Australia, with prevalence rates that are high by international standards.
- In 2004–05, the prevalence of asthma in Australia was estimated at 10.2% (equivalent to 2,010,212 people).
- Compared with 2001, the prevalence of asthma decreased slightly in children and young adults but remained unchanged in older adults.
- Among those aged 0–14 years, the prevalence of asthma is higher among boys than girls, but among those aged 15 years and over, current asthma is more prevalent in females than males.
- The prevalence of asthma increases with increasing socioeconomic disadvantage. The gap in prevalence between the most advantaged and most disadvantaged localities increased between 2001 and 2004–05.
- The majority of children with asthma in Australia are classified as having infrequent episodic asthma while very few (less than 5%) have persistent asthma.
- Among adults, there was a decrease in the proportion classified as having severe asthma between 1999 and 2006, but the majority of adults with asthma have mild or very mild forms of the condition.
- Asthma commonly coexists with other chronic conditions. The presence of one or more comorbid conditions in people with current asthma is likely to compromise their quality of life.

Introduction

Estimating the number of people in the community who have asthma is fundamentally important in assessing the impact of asthma at a population level. Examining levels and trends in the prevalence of asthma allows planners to estimate resource needs and priorities both now and in the future. Differences among population subgroups in the prevalence of asthma provide insights into possible causal factors and also assist in targeting resources to areas of need. Finally, examination of changes over time in the number of people who have asthma contributes to the evaluation of population-based efforts to prevent the disease and, if a rising trend is observed, may stimulate the search for an environmental or lifestyle-related cause for that rise.

In this chapter, we present data on the prevalence of asthma in Australia gathered from a wide range of sources. Data on time trends, differences among population groups, and international comparisons are reported.

In interpreting the information presented in this chapter, it is important to be aware of the difficulties in measuring asthma and reporting its prevalence. There is no universally applied definition of asthma. We report results from some international asthma studies involving Australia (Asher et al. 2006; Pearce et al. 2007) and from studies of local populations (Toelle et al. 2004; Valery et al. 2008; Wilson et al. 2006). The prevalence of asthma has been estimated using a wide range of subjective, or self-reported, and objective measures, alone or in combination, in both clinical and population-based settings.

Self-reported measures include doctor diagnosis of asthma, which may be self- or parent-reported (Adams et al. 2004b; Marks et al. 2007; Robertson et al. 1991; Wilson et al. 2006); symptoms, such as wheeze (Glasgow et al. 2001; ISAAC 1998; Pearce et al. 2007; Robertson et al. 1991), shortness of breath (particularly at night) (Burney et al. 1996; Woods et al. 2001; Zock et al. 2007), cough at night (Grant et al. 2000), wheezing with exercise (Grant et al. 2000; Jones 1994; Ponsonby et al. 1996) and taking treatment for asthma (Burney et al. 1996; Zock et al. 2007).

Objective measurements include: the twitchiness of the airways in response to inhaled stimuli (known as the bronchial provocation challenge test), the extent to which airway narrowing can be reversed by inhaled medication (known as the bronchodilator reversibility test) (Toelle et al. 2004); and day-to-day variability in airway narrowing (peak flow variability) (Parameswaran et al. 1999).

Over the last decade, the prevalence of asthma in Australia has been measured in a range of population health surveys, including the Australian Bureau of Statistics (ABS) National Health Survey and state and territory health surveillance programs. However, there are limited time series data available from these survey programs. Many surveys have been conducted only once or, where there are repeated measures, the definition used to identify people with asthma has changed, making it difficult to compare the prevalence.

The consistent use of standard asthma questions in population health surveys will improve our understanding about asthma, particularly as time series evolve and comparisons can be made across different surveys in Australia. The Australian Centre for Asthma Monitoring (ACAM) has endeavoured to address this issue and released a report in 2007 that recommended a module of survey questions relating to asthma for use in population surveys (ACAM 2007b). The report summarises the outcome of a series of projects that were undertaken to establish feasible, reliable and valid questions that should be used consistently in Australian health surveys to monitor national asthma indicators such as prevalence.

3.1   Ever diagnosed with asthma

The 2004–05 National Health Survey (NHS) provides the most recent nationwide data for the prevalence of asthma. Based on data from this survey, it is estimated that 3,979,476 Australians have been diagnosed with asthma by a doctor or nurse at some time in their lives. This equates to 20.3% (95% CI 19.5–21.0) of Australians reporting ever having been diagnosed with asthma.

Data from recent health surveys show a range of estimates for the proportion of adults who report ever having been diagnosed with asthma (16–24%) (Table 3.1). There was a significant increase in the proportion of all adults ever being diagnosed with asthma in New South Wales from 16.6% (95% CI 16.1–17.2) in 1997 to 19.3% (95% CI 18.1–20.5) in 2006, with this increase being more significant for males than females (Centre for Epidemiology and Research 2007; Public Health Division 2001).

Table 3.1: Prevalence of asthma ever being diagnosed by a doctor, adults, most recent health survey results, 2002–2007

Location (source)	Year	No. in survey	Age range	Rate (%)	95% CI
Ever told by a doctor or nurse they have asthma					
Australia (1)	2004–05	20,400	16 years and over	20.2	19.5–20.8
Queensland (2)	2006	1,521	18 years and over	24.3	21.8–26.9
Ever told by a doctor or hospital they have asthma					
New South Wales (3)	2006	7,948	16 years and over	19.3	18.1–20.5
New South Wales (4)	2005	11,480	16 years and over	19.2	18.2–20.2
Ever told by a doctor they have asthma					
Victoria (5)	2006	approximately 7,500	18 years and over	21.2	19.8–22.6
	2005			21.1	19.7–22.5
	2004			20.2	19.0–21.4
	2003			20.4	19.2–21.6
	2002			21.9	20.5–23.3
Western Australia (6)	2006–07	5,932	16 years and over	17.4	15.8–19.0
	2005–06	5,998		16.7	15.4–18.0
	2004–05	5,010		17.3	15.8–18.9
	2003–04	5,169		17.6	15.9–19.6
	2002–03	4,732		16.3	15.1–17.5
South Australia (7)	2006–07	5,699	16 years and over	19.0	18.0–20.1

Note: CI = confidence interval.

Sources: (1) National Health Survey 2004–05 (confidentialised unit record files); (2) Epidemiology Services Unit, Queensland Health; (3) 2006 Report on Adult Health from the New South Wales Population Health Survey (Centre for Epidemiology and Research 2007); (4) 2005 Report on Adult Health from the New South Wales Population Health Survey (Centre for Epidemiology and Research 2006); (5) Victorian Department of Human Services 2007; (6) WA Health and Wellbeing Surveillance System, Epidemiology Branch, Department of Health, Government of Western Australia (data presented in financial years for WA); (7) South Australian Monitoring and Surveillance System (SAMSS), Department of Health, Government of South Australia.

Among children, recent health survey results indicate that the prevalence of ever being diagnosed with asthma ranges from 15.9% to 25.5% (Table 3.2).

Table 3.2: Prevalence of ever being diagnosed with asthma in children, most recent health survey results, 2002–2007

Location (source)	Year	Age range	No. in survey	Rate (%)	95% CI
Parent/guardian ever told by a doctor or nurse that their child has asthma					
Australia (1)	2004–05	0–15 years	5,506	20.8	19.4–22.1
Parent ever told by doctor that their child has asthma					
Victoria (2)	2006	1–12 years	4,602	20.8	19.5–22.2
Western Australia (3)	2006–07	Under 16 years	1,178	18.6	15.7–21.9
	2005–06		1,231	15.9	13.5–18.6
	2004–05		986	17.7	14.5–21.5
	2003–04		1,105	22.6	18.3–27.4
	2002–03		941	18.3	15.7–21.1
South Australia (4)	2006–07	2–15 years	1,276	22.1	19.9–24.5
Victoria (Barwon region) (5)	2005	6–7 years	2,208	24.4	22.8–26.0
Victoria (Melbourne) (6)	2002	6–7 years	2,968	25.5	23.7–27.4

Note: CI = confidence interval.

Sources: (1) National Health Survey 2004–05 (confidentialised unit record files); (2) 2006 Victorian Child Health and Wellbeing Survey; (3) WA Health and Wellbeing Surveillance System, Epidemiology Branch, Department of Health, Government of Western Australia; (4) South Australian Monitoring and Surveillance System (SAMSS) Department of Health, Government of South Australia; (5) Vuillermin et al. 2007; (6) Robertson et al. 2004.

3.2 Current asthma

The 2004–05 NHS estimated that 2,010,212 Australians had current asthma. This represents 10.2% of the Australian population, down from an estimated 11.6% in 2001. Among adults, the prevalence of current asthma in recent years has ranged from 9.9% to 15.1% with most estimates around 11% (Table 3.3).

Table 3.3: Prevalence of current asthma in adults, most recent health survey results, 2002–2007

Location (source)	Year	Age range	No. in survey	Rate (%)	95% CI
Ever doctor-diagnosed asthma AND 'yes' to 'Do you still get asthma?'					
Australia (1)	2004–05	16 years and over	20,400	9.9	9.4–10.4
Ever doctor-diagnosed asthma AND 'yes' to 'Do you still have asthma?'					
South Australia (2)	2003	15 years and over	n.a.	12.2	n.a.
	2002		n.a.	13.4	n.a.
Ever doctor/hospital diagnosed asthma AND had symptoms of asthma or taken treatment for asthma in the last 12 months					
New South Wales (3)	2006	16 years and over	7,941	10.9	9.9–11.8
New South Wales (4)	2005	16 years and over	11,474	10.4	9.7–11.2
Queensland (5)	2006	18 years and over	1,521	13.7	11.9–15.9
	2004		2,231	15.1	13.5–16.8
Ever doctor-diagnosed asthma AND asthma symptoms (wheezing, coughing, shortness of breath, chest tightness) in the last 12 months					
Victoria (6)	2006	18 years and over	n.a.	10.5	9.5–11.5
	2005		n.a.	11.3	10.3–12.3
	2004		n.a.	10.5	9.5–11.5
	2003		n.a.	11.7	10.7–12.7
	2002		n.a.	12.6	11.6–13.6
Ever doctor-diagnosed asthma AND had symptoms of asthma or taken treatment for asthma in the last 12 months					
Western Australia (7)	2006–07	16 years and over	5,932	10.1	8.9–11.4
	2005–06		5,998	10.5	9.5–11.6
	2004–05		5,010	10.8	9.6–12.1
	2003–04		5,169	10.7	9.4–12.3
	2002–03		4,732	10.2	9.3–11.2
Ever doctor-diagnosed asthma AND 'took asthma medication that was prescribed or given to you by a doctor' or 'had whistling or wheezing in the chest at any time' in the past 12 months					
South Australia (8)	2006–07	16 years and over	5,699	13.4	12.5–14.3
	2005–06		5,727	13.9	13.0–14.8
	2004–05		5,791	14.1	13.2–15.0
Ever doctor-diagnosed asthma AND 'still have asthma' or 'had whistling or wheezing in the chest at any time in the past 12 months'					
Australia (9)	Dec 2003–Jan 2004	16 years and over	1,006	11.2	9.1–13.0

n.a. Not available

Sources: (1) National Health Survey 2004–05 (confidentialised unit record files); (2) Wilson et al. 2006; (3) 2006 Report on Adult Health from the New South Wales Population Health Survey (Centre for Epidemiology and Research 2007); (4) 2005 Report on Adult Health from the New South Wales Population Health Survey (Centre for Epidemiology and Research 2006); (5) Queensland Omnibus Survey, Epidemiology Services Unit, Queensland Health; (6) Victorian Department of Human Services 2007; (7) WA Health and Wellbeing Surveillance System, Epidemiology Branch, Department of Health, Government of Western Australia; (8) South Australian Monitoring and Surveillance System, Department of Health, Government of South Australia; (9) Australian Asthma Survey (Marks et al. 2007).

3. Prevalence

The most recent nationwide survey conducted in 2004–05 estimated that 11.3% of children aged 0–15 years in Australia had current asthma, defined as those who reported ever being diagnosed with asthma and responding 'yes' to 'Do you still get asthma?'. The prevalence of asthma has also been measured in a number of state, territory or local population-based surveys in Australia (Table 3.4).

The surveys have used different definitions to identify asthma and this is likely to influence the resulting prevalence estimates. Most state surveys defined current asthma as ever being diagnosed with asthma and also either having symptoms of asthma and/or taking treatment for asthma in the preceding year. Using this definition, the estimated prevalence of asthma in children in Western Australia (2006–07) and Victoria (2006) was 11.8% (aged 0–15 years) and 13.2% (1–12 years), respectively (Table 3.4). The differences in prevalence estimates are also likely to be influenced by the different age ranges of survey participants.

Table 3.4: Prevalence of current asthma in children, most recent health survey results, 2002–2007

Location (source)	Year	Age range	No. in survey	Rate (%)	95% CI
Ever doctor-diagnosed asthma and 'yes' to 'Do you still get asthma?'					
Australia (1)	2004–05	0–15 years	5,506	11.3	10.3–12.3
Australia (1)	2004–05	0–17 years	6,405	11.3	10.4–12.3
Ever doctor-diagnosed asthma AND had symptoms of asthma (coughing, wheezing, shortness of breath and chest tightness, when no cold or respiratory infection) or taken medication for asthma in last 12 months					
Victoria (2)	2006	1–12 years	4,602	13.2	12.0–14.4
Ever doctor-diagnosed asthma AND had symptoms of asthma or has taken treatment for asthma in the last 12 months					
Western Australia (3)	2006–07	Under 16 years	1,178	11.8	9.4–14.7
	2005–06		1,231	9.8	7.9–12.1
	2004–05		986	12.7	9.9–16.1
	2003–04		1,105	15.7	12.1–20.2
	2002–03		941	14.2	11.9–16.8
Australian Capital Territory (4)	2005	4–6 years	3,851	11.3	10.0–12.0
	2004		3,826	11.8	11.0–13.0
	2003		3,700	12.6	11.9–14.1
	2002		3,794	14.0	12.9–15.1
Ever doctor-diagnosed asthma AND 'took asthma medication that was prescribed or given to [child] by a doctor' or 'had whistling or wheezing in the chest at any time' in the past 12 months					
South Australia (5)	2006–07	2–15 years	1,276	14.8	13.0–16.9
	2005–06		1,339	16.6	14.7–18.7
	2004–05		1,345	17.7	15.8–19.9
Experienced wheeze or whistling in the chest in past 12 months					
Victoria (2)	2006	1–12 years	4,602	23.3	21.8–24.7
Victoria (Barwon region) (6)	2005	6–7 years	2,208	20.2	1.8–22.2
Victoria (Melbourne) (7)	2002	6–7 years	2,968	20.0	18.4–21.8
Had wheezing or whistling in chest at any time in the last 12 months					
South Australia (5)	2006–07	2–15 years	1,276	17.5	15.6–19.7

Note: CI = confidence interval.

Sources: (1) Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics National Health Survey 2004–05 (confidentialised unit record files) (age standardised to the 2001 Australian population); (2) 2006 Victorian Child Health and Wellbeing Survey; (3) WA Health and Wellbeing Surveillance System, Epidemiology Branch, Department of Health, Government of Western Australia; (4) Phillips et al. 2007; (5) South Australian Monitoring and Surveillance System, Department of Health, Government of South Australia; (6) Vuillermin et al. 2007; (7) Robertson et al. 2004.

The prevalence of 'recent wheeze' was higher than the prevalence of asthma in children (Table 3.4). In Victoria in 2006, it was estimated that 23.3% of children aged 1–12 years had experienced wheeze or whistling in their chest in the past 12 months. An estimated 17.5% of children aged 2–15 years had experienced the same symptoms in South Australia in 2006–07. The extent to which this represents undiagnosed asthma, as opposed to non-asthma, viral-associated wheeze, cannot be ascertained from the available data.

3.3   Time trends in current asthma

Important changes in the prevalence of asthma have been noted over the past 20–30 years. During the 1980s and early 1990s, there was a substantial worldwide increase in the prevalence of asthma. In recent years, this increasing trend appears to have plateaued (Asher et al. 2006; Eder et al. 2006).

Comparison of results from the 2004–05 NHS with those reported in 2001 shows that, overall, the prevalence of ever being diagnosed with asthma remained relatively constant (20.4% in 2001 compared to 20.3% in 2004–05).

Among adults in South Australia, the prevalence of asthma diagnosed by a doctor increased in the early 1990s, especially among females and the elderly (Wilson et al. 2006). However, since 1997, the prevalence of current asthma among adults has been remarkably stable in a number of studies (Figure 3.1). In contrast, the prevalence of current asthma among children increased during the 1980s and early 1990s (Figure 3.2) but since then the trend has reversed. The nationwide prevalence of current asthma among people aged 5–34 years declined from 14.0% in 2001 to 11.7% in 2004–05 ($p < 0.0001$, ABS National Health Surveys). This downward trend is confirmed in several series of surveys conducted in children since the mid-1990s. International studies have also observed a decrease in the prevalence of asthma among children in countries with a history of high prevalence rates (Asher et al. 2006).

Proportion (per cent)

- ■ Ever diagnosed + symptoms or treatment (NSW, aged 16 years and over)
- ▲ Ever diagnosed + symptoms (Vic, aged 18 years and over)
- ■ Ever diagnosed + symptoms or treatment in last 12 months (Qld, aged 18 years and over)
- ✕ Ever diagnosed + symptoms or treatment in last 12 months (WA, aged 16 years and over)
- ● Ever diagnosed + symptoms or treatment (SA, aged 16 years and over)
- ● Ever diagnosed + wheeze or prescribed asthma medication in the last 12 months (SA, SAMSS, aged 16 years and over)
- ◆ Ever diagnosed + still have asthma (SA, Omnibus, aged 15 years and over)
- ★ Ever diagnosed and still have asthma (Australia, NHS, aged 16 years and over)

Note: SAMSS = South Australian Monitoring and Surveillance System.

Sources: State computer-assisted telephone interview (CATI) surveys; Australian Bureau of Statistics National Health Surveys (NHSs).

Figure 3.1: Prevalence of current asthma, adults, 1990–2007

Proportion (per cent)

Legend:
- Recent wheeze (Belmont, NSW)
- Recent wheeze (Wagga Wagga, NSW)
- Current wheeze (Melbourne, Vic)
- Ever diagnosed + symptoms or treatment (SA, SAMSS aged 2–15 years)
- Recent wheeze + AHR (Belmont, NSW)
- Recent wheeze + AHR (Wagga Wagga, NSW)
- Ever diagnosed + symptoms or treatment in the last 12 months (WA, aged 0–15 years)
- Ever diagnosed + wheeze or taken prescribed asthma medication in last 12 months (SA, SAMSS, aged 2–15 years)
- Ever diagnosed + symptoms or treatment in last 12 months (ACT)

Notes: SAMSS = South Australian Monitoring and Surveillance System, AHR = airway hyperresponsiveness.

Sources: Comino et al. 1996; Downs et al. 2001; Peat et al. 1994; Toelle et al. 2004; Population Research and Outcome Studies Unit, South Australian Department of Human Services; WA Health and Wellbeing Surveillance System, Epidemiology Branch, Department of Health, Government of Western Australia.

Figure 3.2: Prevalence of current asthma, children aged 15 years and under, 1982–2007

3.4 International comparisons

The prevalence of asthma is relatively high in Australia by international standards. The reason for the high prevalence of asthma in Australia is not known. In phase III of the International Study of Asthma and Allergies in Childhood (ISAAC), the prevalence of wheeze in the last 12 months among those aged 6–7 years ranged from 2.4% to 37.6% and was highest among centres in New Zealand, the United Kingdom, Australia and Latin America (Pearce et al. 2007—supplementary web-tables). In Australia, the prevalence of recent wheeze had decreased by 0.8% per year between phase I (conducted in 1993) and phase III (2002).

Singapore (–0.80% per year) and South Korea (–1.71% in Seoul) also reported decreases in the prevalence of recent wheeze between phase I and III, but increases were observed in the eastern Mediterranean region (0.79% per year), Spain, the United Kingdom (0.50%) and Canada (0.47%). Generally speaking, the ISAAC study has demonstrated a trend towards a decline in the prevalence of asthma symptoms in English-speaking countries.

3.5   Population subgroups

Age and sex

Ever having been diagnosed with asthma

The overall prevalence of ever having been diagnosed with asthma was similar in females (20.6%) and males (19.7%). However, among children (aged less than 15 years) the prevalence was higher in males, and among adults the prevalence was higher in females (Figure 3.3; see also Appendix 2, Table A2.5).

Prevalence of ever-diagnosed asthma (per cent)

Note: Age-standardised to the Australian population as at June 2001.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004−05 confidentialised unit record files.

Figure 3.3: Prevalence of ever having been diagnosed with asthma, by age and sex, 2004−05

Current asthma

In 2004–05, the median age of people with asthma, excluding those aged less than 5 years, was 33 years.

Overall, females had a significantly higher prevalence of current asthma than males (11.5% compared with 8.9%) and females comprised 57% of all people with the condition in 2004–05.

Among those aged 0–14 years, the prevalence was higher for males than females, but among those aged 15 years and over, current asthma was more prevalent in females than males. Among males, the highest prevalence was in those aged 10–14 years (16.8%), while among females it was highest in those aged 15–24 years (14.4%) (Figure 3.4; see also Appendix 2, Table A2.6).

Note: Age-standardised to the Australian population as at June 2001. The overall prevalence of current asthma among females was significantly higher than among males (p < 0.0001).

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files.

Figure 3.4: Prevalence of current asthma, by age and sex, 2004–05

Current asthma in children

Among girls aged 0–17 years, the prevalence of current asthma in 2004–05 increased with age. The prevalence among boys was higher than girls up to age 11 years, with the highest being among boys of primary school age (5–11 years) (Figure 3.5). In this age group, the prevalence of current asthma was 15.1% in boys compared with 11.0% in girls.

Between 2001 and 2004–05, the prevalence of current asthma among children aged 0–17 years fell significantly, from 14.0% to 11.3% ($p < 0.0003$).

Prevalence of current asthma (per cent)

Note: Age-standardised to the Australian population as at June 2001.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files.

Figure 3.5: Prevalence of current asthma in children, by age and sex, 2004–05

States and territories

Estimates of the prevalence of current asthma in 2004–05 varied between 9.3% in New South Wales and 13.4% in Tasmania (Figure 3.6). While the prevalence of current asthma did not differ significantly from the national average in any of the states or the Australian Capital Territory, the rate in Tasmania was significantly higher than the rate in New South Wales.

Note: Age-standardised to the Australian population as at June 2001. The Northern Territory is excluded as the numbers are too small to produce reliable estimates, but it does contribute to the national estimate.

Source: Australian Centre for Asthma Monitoring analysis of Australian Bureau of Statistics National Health Survey 2004–05 confidentialised unit record files.

Figure 3.6: Prevalence of current asthma, by state and territory, all ages, 2004–05

Urban, rural and remote areas

In 2004–05, there were 13.2 million people living in major cities of Australia, about 4 million living in inner regional Australia and the remaining 2.5 million in outer regional Australia and other areas. With the exception of people aged 5–34 years, the prevalence of current asthma was similar across all these geographical areas in 2004–05 (Figure 3.7). However, among people aged 5–34 years, those living in inner regional areas had a significantly higher prevalence of asthma (15.1%) than those living in major cities (11.6%) or other areas (10.8%). Further, among people living in inner regional areas and major cities, the prevalence of asthma was significantly higher in people aged 5–34 years than in younger or older people.

Note: Age-standardised to the Australian population as at June 2001. 'Other areas' includes Outer Regional, Remote and Very Remote categories of remoteness.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files.

Figure 3.7: Prevalence of current asthma, by age and remoteness, 2004–05

Country of birth

Data from the South Australian Omnibus survey aggregated from 1990 to 2003 show that the prevalence of asthma among people born in Australia was 1.39 times (95% CI 1.24–1.55) as high as the prevalence of asthma among those born overseas (Wilson et al. 2006). Data from the ABS 2004–05 NHS support this. In 2004–05, people from non-English-speaking backgrounds had a lower prevalence of current asthma than other Australians, especially among those aged 0–64 years (Figure 3.8). Compared with people from non-English-speaking backgrounds, the prevalence of current asthma among people from English-speaking backgrounds was 2.7 times as high in those aged less than 35 years, and 2.4 times as high in those aged 35–64 years. There was no difference in the prevalence of asthma by English-speaking background for people aged 65 years and over.

The prevalence of current asthma among people from non-English-speaking backgrounds did not differ between the sexes in 2004–05 (data not shown).

Notes: Age-standardised to the Australian population as at June 2001. English-speaking background includes anyone born in Australia, New Zealand, Canada, United Kingdom, Ireland, United States of America or South Africa. Non-English-speaking background includes all those born in other countries. See Appendix 1, Section A1.12.2 for further information on country of birth classifications.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files.
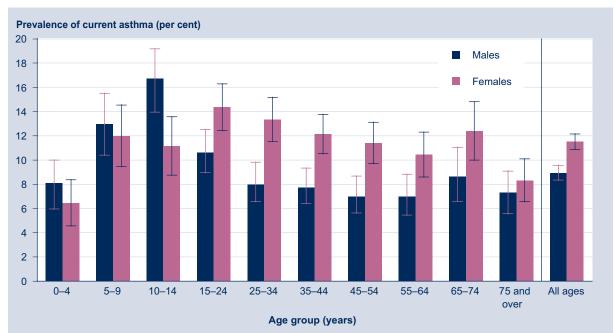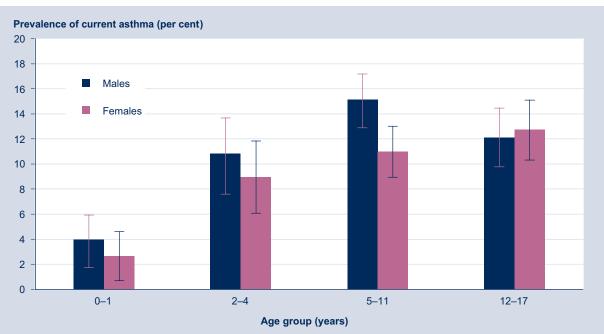
Figure 3.8: Prevalence of current asthma, by age and country of birth, 2004–05

3. Prevalence

The disparity in the prevalence of asthma between those born in English-speaking countries and those born in non-English-speaking countries diminished with age (Figure 3.8). A large study in the United Kingdom reported a lower incidence of new-onset asthma among those born outside the United Kingdom (odds ratio 0.75; 95% CI 0.67–0.83) (Gopalakrishnan et al. 2005). Surveys conducted in migrant populations have shown that the risk of developing asthma increases with duration of residence in Australia (Leung 1996; Leung et al. 1994).

There was no difference in the prevalence of asthma between those born in Australia and those born in other English-speaking nations who subsequently migrated to Australia, regardless of the duration of residence in Australia (Figure 3.9). In contrast, among those born overseas in non-English-speaking countries, the prevalence of asthma was higher if they had migrated to Australia before 1985 than if they arrived in 1986 or later (p = 0.012).

Prevalence of current asthma (per cent)

Note: English-speaking background (ESB) includes anyone born in Australia, New Zealand, Canada, United Kingdom, Ireland, United States of America or South Africa. Non-English-speaking background (NESB) includes all those born in other countries. See Appendix 1, Section A1.12.2 for further information on country of birth classifications.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files.

Figure 3.9: Prevalence of current asthma by country of birth and year of arrival in Australia, 2004–05

Socioeconomic disadvantage

In 2004–05, the prevalence of current asthma was significantly higher among people living in more socioeconomically disadvantaged localities compared with those in more advantaged localities (p trend < 0.0001, Figure 3.10). The trend did not differ between men and women (data not shown). This observation reinforces findings from a longer-term survey conducted in South Australia between 1990 and 2003, which found that the prevalence of asthma was significantly inversely associated with income (Wilson et al. 2006).

Prevalence of current asthma (per cent)

Notes: Age-standardised to the Australian population as at June 2001; SEIFA = Socio-economic Indexes for Areas.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files.

Figure 3.10: Prevalence of current asthma by socioeconomic status, 2004–05

The most recent Australian data show an increase in the disparity and a significant difference in asthma prevalence between those living in the most disadvantaged areas and those living in the least disadvantaged areas. The difference in the prevalence of asthma between the lowest and highest socioeconomic quintile was 2.2 percentage points in 2004–05. This gap has widened since the 2001 survey, when the difference was 0.9 percentage points.

3. Prevalence

3.6   Patterns of asthma in adults

Among adults, asthma can be classified according to its pattern and severity as intermittent, mild persistent, moderate persistent or severe persistent, using the criteria listed in Table 3.5. The individual is assigned to the asthma pattern in which the most severe feature is present, even if no other features associated with that pattern are present.

Table 3.5: National Asthma Council Australia Asthma Management Handbook assessment of asthma severity in newly diagnosed adults

Feature	Intermittent	Mild persistent	Moderate persistent	Severe persistent
Daytime asthma symptoms	Less than weekly	More than weekly and less than daily	Daily	Daily—physical activity is restricted
Night-time asthma symptoms	Less than 2 per month	More than twice a month but not weekly	Weekly or more often	Frequent
Exacerbations	Infrequent	Occasional	Occasional	Frequent
	Brief	May affect activity or sleep	May affect activity or sleep	
Spirometry				
FEV$_1$	At least 80% predicted	At least 80% predicted	60–80% predicted	60% predicted or less
FEV$_1$ variability	Less than 20%	20–30%	More than 30%	More than 30%

Note: FEV$_1$ = forced expiratory volume in 1 second.
Source: NAC 2006.

Among 503 adults attending general practitioners (GPs) for the management of asthma in 2006, about one-third had 'very mild' (intermittent) asthma (34.8%) and 'mild' asthma (34.4%), while 27.8% had 'moderate' asthma and only 3.0% were classified as having 'severe' asthma (AIHW: Britt & Miller 2007, Supplementary Analysis of Nominated Data (SAND) abstract 96). From 1999 to 2006, the proportion of adults with asthma who were assessed by their GPs as having severe asthma decreased from 7.9% to 3.0%. The majority (70%) of adults with asthma were classified by their GPs as having mild or very mild asthma (Figure 3.11).

Proportion of adults with asthma (per cent)

Notes: In data point for 2003, moderate section also includes those whose asthma was classified as severe. In data point for 2000 the mild category also includes adults whose asthma was classified as being very mild. In data point for 1999, asthma severity classifications were not available for 4.2% of adults and, therefore, the column does not add up to 100%.

Source: AIHW: Britt & Miller 2007.

Figure 3.11: Distribution of severity of asthma among adults attending general practitioners, 1999 to 2006

People with troublesome asthma in adult life have often had symptoms of asthma in childhood. The Tasmanian Longitudinal Health Study (TAHS), which includes 8,583 subjects who have been followed since 1968, found that 91% of adults classified as having persistent asthma (asthma symptoms reported during at least three follow-up visits over a 37-year period) or frequent asthma (asthma symptoms during two follow-up visits) at age 44 years had developed their asthma as young children (Dharmage et al. 2008).

Several studies have now suggested that females are more likely to be classified as having severe asthma than males. A European study found 2.8 times more females in the severe asthma group than males (ENFUMOSA Study Group 2003).

3.7   Patterns of asthma in children

Among children, asthma is classified as infrequent intermittent, frequent intermittent, mild persistent, moderate persistent or severe persistent using the criteria listed in Table 3.6. As for adults, the child is assigned to the asthma pattern in which the most severe feature is present, even if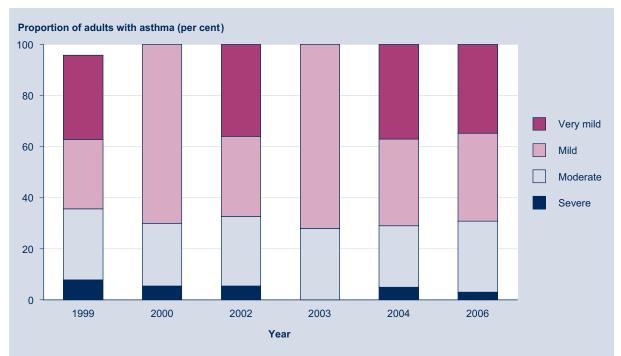 no other features associated with that pattern are present. Before 2006, a three-level classification was used: persistent, frequent episodic and infrequent episodic (NAC 2002).

Table 3.6: National Asthma Council Australia Asthma Management Handbook assessment of asthma severity in newly diagnosed children aged over 5 years

Feature	Infrequent intermittent	Frequent intermittent	Mild persistent	Moderate persistent	Severe persistent
Daytime asthma symptoms between exacerbations	Nil	Nil	More than once a week but not every day	Daily	Continuous
Night-time asthma symptoms between exacerbations	Nil	Nil	More than twice a month but not every week	More than once a week	Frequent
Exacerbations	Brief Mild Occur less than every 4–6 weeks	More than twice a month	May affect activity and sleep	At least twice a week Restrict activity or affects sleep	Frequent Restrict activity
PEF or FEV$_1$	More than 80% predicted	At least 80% predicted	At least 80% predicted	60–80% predicted	60% predicted or less
PEF variability	Less than 20%	Less than 20%	20–30%	More than 30%	More than 30%

Note: PEF = peak expiratory flow; FEV$_1$ = forced expiratory volume in 1 second.
Source: NAC 2006.

More severe or poorly controlled asthma has important consequences for the child and the health-care system. Children with inadequately controlled or severe asthma are more likely to use emergency medical care or require hospital admission compared with those with mild-to-moderate forms of the condition.

Among children with asthma, the proportion classified as having 'persistent' asthma fluctuated around 4% (period average) between 1999 and 2006. There was a peak in the proportion of children with persistent asthma in 2004 (7.6%) and then a substantial drop to only 1.2% in 2006 (Figure 3.12). The majority of children with asthma (76%) had infrequent episodic asthma during the observed period, whilst 18.6% were classified by their GPs as having 'frequent episodic' asthma.

Proportion of children with asthma (per cent)

Note: Blue section of 2003 column represents the proportion of children classified as having 'persistent' or 'frequent episodic' asthma. In data point for 1999, asthma severity classifications were not available for 5.6% of children and, therefore, the column does not add up to 100%.

Source: Supplementary Analysis of Nominated Data (SAND) abstracts (AIHW: Britt & Miller 2007).

Figure 3.12: Distribution of severity of asthma among children attending general practitioners, 1999 to 2006

3.8   Sleep disturbance due to asthma

People with severe or poorly controlled asthma may be woken from sleep with asthma symptoms. Sleep disturbance due to asthma is an important adverse outcome of the illness and is regarded as a marker of disease control. Population surveys confirm that this is a common problem in both adults and children with asthma (Table 3.7). In Victoria in 2006, 17.2% of children aged 1–12 years had been woken by asthma or wheezing in the last 4 weeks (Victorian Child Health and Wellbeing Survey).

The Australian centre of the ISAAC study reported a slight reduction in the prevalence of symptoms of severe asthma among 6–7-year-old children between 1993 and 2002. Decreases in night cough (–0.43% per year) and a reduction in the proportion of children who reported more than four attacks of wheezing in the previous 12 months (–0.32%) were observed (Pearce et al. 2007—supplementary web-tables). We cannot determine whether this apparent reduction in symptoms of severe asthma between 1993 and 2002 can be attributed to better management of the condition (both at home and in the primary care setting) or a decrease in the prevalence of severe asthma during this time.

In Australia, an estimated 20.4% of children and 22.5% of adults had been woken due to their asthma during the past 4 weeks in the summer of 2003–04 (Marks et al. 2007). Overseas studies have demonstrated much higher rates of sleep disturbance, varying from 36–59% in North America, Europe and Asia (Rabe et al. 2004).

3. Prevalence

Table 3.7: Proportion of people with current asthma whose sleep was disturbed by asthma, 1996–2006

Population/study	Response	Rate (%)	95% CI
ADULTS			
Times woken up because of asthma in the past 4 weeks			
Australian Asthma Survey	Every night	3.2	2.1–4.3
December 2003 to January 2004	More than once per week	8.8	7.1–10.6
	Less than once per week	10.5	8.2–11.9
Age 16 years and over	Not at all	77.5	75.4–80.6
		(*n* = 1,006)	
Woken at night due to asthma			
SA Omnibus	Weekly or more often	2003 16.2	n.a.
Age 15 years and over		2002 17.6	n.a.
		2001 15.9	n.a.
		2000 11.8	n.a.
		1999 14.5	n.a.
		1998 13.3	n.a.
		1997 21.6	n.a.
		1996 15.4	n.a.
CHILDREN			
Been woken by asthma or wheezing in last 4 weeks			
Victorian Child Health and Wellbeing Survey (2006)	Yes	17.2	13.7–20.7
Age 1 to under 13 years	No	82.7	79.2–86.2
		(*n* = 652)	
Times woken up because of asthma in the past 4 weeks			
Australian Asthma Survey	Every night	0.9	0.0–2.2
December 2003 to January 2004	More than once per week	7.6	3.9–11.3
	Less than once per week	11.9	7.5–16.5
Age less than 16 years	Not at all	79.6	74.4–85.6
		(*n* = 199)	

n.a. Not available

Note: 95% confidence intervals (95% CIs) for results from the Australian Asthma Survey were estimated using the sample size and the proportions and the normal approximation.

Sources: Australian Asthma Survey—Marks et al. 2007; Victorian Child Health and Wellbeing Survey—unpublished data; SA Omnibus— Wilson et al. 2006.

3.9 Comorbid conditions among people with asthma

People with asthma are more likely to report diabetes, arthritis, heart disease, stroke, cancer and osteoporosis (Adams et al. 2006). Furthermore, having both asthma and another chronic condition is associated with worse quality of life, especially among those aged 35 years and over (Adams et al. 2006).

This section compares the prevalence of comorbidity with other long-term conditions among people with and without asthma using data from the ABS 2004–05 NHS.

The most common respiratory comorbid condition among people with asthma was sinusitis or rhinitis (40%). The prevalence of sinusitis or rhinitis among people without asthma was less than half this (19%) (Table 3.8). The association with asthma was strongest in those aged 0–34 years, where the prevalence of sinusitis or rhinitis was 2.5 times as high among those with asthma as those without asthma.

People with asthma were 4.5 times more likely to also report emphysema or chronic bronchitis (prevalence 10%) than people without asthma (prevalence 2.2%). Among those aged 35–64 years, the difference was even greater. In this age group, the prevalence of emphysema or chronic bronchitis was 5.4 times as high among those with asthma as those without asthma.

In terms of non-respiratory comorbidities, overall, the prevalence of mental and behavioural disorders was 1.7 times as high among people with asthma as those without asthma. The association was strongest in those aged 0–34 years, where the prevalence of mental and behavioural disorders among people with current asthma was 1.9 times as high as the prevalence among those without current asthma.

Table 3.8: The prevalence and rate ratios associated with selected long-term comorbidities among people with and without asthma by age group, 2004–05

Age group	Comorbidity	Current asthma % (95% CI)	No asthma % (95% CI)	Rate ratio (95%CI)
0–34 years	Sinusitis and rhinitis	39.6 (36.6–42.6)	15.5 (14.7–16.4)	2.5 (2.3–2.9)
	Emphysema and chronic bronchitis	4.3 (3.1–5.6)	1.2 (0.9–1.4)	3.7 (2.2–6.2)
	Diabetes mellitus	n.p.	0.4 (0.2–0.5)	n.p.
	Heart, stroke and vascular disease	n.p.	0.2 (0.1–0.3)	n.p.
	Arthritis and osteoporosis	3.3 (2.2–4.4)	1.6 (1.3–1.9)	2.1 (1.3–3.3)
	Mental and behavioural disorders	12.4 (10.3–14.4)	6.5 (6.0–7.1)	1.9 (1.5–2.4)
	Cancer	n.p.	*0.2 (0.1–0.3)	n.p.
35–64 years	Sinusitis and rhinitis	44.1 (40.0–48.1)	23.7 (22.6–24.7)	1.9 (1.6–2.1)
	Emphysema and chronic bronchitis	12.5 (10.0–15.0)	2.3 (1.9–2.7)	5.4 (3.6–8.3)
	Diabetes mellitus	6.5 (4.8–8.3)	3.9 (3.4–4.4)	1.7 (1.2–2.4)
	Heart, stroke and vascular disease	6.3 (4.6–8.1)	3.2 (2.8–3.7)	2.0 (1.3–2.9)
	Arthritis and osteoporosis	34.8 (31.3–38.3)	22.3 (21.3–23.2)	1.6 (1.4–1.8)
	Mental and behavioural disorders	17.3 (14.5–20.2)	10.5 (9.7–11.2)	1.7 (1.3–2.1)
	Cancer	4.7 (3.2–6.2)	1.8 (1.5–2.2)	2.6 (1.5–4.3)
65 years and over	Sinusitis and rhinitis	28.7 (22.6–34.7)	18.0 (16.3–19.7)	1.6 (1.2–2.1)
	Emphysema and chronic bronchitis	24.9 (19.1–30.7)	6.1 (5.0–7.2)	4.1 (2.6–6.4)
	Diabetes mellitus	16.3 (11.6–21.0)	13.4 (11.8–14.9)	1.2 (0.9–1.7)
	Heart, stroke and vascular disease	21.5 (16.2–26.9)	18.5 (16.8–20.3)	1.2 (0.9–1.5)
	Arthritis and osteoporosis	85.5 (81.1–89.9)	61.7 (59.5–63.8)	1.4 (1.3–1.5)
	Mental and behavioural disorders	7.5 (4.4–10.5)	7.0 (5.9–8.1)	1.1 (0.7–1.7)
	Cancer	*5.9 (3.0–8.7)	6.2 (5.1–7.2)	0.9 (0.6–1.6)
All ages	Sinusitis and rhinitis	40.0 (37.7–42.2)	19.0 (18.4–19.6)	2.1 (1.9–2.3)
	Emphysema and chronic bronchitis	10.0 (8.7–11.4)	2.2 (2.0–2.5)	4.5 (3.5–5.9)
	Diabetes mellitus	4.7 (3.8–5.6)	3.4 (3.1–3.6)	1.4 (1.1–1.8)
	Heart, stroke and vascular disease	5.3 (4.3–6.2)	3.7 (3.4–4.0)	1.4 (1.1–1.8)
	Arthritis and osteoporosis	25.7 (24.2–27.3)	17.1 (16.6–17.6)	1.5 (1.4–1.6)
	Mental and behavioural disorders	13.7 (12.1–15.2)	8.1 (7.7–8.5)	1.7 (1.5–2.0)
	Cancer	2.7 (2.0–3.4)	1.6 (1.4–1.8)	1.7 (1.2–2.4)

*   Estimate has a relative standard error greater than 25% and should be interpreted with caution.
n.p.   Not published (estimate has a relative standard error greater than 45% and is not statistically reliable).

Notes

1. Age-standardised rates shown. Age-standardised to the Australian population as at 30 June 2001.

2. Arthritis includes all types.

3. Cancer describes 'malignant neoplasm'. People in hospital are excluded from the sample.

4. Mental and behavioural disorders include mood (affective) problems, anxiety-related problems, and behavioural and emotional problems with usual onset in childhood or adolescence.

5. Heart, stroke or vascular disease includes ischaemic heart diseases, cerebrovascular diseases, oedema and heart failure, and diseases of the arteries, arterioles and capillaries.

6. CI = confidence interval.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files.

3. Prevalence

Among those aged 35–64 years, 6.5% of people with asthma and 3.9% of people without asthma had diabetes in 2004–05. In this age group, the prevalence of cancer (malignant neoplasm) among people with asthma was 2.6 times as high as the prevalence among people without asthma.

Among those aged 0–34 years, people with current asthma were twice as likely to have arthritis or osteoporosis as those without asthma. The strength of this association decreased with increasing age. This relationship has been observed in previous studies. It has been shown that people who are hospitalised with asthma or die from asthma are more likely to have also had musculoskeletal problems reported (ACAM 2006). It was hypothesised that this may be related to steroid-induced osteoporosis associated with the use of steroids to manage asthma.

Asthma commonly coexists with other chronic conditions. The presence of one or more comorbid conditions in people with current asthma is likely to compromise their quality of life. Furthermore, the presence of comorbid conditions may complicate the process of managing asthma.

Summary

Among children aged 0–14 years, asthma was more common in boys than girls, but among people aged 15 years and over, asthma was more common among females than males. The highest reported prevalence was among 10–14-year-old boys. People from English-speaking backgrounds had a higher prevalence of asthma than those from a non-English-speaking background, particularly among those aged less than 65 years. None of the states or territories had prevalence rates for asthma that differed from the national average.

In recent years, the prevalence of asthma in Australia has decreased in people aged less than 35 years but has remained unchanged among people aged 35 years and over. There is also evidence of an increase in the gap in asthma prevalence between the highest and lowest socioeconomic quintiles.

The majority of children with asthma in Australia are classified as having infrequent episodic asthma, while less than 5% of children have persistent asthma. Among adults, the proportion classified as having severe asthma decreased between 1999 and 2006, and the majority of adults with asthma have mild or very mild forms of the condition. Findings from the ABS 2004–05 NHS indicated that there was a higher prevalence of arthritis or osteoporosis, particularly among children and young adults, and of mental and behavioural disorders among people with current asthma compared with people without asthma. The proportion of people with emphysema or chronic bronchitis was also 4.5 times as high and the proportion of people with sinusitis or rhinitis was 2.1 times as high among people with asthma compared with people without asthma. The presence of one or more comorbid conditions in people with current asthma is likely to compromise their quality of life and may complicate the management of the disease.

4. Mortality

Key points

- There were 402 deaths attributed to asthma as the underlying cause in 2006. This represents 0.30% of all deaths in that year.
- There was a 69% decrease in the mortality attributed to asthma between 1989 and 2006; however the rate of mortality due to asthma in Australia remains high on an international scale.
- Deaths due to asthma occur in all age groups, although the risk of dying from asthma increases with age.
- The age distribution of asthma deaths is quite different to that observed for all-cause deaths. Of all asthma deaths in 2006, 32% occurred among people aged 5–64 years. In contrast, the proportion of all-cause deaths in this age group was only 20%.
- People living in more socioeconomically disadvantaged areas have a higher risk of dying from asthma than people who live in more advantaged areas.

Introduction

There is evidence that effective management of asthma can reduce the risk of death due to this disease (Suissa et al. 2000). Monitoring trends and differentials in rates of death due to asthma assists in the evaluation of existing measures to control the impact of asthma.

In this chapter, we investigate time trends in asthma deaths, seasonality of deaths due to asthma as well as differences in age-standardised asthma mortality rates according to age, sex, remoteness of residence, socioeconomic status and country of birth. These analyses are limited to deaths in which asthma was listed as the underlying cause of death. The underlying cause of death is defined as the condition which is 'deemed to have started the train of events that led to death' (ABS 2003). We also investigate international comparisons in asthma mortality rates, comorbidities in people who died from asthma and asthma as an associated cause of death.

Asthma was certified as the underlying cause of 402 deaths in 2006. This corresponds to an asthma mortality rate of 1.80 (95%CI 1.63–1.98) per 100,000 population, representing 0.30% of all deaths.

4.1   Time trends in asthma deaths

In this section, we investigate trends in asthma deaths since 1979. Age-specific comparability factors were applied to data on deaths due to asthma which occurred before 1997, and hence were coded under the International Classification of Diseases, 9th Revision (ICD-9), to enable comparison with more recent data coded using ICD, 10th Revision (ICD-10) (see Appendix 1, Section A1.10.3).

All ages

In 1979, the rate of mortality attributed to asthma was 2.84 per 100,000 population and this steadily increased to a high of 4.99 per 100,000 in 1989. After that peak, the rate declined steadily by almost 70% to 1.54 per 100,000 in 2003. The rate remained stable in 2004 and 2005 at 1.51 and 1.49 per 100,000, respectively, but increased to 1.80 per 100,000 population in 2006.

From the late 1970s, the asthma mortality rate was higher in males than females for most years, but since the late 1980s, the mortality rate has declined more among men than women (Figure 4.1; see also Appendix 2, Table A2.7). Since the early 1990s, the mortality rate has remained higher in females than males and in 2006, the asthma mortality rate was about 1.3 times as high in females (2.04 per 100,000 population) than males (1.52 per 100,000 population).

Deaths per 100,000 population

Note: Age-standardised to the Australian population as at 30 June 2001. Asthma classified according to International Statistical Classification of Diseases, 9th Revision (ICD-9) code 493 and 10th Revision (ICD-10) codes J45 and J46. Deaths coded to ICD-9 (1979–1996) were converted to ICD-10 (1997 onwards) using conversion factors (see Appendix 1 for details).

Sources: AIHW National Mortality Database; Australian Bureau of Statistics.

Figure 4.1: Deaths due to asthma per 100,000 population, 3-year moving average, by sex, all ages and people aged 5–34 years, 1979–2006

The increase in deaths attributed to asthma in 2006, compared with 2005, was limited to people aged 65 years and over. Among males, it was more than balanced by a decrease in the number of deaths attributed to chronic obstructive pulmonary disease (COPD) in this age group, with a resultant decline in deaths due to all forms of obstructive lung diseases (ICD-10 codes J40–47). However, among females, there was no decrease in the number of deaths attributed to COPD among those aged 65 years and over and, hence, there was an overall small increase in the number of deaths attributed to obstructive lung disease in this age group (Figure 4.2).

People aged 5–34 years

Because attribution of death to asthma is more certain among those aged 5–34 years, this age group is commonly used for examining time trends and for making international comparisons. In older people, other causes of death, in particular chronic obstructive pulmonary disease, commonly cause difficulties in the attribution of causes of death (Jones et al. 1999; Sears et al. 1986; Smyth et al. 1996). This is due to the complexity of diagnosis of respiratory problems in the elderly. In fact, there is also considerable overlap between self-reported diagnoses of asthma, chronic bronchitis and emphysema (Abramson 2005).

4. Mortality

Since the mid to late 1980s, the rate of death attributed to asthma in 5–34-year-olds declined substantially (Figure 4.1; see also Appendix 2, Table A2.8). However, in contrast to the trend observed in the population as a whole, in this more-limited age group, there has been little difference between the sexes in the mortality rate due to asthma.

Interpretation

The reason for the long-term reduction in the rate of asthma mortality is uncertain. There has been no corresponding decline in the prevalence of asthma among adults. Hence, the reduction in deaths due to asthma must be largely attributable to a reduction in the risk of dying among people who have asthma. The introduction of asthma management guidelines in the early 1990s, together with changes in the availability and use of treatments for asthma since then, may have contributed to this favourable outcome. Policy initiatives at state and national levels, including targeted funding and increased awareness amongst health professionals and patients with asthma, have also occurred over this period. Finally, environmental changes, which affect the severity of asthma and the severity of exacerbations of the condition, may have also played a part in reducing the rate of asthma mortality.

The rise in deaths among people aged 65 years and over in 2006 is a cause for some concern. While it may be partially attributed to diagnostic transfer from other forms of obstructive lung disease, this does not seem to be the explanation in females, where there has been a slight rise in overall mortality due to obstructive lung disease (Figure 4.2). Further increases in the near future would require investigation and action.

Deaths per 100,000 population

Note: Age-standardised to the Australian population as at 30 June 2001. Data includes all deaths from bronchitis (International Classification of Diseases, 10th Revision (ICD-10) code J40), chronic obstructive pulmonary disease (J41–J44), asthma (J45–J46) and bronchiectasis (J47).

Sources: AIHW General Record of Incidence of Mortality (GRIM) books; Australian Bureau of Statistics.

Figure 4.2: Deaths due to all obstructive lung disease per 100,000 among persons aged 65 years and over, by sex, 1997–2006

4.2   International comparisons

Mortality rates due to asthma in Australia are relatively high by international standards. Similar rates are reported for the United States, United Kingdom and New Zealand (Figure 4.3). However, many other countries, including Japan, France, Germany, Spain and Poland, have lower rates of asthma mortality.

Country

Georgia (00–01)
Thailand (02)
New Zealand (00–03)
United Kingdom (01–04)
Australia (00–04)
USA (00–04)
Kyrgyzstan (00–04)
Hong Kong SAR (01–04)
Portugal (02–03)
Canada (00–02)
Slovakia (00–04)
Japan (00–04)
Serbia and Montenegro (00–02)
Uzbekistan (04)
France (00–04)
Hungary (00–04)
Germany (00–04)
Spain (00–04)
Czech Republic (00–04)
Netherlands (00–04)
Republic of Korea (00–04)
Poland (00–04)
Romania (00–04)

Deaths per 100,000 population

Notes
1. Data are for countries reporting to the World Health Organization Statistical Information System (WHOSIS) Mortality Database in International Classification of Diseases, 10th Revision (ICD-10) format (J45 and J46). Analysis of these data was undertaken by the Australian Centre for Asthma Monitoring (ACAM) and all interpretations and conclusions published here are those of ACAM and not WHO, which is responsible only for the provision of the original data.
2. Data for Australia 2004 and New Zealand 2002 and 2003 were sourced separately (see below).
3. For each country, data are the average over one or more years during the period 2000–2004 (years of coverage for each country are shown in brackets).
4. Rates are age-standardised to the WHO World Standard Population (Ahmad et al. 2001). Only those countries for which the relative standard error for the average asthma mortality rate was less than 25% are included.

Sources
1. Data were obtained from the WHO Mortality Database for all countries, except Australia for 2004 and New Zealand for 2002 and 2003.
2. Data for Australia for 2004 were obtained from the AIHW General Record of Incidence of Mortality (GRIM) Book for asthma (AIHW 2007b).
3. Data for New Zealand for 2002 and 2003 were obtained from the New Zealand Health Information System 2006.

Figure 4.3: World ranking of asthma mortality per 100,000 population, people aged 5–34 years, 2000–2004

4. Mortality

4.3   Population subgroups

Age and sex

While deaths due to asthma occur in all age groups, the risk of dying from asthma increases with age in both males and females (Figure 4.4). Most deaths attributed to asthma occur in people aged 65 years and over. This is also the age group in which chronic obstructive pulmonary disease (COPD) is common. There is substantial overlap in the clinical features of asthma and COPD. As a result, the attribution of death to one or the other of these diseases is not reliable in clinical practice or in mortality statistics.

There are more deaths attributed to asthma among females aged 65 years and over than males of the same age. The relative importance of sex differences in the risk of asthma and gender differences in the labelling of airway disease in this age group is uncertain.

Deaths per 100,000 population

Note: Age-specific mortality rates calculated for aggregated data from 2002–2006. Age-standardised to the Australian population as at June 2001.

Sources: AIHW General Record of Incidence of Mortality (GRIM) books; Australian Bureau of Statistics.

Figure 4.4: Deaths due to asthma per 100,000 population, by age and sex, 2002–2006

During 2002–2006, most deaths due to asthma occurred in people aged 65 years and over (figures 4.4 and 4.5). However, the proportion of asthma-related deaths that occurred at this age (67%) was smaller than the proportion of deaths due to all causes in this age group (79%; Figure 4.5).

In contrast, deaths among people aged 5–64 years represented a larger proportion of asthma deaths than all-causes deaths (32% and 20%, respectively).

Proportion (per cent)

Note: Age-specific mortality rates calculated for aggregated data from 2002–2006. Asthma classified according to International Classification of Diseases, 10th Revision (ICD-10) codes J45 and J46.

Sources: AIHW National Mortality Database; AIHW General Record of Incidence of Mortality (GRIM) books.

Figure 4.5: Age distribution for asthma and all cause mortality, 2002–2006

4. Mortality

States and territories

During 2002–2006, mortality rates due to asthma ranged from 1.5 per 100,000 population in Western Australia to 2.0 per 100,000 population in Tasmania (Figure 4.6). However, the small number of deaths in the states and territories with smaller populations means that the differences need to be interpreted with caution.

Deaths per 100,000 population

Note: Age-standardised to the Australian population as at June 2001. Mortality rates for aggregated data from 2002–2006. NT excluded because the numbers were too small to produce a reliable estimate.

Sources: AIHW National Mortality Database; Australian Bureau of Statistics.

Figure 4.6: Deaths due to asthma per 100,000 population, by state and territory, 2002–2006

Urban, rural and remote areas

There was little variation in the mortality rate for asthma according to remoteness of residence for those aged 5–34 years, 35–64 years and 65 years and over (Figure 4.7). Due to the small number of deaths from asthma that occurred in remote areas of Australia, it was not possible to reliably estimate age-specific rates for these areas individually. For the purposes of this report, we have amalgamated deaths that occurred in remote and very remote areas of Australia.

Deaths per 100,000 population

5–34 years

Deaths per 100,000 population

35–64 years

Deaths per 100,000 population

65 years and over

Major Cities   Inner Regional   Outer Regional   Remote and Very Remote

Remoteness category

Notes: Age-standardised to the Australian population as at June 2001. Mortality rates for aggregated data from 2002–2006. Asthma classified according to International Classification of Diseases, 10th Revision (ICD-10) codes J45 and J46. Remoteness classified according to the Australian Standard Geographical Classification (ASGC) categories of remoteness. Y axis has different scale for each age group.

Sources: AIHW National Mortality Database; Australian Bureau of Statistics.

Figure 4.7: Deaths due to asthma per 100,000 population, by remoteness, people aged 5 years and over, 2002–2006

4. Mortality

Country of birth

Among those aged 5 years and over, the mortality rate due to asthma was higher among people from an English-speaking background (1.85 per 100,000 population) compared with those from a non-English speaking background (1.46 per 100,000 population) (p = 0.0014). The disparity was largest among those aged 35–64 years and those aged 5–34 years (Figure 4.8).

Deaths per 100,000 population

Age group (years)

Notes: Age-standardised to the Australian population as at June 2001. Mortality data aggregated from 2002–2006. Asthma classified according to International Classification of Diseases, 10th Revision (ICD-10) codes J45 and J46. English-speaking background includes anyone born in Australia, New Zealand, Canada, United Kingdom, Ireland, United States of America, South Africa or Zimbabwe. Non-English-speaking background includes all those born in other countries. See Appendix 1, Section A1.12.2 for further information on country of birth classifications. Results for significance testing for differences between non-English-speaking versus English-speaking background within each age group were as follows: 5–34 years, p = 0.0299; 35–64 years, p < 0.0001; 65 years and over, p = 0.5936.

Sources: AIHW National Mortality Database; Australian Bureau of Statistics.

Figure 4.8: Deaths due to asthma per 100,000 population, by country of birth, people aged 5 years and over, 2002–2006

The case-fatality rate due to asthma in all age groups was similar among people from English-speaking and non-English-speaking backgrounds (Figure 4.9).

Deaths per 100,000 people with asthma

Notes: Mortality data aggregated from 2002–2006. English-speaking background includes anyone born in Australia, New Zealand, Canada, United Kingdom, Ireland, United States of America or South Africa. Non-English-speaking background includes all those born in other countries. For this case-fatality analysis, Zimbabwe was included in the non-English-speaking background category because the asthma population estimate from the National Health Survey included Zimbabwe as a country of non-English-speaking background. See Appendix 1, Section A1.12.2 for further information on country of birth classifications.

Sources: AIHW National Mortality Database; Australian Bureau of Statistics 2004–05 National Health Survey.

Figure 4.9: Deaths due to asthma per 100,000 people with asthma, by country of birth, people aged 5 years and over, 2002–2006

4. Mortality

Socioeconomic disadvantage

As with asthma prevalence, socioeconomic disparities also exist in regard to the severity of the disease and in health-seeking behaviours. In children, it has been shown that severe asthma is associated with lower socioeconomic status and poverty (Babin et al. 2007; Mielck et al. 1996). Studies from the United States of America also show an increase in the risk of asthma mortality related to lower socioeconomic status (Castro et al. 2001; Grant et al. 2000).

This is reflected in Australian mortality data, which show a significant relationship between increasing levels of socioeconomic disadvantage and higher risk of death from asthma, particularly among those aged 35–64 years and 65 years and over (Figure 4.10). Among those aged 5–34 years, there is no evidence of this relationship. These same trends, or lack thereof, exist for both males and females (data not shown).

Deaths per 100,000 population

Age group (years)

Notes: Age-standardised to the Australian population as at June 2001. Mortality data aggregated from 2002–2006. Results for testing for linear trends in mortality according to socioeconomic status were as follows: 5–34 years, p trend = 0.2085; 35–64 years, p trend < 0.0001; 65 years and over, p trend = 0.0001. SEIFA = Socio-economic Indexes for Areas.

Sources: AIHW National Mortality Database; Australian Bureau of Statistics.

Figure 4.10: Deaths due to asthma per 100,000 population, by age and socioeconomic status, people aged 5 years and over, 2002–2006

4.4   Seasonal variation in mortality risk

The risk of death due to asthma varies with the time of year and is different between age groups. Studies from the United States (Weiss 1990) and the United Kingdom (Marks & Burney 1997) have demonstrated higher rates of asthma deaths during winter months among older people. Data for Australia (Figure 4.11) reflect a similar pattern in people aged 65 years and over, while for those aged 35–64 years, the risk of death due to asthma is higher in late winter and May. This pattern could reflect the impact of the winter rise in influenza and pneumonia. In contrast, among those aged 5–34 years, the highest death rates tend to occur in April and May, coinciding with mid–late autumn.

Notes: Asthma classified according to International Classification of Diseases, 10th Revision (ICD-10) codes J45 and J46. Mortality data aggregated from 2002–2006. For each month, the deviation from that year's monthly average number of deaths for the relevant age group was calculated. The mean monthly deviation was then calculated over the observed 5 years. Results for significance testing of monthly deviation from the yearly average were as follows: 5–34 years, p = 0.0890; 35–64 years, p = 0.1643; 65 years and over, p < 0.001.

Sources: AIHW National Mortality Database; Australian Bureau of Statistics.

Figure 4.11: Seasonal variation in the rate of deaths due to asthma, by broad age group, 2002–2006

4.5 Comorbidities in people who died from asthma

This section describes the prevalence of selected comorbid conditions listed on the death certificate as associated causes of death among people whose underlying cause of death was asthma.

Among people whose deaths were attributed to asthma, the most common comorbidity was heart, stroke and vascular disease, which was listed on 29.4% of all death certificates (Table 4.1), including 15.4% among those who died aged 35–64 years and 39.0% among those who died aged 65 years and over.

Of all deaths due to asthma between 2001 and 2005, 26.2% had an acute respiratory infection (ICD-10 codes J0–J22) listed as an associated cause of death. It is well established in children (Johnston et al. 1995, 1996) and adults (Green et al. 2002) that viral infections are an important trigger for exacerbations of asthma leading to hospitalisation. The relatively low prevalence of acute respiratory infections recorded in association with deaths attributed to asthma may indicate that other factors are more important in precipitating fatal attacks. However, it is also possible that preceding viral infections did occur but that the attending medical practitioner who certified the patient's death was not aware of the antecedent events.

The proportion of people who died from asthma and who had comorbid conditions listed elsewhere on the death certificate increased with age. Among those aged 65 years and over, 11% had COPD or bronchiectasis listed as a comorbid condition. In contrast, only 6% of non-asthma deaths among people aged 65 years and over had COPD or bronchiectasis listed as a comorbid condition. Furthermore, 7% of non-respiratory deaths among people aged 65 years and over had COPD or bronchiectasis listed as a comorbid condition.

Table 4.1: Comorbidities in people who died from asthma, by broad age group, 2001–2005

Comorbidity	Proportion of asthma deaths (per cent)		
	35 to 64 years	65 years and over	All ages
Influenza, pneumonia and other acute lower respiratory infections	10.3	36.2	26.2
Chronic obstructive pulmonary disease (COPD) and bronchiectasis	8.8	10.8	9.3
Diabetes mellitus	7.8	9.9	8.5
Heart, stroke and vascular disease	15.4	39.0	29.4
Arthritis and osteoporosis	1.9	8.0	5.6
Mental and behavioural problems	1.9	2.3	2.0
Cancer	1.5	4.6	3.3

Notes

1. Results for people aged under 35 years are not presented because the number of deaths due to asthma with a comorbid condition listed was too small to produce a reliable estimate.

2. Associated causes of death are not mutually exclusive. Therefore, the columns for each age group can add up to more than 100%.

3. Asthma was classified according to International Classification of Diseases, 10th Revision (ICD-10) codes J45 and J46. Comorbidities were classified as follows: Influenza and pneumonia (J0–J22); COPD and bronchiectasis (J40–J44, J47); diabetes mellitus (E10–E14); heart, stroke and vascular disease (I20–I25, I60–I69, I50, I70–I79); arthritis and osteoporosis (M00–M25, M80–M82); mental and behavioural disorders (F30–F39, F40–F48, F90–F98); and malignant neoplasms (i.e. cancer) (C00–C97).

Source: AIHW National Mortality Database.

4.6 Asthma as an associated cause of death in deaths attributed to other causes

Asthma is relatively uncommonly listed as an associated cause of death in people dying of other causes. Between 2001 and 2005, there were 657,765 deaths in Australia (ABS 2008). Asthma was listed as an *associated* cause of death on 4,652 death certificates (0.71%) during this time.

Cardiovascular disease (heart, stroke and vascular disease) was most commonly listed as the underlying cause of death among deaths where asthma was an associated cause (41.1%). Among all deaths from cardiovascular disease, asthma occurred as an associated cause for only a small proportion (0.91%) (Table 4.2). Aside from cardiovascular disease, the other most common underlying causes of death where asthma was listed as an associated cause were cancer (21.4%) and diabetes (4.2%) (data not shown).

The underlying causes of death for which asthma was most likely to be an associated cause of death were arthritis and osteoporosis (1.20%) and diabetes (1.16%) (Table 4.2). Among those aged 5–34 years, 3.70% of those who died from COPD or bronchiectasis had asthma listed as an associated cause of death.

Table 4.2: Proportion of deaths due to other causes where asthma was listed as an associated cause, 2001–2005 (per cent)

| Condition | Age group (years) | | | |
	5–34	35–64	65 and over	All ages
Malignant neoplasms (cancer)	0.30	0.46	0.56	0.53
Endocrine, nutritional and metabolic diseases	0.74	1.89	1.15	1.25
Diabetes mellitus	0	1.41	1.12	1.16
Mental and behavioural disorders	n.p.	0	0.57	0.80
Diseases of the circulatory system	0.98	1.07	0.92	0.93
Heart, stroke and vascular disease	1.51	0.97	0.90	0.91
Diseases of the respiratory system	0.52	1.32	0.44	0.51
Influenza, pneumonia and other acute respiratory tract infections	0.83	1.78	0.31	0.39
Chronic obstructive pulmonary disease (COPD) and bronchiectasis	3.70	1.25	0.54	0.61
Other upper respiratory tract diseases	0	3.03	0	0.62
Diseases of the musculoskeletal system and connective tissue	1.47	1.22	0.83	0.88
Arthritis and osteoporosis	0	1.40	1.20	1.20
Total deaths	**0.46**	**0.72**	**0.72**	**0.71**

n.p. Not published (numbers too small to produce a reliable estimate)
Sources: AIHW General Record of Incidence of Mortality (GRIM) books; ABS 2008.

Summary

Death due to asthma is uncommon. However, the long-term decline in mortality rates due to asthma has levelled out over the last 3 years, with a slight increase among older people in 2006. The rate in Australia remains high by international standards.

The risk of death due to asthma increases with age. However, compared to deaths from all causes, a higher proportion of deaths due to asthma occur in younger age groups. Between 2002 and 2006, 67% of all deaths due to asthma occurred in those aged 65 years and over. In this older age group, mortality attributed to asthma was more common in women. People aged 35 years and over living in socioeconomically disadvantaged areas had higher mortality rates due to asthma than those living in socioeconomically advantaged localities.

Around one-quarter of all deaths from asthma are associated with respiratory infections.

5. Use of health services

Key points

General practice encounters for asthma

- There has been a decrease in the rate of general practice encounters for asthma among adults (–24%) and children (–37%) between 1998 and 2008.
- Inhaled corticosteroids are prescribed at more than half of asthma-related general practice encounters.
- Lung function testing and provision of asthma action plans occur in less than 10% of general practice encounters for asthma.
- Claims for completed Practice Incentives Program Asthma Cycle of Care are highest among boys aged 0–14 years and women aged 65 years and over and tend to peak in the winter months.
- Adults aged 15–34 years, people living in remote areas and people living in areas of a relatively higher socioeconomic status are less likely to access the Asthma Cycle of Care.

Hospitalisations and emergency department visits for asthma

- Children have higher rates of hospitalisation for asthma than adults.
- There has been a reduction in the rate of hospital admissions for asthma between 1993–94 and 2006–07, which has occurred among both adults (–45%) and children (–42%).
- Hospital admissions for asthma are higher in boys compared with girls, adult women compared with adult men, people from English-speaking backgrounds compared with those from a non-English-speaking background, adults living in remote areas compared with adults residing in major cities and people living in socioeconomically disadvantaged areas compared with those living in the least disadvantaged areas.
- Peaks in hospital admissions for asthma vary by age, with rates highest in February and May among children and highest in the winter months among adults.
- Respiratory infections are commonly listed as an associated diagnosis among people of all ages admitted to hospital for asthma.

Invasive mechanical ventilation

- In 2006–07, 11.7 out of every 1,000 hospitalisations for asthma included a period of mechanical ventilation.
- People who require mechanical ventilation during their hospital stay for asthma have a longer average length of stay and a higher rate of in-hospital mortality than those who do not require the procedure.
- The highest proportion of hospitalisations for asthma which required mechanical ventilation was among adults aged 35–64 years. In this age group, people from non-English-speaking backgrounds were more likely to require mechanical ventilation during a hospitalisation than people from English-speaking backgrounds.

Health-care expenditure

- Health expenditure on asthma was $606 million in 2004–05.
- Asthma expenditure accounted for 1.2% of total allocated health-care expenditure in 2004–05.
- More than half of all asthma expenditure during 2004–05 was attributed to prescription pharmaceuticals.

Introduction

People with asthma seek health care for non-urgent reasons, such as routine review and prescription of usual asthma therapy, or for urgent management of disease exacerbations or 'attacks'. This chapter presents analyses of data on the use of health-care services by people with asthma. In particular, there is a focus on the application of these data to investigate the nature of exacerbations of asthma at a population level.

Clinicians monitor markers of asthma control to guide management and changes in medication. Well-controlled asthma indicates that the disease is mild or well managed and poor asthma control may indicate poor management. Hence, knowledge of the overall level of asthma control in the population provides some information on the effectiveness of the management of asthma in the community and the need for further efforts in improving asthma management. Most markers of disease control require clinical measures that are not readily available at a population level. However, exacerbations are one marker of poor asthma control that can be measured using urgent health-care utilisation data as a proxy for the occurrence of exacerbations. Therefore, these data can be used to monitor levels of asthma control in the population.

There is empirical support for the interpretation of health-care utilisation as a population-based indicator of the level of control of asthma (Cowie et al. 2001; de Marco et al. 2003; Herjavecz et al. 2003; Vollmer et al. 2002). Factors predisposing to poorly controlled asthma, such as poor knowledge about asthma (Goeman et al. 2004; Radeos et al. 2001), absence of an asthma management plan (Adams et al. 2000; Fernandes et al. 2003; Radeos et al. 2001), poor self-management skills (Kennedy et al. 2003; Soriano et al. 2003) and limited access to primary care (Christakis et al. 2001), are also associated with greater health-care utilisation. Furthermore, interventions that are aimed at improving asthma control through self-management plans and education have been shown to reduce urgent health-care utilisation (Castro et al. 2003; Cote et al. 2001). However, the occurrence of exacerbations does not always indicate the presence of severe or poorly controlled asthma. Viral respiratory tract infections cause disease exacerbations, even in people with otherwise well-controlled asthma (Reddel et al. 1999). Hence, the incidence of exacerbations of asthma is an imperfect marker of the potential for improved control of asthma at a population level.

The nature of the health care is related to the severity of the exacerbation. People with asthma who experience exacerbations of their disease may self-manage the episode or seek urgent medical care from their general practitioner. In more severe cases, they may seek care from a hospital emergency department. There is a relationship between severity of the exacerbation and type of health care used. General practitioners provide the largest volume of care, however this includes maintenance and review care for asthma as well as management of asthma exacerbations. Hospitals are generally only used for the management of exacerbations of asthma, although some people do attend emergency departments for care that could best be described as 'maintenance'. Generally, people with more severe exacerbations require admission to hospital for a period of one or more days. At the most severe end of the spectrum of exacerbations are those associated with acute ventilatory failure, for which mechanical ventilation is required. Hence, there is a spectrum of intensity of health-care interventions, which approximately corresponds to the severity of the exacerbation.

Health-care use attributable to exacerbations of asthma is an indicator, albeit imperfect, of the level of control of asthma in the community. The nature and intensity of health service use gives a further indication of disease control by reflecting the severity of the exacerbations of asthma. In this chapter, we investigate general practice encounters, hospitalisations and emergency department (ED) visits for asthma as well as hospital admissions which required invasive mechanical ventilation. Furthermore, we examine health-care expenditure associated with asthma.

5.1   General practice encounters for asthma

General practitioners (GPs) play a central role in the management of asthma in the community. This role includes assessment, prescription of regular medications, education and review as well as managing acute exacerbations.

Asthma-related visits to GPs may occur for a variety of reasons, including:

• the acute or reactive management of asthma symptoms

• a review during or following an acute episode

• a visit for maintenance activities, such as monitoring and prescription of regular medications.

The GP may initiate an opportunistic review when a patient visits for another condition or the patient or GP may schedule a structured asthma review visit.

In a study of 1,006 adults with current asthma during 2003 and 2004, 14.3% had an emergency visit to a general practitioner for asthma in the 12 months before being surveyed (Marks et al. 2007). This same study reported that 21.4% of 199 children made an emergency visit to the GP. In another study, 58% of 421 patients with asthma who had visited the GP in the past 12 months had had asthma managed during at least one of those visits. Of those who had not had their asthma managed by a GP in the last 12 months, 72.6% stated it had been more than 2 years since such management had been provided by their GP (AIHW: Britt & Miller 2007, SAND abstract 104).

Unscheduled medical visits for asthma, which are most likely to represent visits for acute or reactive management of asthma symptoms, occur less commonly among Australians with asthma than people with asthma in other countries. In the Asthma Insights and Reality surveys of North America, Europe and Asia, the rate of unscheduled asthma visits to a health facility other than a hospital ED (for example, visits to a GP) among people with asthma ranged from 25% in western Europe to 47% in Japan (Rabe et al. 2004).

This section presents information on all asthma-related general practice encounters. These estimates are based on data from the Bettering the Evaluation and Care of Health (BEACH) survey (AIHW: Britt et al. 2008), which are derived from a set of encounters reported by a rolling random sample of GPs in Australia. Rates are expressed as population-based rates and as proportions of all general practice encounters. This section also includes data on how asthma is managed in general practice, also obtained from the BEACH survey. Information on referrals, performance of spirometry and other lung function tests, prescription patterns and the provision of education are provided. For more details about BEACH data and methods, see Appendix 1, Section A1.3. This section also reports data on Practitioner Incentives Payment (PIP) claims for reimbursement for structured general practice review visits for asthma (the Asthma Cycle of Care, formerly the Asthma 3+ Visit Plan).

5.1.1   Time trends

The rate of general practice encounters for asthma has decreased since 1998–99. The largest reduction, expressed as the rate per 100 population, has been among children, where the rate fell by around 37 percentage points between 1998 and 2008 (Figure 5.1). The rate among adults demonstrated a slightly slower overall decline (24 percentage points) reaching a plateau of around 10 encounters for asthma per 100 population during the most recent 4 years (Figure 5.1; see also Appendix 2, Table A2.9). The proportion of all GP encounters that include the management of asthma has also declined over this time period, although the relative decrease is smaller than absolute reduction in visits for asthma (Figure 5.2; see also Appendix 2, Table A2.9). In 2007–08, encounters at which asthma was managed accounted for 4.8% of all GP encounters with children and 1.8% of all adult GP encounters.

General practice encounters per 100 population

Notes: Asthma classified according to International Classification of Primary Care, 2nd edition (ICPC-2) code R96. Bettering the Evaluation and Care of Health (BEACH) year is April to March.

Sources: BEACH Survey of General Practice; Australian Bureau of Statistics.

Figure 5.1: General practice encounters for asthma per 100 population, adults and children, April 1998 to March 2008

Proportion of general practice encounters (per cent)

Notes: Asthma classified according to International Classification of Primary Care, 2nd edition (ICPC-2) code R96. Bettering the Evaluation and Care of Health (BEACH) year is April to March.

Sources: BEACH Survey of General Practice; Medicare Australia.

Figure 5.2: Proportion of general practice encounters for asthma, adults and children, April 1998 to March 2008

5. Use of health services: General practice encounters

5.1.2   Population subgroups

Age and sex

Among children, boys are more likely than girls to have an asthma-related general practice encounter. After the age of 15 years, this trend is reversed and females have more asthma-related general practice encounters than males (Figure 5.3). This reflects the change in asthma prevalence during the teenage years.

General practice encounters per 100 population

Notes: Asthma classified according to International Classification of Primary Care, 2nd edition (ICPC-2) code R96. Bettering the Evaluation and care of Health (BEACH) year is April to March.

Sources: BEACH Survey of General Practice; Australian Bureau of Statistics.

Figure 5.3: General practice encounters for asthma per 100 population, by age and sex, April 2004 to March 2007

Although the absolute rates of asthma-related GP encounters were highest in children aged 0–4 years and in adults aged 65 years and over, people in these age groups also visited general practices relatively more commonly for reasons other than asthma. Out of all general practice encounters, the proportion of those related to asthma was largest among children aged 5–14 years (7.0% in boys and 5.3% in girls) and the smallest in adults aged 65 years and over (1.3% in males and 1.8% in females) (Figure 5.4).

States and territories

The rates of general practice encounters for asthma in Western Australia, the Australian Capital Territory and the Northern Territory were lower than the national average (10.5%). There was little variation in rates of asthma-related GP encounters among other states (Figure 5.5).

Proportion of general practice encounters (per cent)

Notes: Asthma classified according to International Classification of Primary Care, 2nd edition (ICPC-2) code R96. Bettering the Evaluation and Care of Health (BEACH) year is April to March.

Source: BEACH Survey of General Practice.

Figure 5.4: Proportion of general practice encounters for asthma, by age and sex, April 2004 to March 2007

General practice encounters per 100 population

Notes: Asthma classified according to International Classification of Primary Care, 2nd edition (ICPC-2) code R96. Bettering the Evaluation and Care of Health (BEACH) year is April to March.

Sources: BEACH Survey of General Practice; Australian Bureau of Statistics.

Figure 5.5: General practice encounters for asthma per 100 population, by state and territory, April 2004 to March 2007

5. Use of health services: General practice encounters

Urban, rural and remote areas

Published studies of aggregated BEACH data (1998–2004) showed that rates of management of respiratory problems in general decreased with increasing remoteness (from 22.2 per 100 GP encounters in major cities to 19.5 in inner regional, 19.4 in outer regional and 18.3 in remote Australia, with a slight increase to 19.4 per 100 GP encounters in very remote Australia (AIHW: Knox et al. 2005). However, the proportion of asthma-related general practice encounters did not differ across major cities (2.3%), inner regional (2.4%), outer regional (2.4%) or remote/very remote (2.4%) areas of Australia for the period April 2004 to March 2007.

Socioeconomic disadvantage

It has been reported that socioeconomically disadvantaged persons have higher rates of overall general practice consultations than those who are less disadvantaged (Charles et al. 2003b). However, analysis of recent BEACH data shows that the proportion of GP encounters that were for asthma was lowest in those living in the most disadvantaged localities ($p = 0.03$) (Figure 5.6). This association with socioeconomic status did not differ between age groups ($p = 0.5$).

Proportion of general practice encounters (per cent)

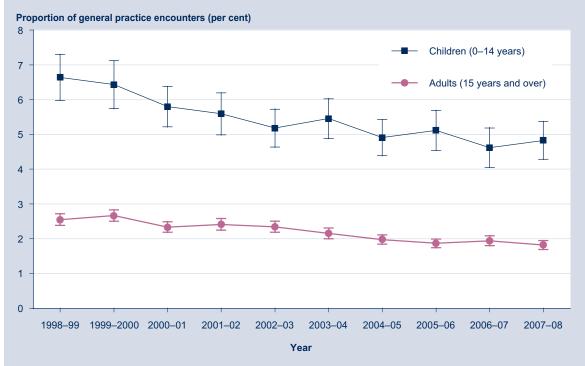*Notes:* Asthma classified according to International Classification of Primary Care, 2nd edition (ICPC-2) code R96. Bettering the Evaluation and Care of Health (BEACH) year is April to March. SEIFA = Socio-economic Indexes for Areas.
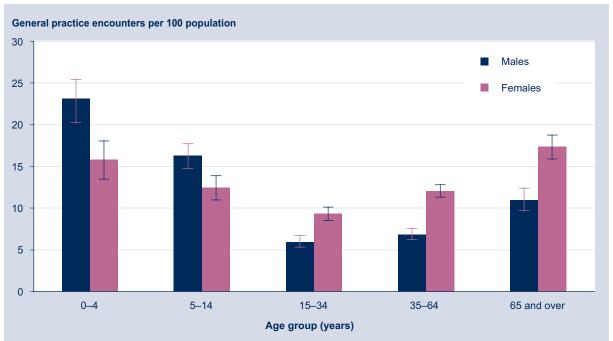
Sources: BEACH Survey of General Practice; Australian Bureau of Statistics.

Figure 5.6: Proportion of general practice encounters for asthma, by socioeconomic status, April 2004 to March 2007

5.1.3 Practice Incentives Program Asthma Cycle of Care (formerly the Asthma 3+ Visit Plan)

On 1 November 2006, the Practice Incentives Program (PIP) Asthma Cycle of Care replaced the Asthma 3+ Visit Plan, which had been in operation since 2001. The initiatives, both funded by the Australian Government, were introduced to recognise the key role general practice plays in the monitoring and management of asthma. The changeover occurred in response to feedback received by GPs, respiratory physicians and patients on how the Asthma 3+ Visit Plan could be improved (DoHA 2007a).

Zwar et al. (2005) interviewed 315 GPs in 5 Divisions of General Practice in metropolitan Sydney and found that 91.2% knew of the Asthma 3+ Visit Plan, but only 44.9% had used it. Major barriers to use of the Asthma 3+ Visit Plan included workload and administrative complexities, while patient attitude towards asthma care, non-compliance of follow-up consultations and patient assessment of the severity of their asthma influenced the completion of the Asthma 3+ Visit Plan.

As with the Asthma 3+ Visit Plan, the Asthma Cycle of Care is aimed at patients with moderate to severe asthma and entails the development and ongoing review of an asthma action plan. In contrast to the Asthma 3+ Visit Plan, which required a patient to visit the doctor at least three times over a 4-month period, the Asthma Cycle of Care requires at least two visits over a 12-month period. The following five steps must be implemented during these two visits to ensure the Asthma Cycle of Care is successfully completed:

1. document diagnosis and assessment of asthma severity and level of asthma control
2. review the patient's use of, and access to, asthma-related medication and devices
3. provide a written asthma action plan (or document alternative if the patient is unable to use a written action plan)
4. provide asthma self-management education
5. review the written or documented asthma action plan.

The number of claims for payment under the Asthma 3+ Visit Plan gradually declined from 2002 to 2006 but after the commencement of the Asthma Cycle of Care in November 2006, the number of claims rose (Figure 5.7)—to the end of December 2007, there had been 28,503 claims for completed Asthma Cycles of Care lodged for 28,305 individuals.

For the Asthma Cycle of Care and the Asthma 3+ Visit Plan, there has been a general trend for claims to peak during the winter months and for low rates of claims during January to March (Figure 5.7).

5. Use of health services: General practice encounters

Number of claims

Notes: Claims are for asthma review visit classified codes 2546, 2547, 2552, 2553, 2558, 2559, 2664, 2666, 2668, 2673, 2675 & 2677. The Asthma Cycle of Care replaced the Asthma 3+ Visit Plan in November 2006. PIP = Practice Incentives Program.

Source: Medicare Australia, Medicare Benefits Schedule (MBS) online statistics.

Figure 5.7: Number of claims for completed Practice Incentives Program Asthma 3+ Visit Plan /Asthma Cycle of Care, all ages, November 2001 to July 2008

5.1.4   Claims for completed Asthma Cycles of Care in population subgroups

Age and sex

Among children aged 14 years and under, the rate of claims for completed Asthma Cycles of Care was higher for males than females (Figure 5.8). This is consistent with the higher prevalence of asthma among boys in this age group. From the age of 15 years, females had a higher rate of claims than males. The highest rate of claims for completed Asthma Cycles of Care occurred among boys aged 5–14 years (237 per 100,000 population) and females aged 65 years and over (196 per 100,000 population).

Among people with asthma, young adults aged 15–34 years were least likely to have utilised the Asthma Cycle of Care with 6.3 claims per 1,000 population (Figure 5.9). Children aged 0–4 years, especially males, and older Australians aged 65 years and over had the highest rates of claims.

Claims per 100,000 population

Notes: Claims are for asthma review visit classified codes 2546, 2547, 2552, 2553, 2558, 2559, 2664, 2666, 2668, 2673, 2675 and 2677. Age standardised to the Australian population as at June 2001; PIP = Practice Incentives Program.

Sources: Derived from Department of Health and Ageing Medicare Benefits Schedule (MBS) statistics; Australian Bureau of Statistics.

Figure 5.8: PIP Asthma Cycle of Care claims per 100,000 population, by age and sex, 2007

Claims per 1,000 people with asthma

Notes: Claims are for asthma review visit classified codes 2546, 2547, 2552, 2553, 2558, 2559, 2664, 2666, 2668, 2673, 2675 and 2677; PIP = Practice Incentives Program.

Sources: Derived from Department of Health and Ageing Medicare Benefits Schedule (MBS) statistics; ABS National Health Survey 2004–05; Australian Bureau of Statistics.

Figure 5.9: PIP Asthma Cycle of Care claims per 1,000 people with asthma, 2007

5. Use of health services: General practice encounters

States and territories

During 2007, the rate of claims for completed Asthma Cycles of Care varied widely by state and territory (Figure 5.10). New South Wales, Victoria and Tasmania showed a higher rate of claims than the national average, while the rate of claims observed in the Northern Territory, Australian Capital Territory, Western Australia and Queensland were much lower than the national average. The low rate of claims in some states and territories may reflect access to the Asthma Cycle of Care in those areas.

Claims per 100,000 population

Notes: Claims are for asthma review visit classified codes 2546, 2547, 2552, 2553, 2558, 2559, 2664, 2666, 2668, 2673, 2675 and 2677. Age-standardised to the Australian population as at June 2001. PIP = Practice Incentives Program.

Sources: Derived from Department of Health and Ageing Medicare Benefits Schedule (MBS) statistics; Australian Bureau of Statistics.

Figure 5.10: PIP Asthma Cycle of Care claims per 100,000 population, by state and territory, 2007

Urban, rural and remote areas

There was a significant relationship between increasing remoteness and decreasing rates of claims for completed Asthma Cycles of Care in 2007 (Figure 5.11). The highest rates of claims were observed among people residing in inner regional (141 per 100,000 population) and outer regional areas (103 per 100,000) of Australia. People living in very remote areas were 75% less likely than those living in inner regional areas to access the Asthma Cycle of Care ($p < 0.0001$). Claims for completed Asthma Cycles of Care can only be made by practices which participate in the PIP and have registered for the PIP Asthma incentive.

Claims per 100,000 population

Notes: Claims are for asthma review visit classified codes 2546, 2547, 2552, 2553, 2558, 2559, 2664, 2666, 2668, 2673, 2675 and 2677. Age-standardised to the Australian population as at June 2001. PIP = Practice Incentives Program.

Sources: Derived from Department of Health and Ageing Medicare Benefits Schedule (MBS) statistics; Australian Bureau of Statistics.

Figure 5.11: PIP Asthma Cycle of Care claims per 100,000 population, by remoteness, 2007

Socioeconomic disadvantage

The rate of claims for completed Asthma Cycles of Care decreased with increasing socioeconomic status (Figure 5.12). People living in the most disadvantaged areas were 33% more likely than those living in the least disadvantaged areas to access the Asthma Cycle of Care ($p < 0.0001$).

Claims per 100,000 population
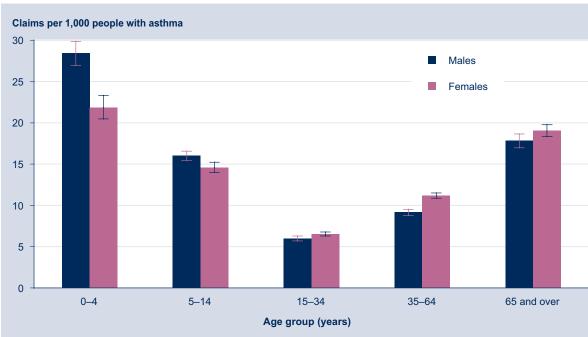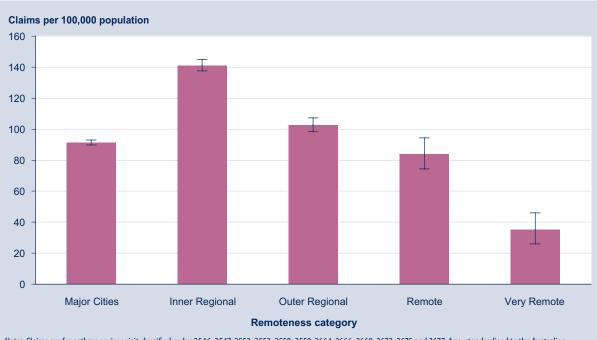

Notes: Claims are for asthma review visit classified codes 2546, 2547, 2552, 2553, 2558, 2559, 2664, 2666, 2668, 2673, 2675 & 2677. Age-standardised to the Australian population as at June 2001. SEIFA = Socio-economic Indexes for Areas; PIP = Practice Incentives Program.

Sources: Derived from Department of Health and Ageing Medicare Benefits Schedule (MBS) statistics; Australian Bureau of Statistics.

Figure 5.12: PIP Asthma Cycle of Care claims per 100,000 population, by socioeconomic status, 2007

5.1.5   Management of asthma in general practice

Between April 2004 and March 2007, there were 290,000 encounters recorded in the BEACH survey of general practice and asthma was managed in 6,583 (2.3%; 95%CI 2.2–2.4) of these encounters. For the analysis of the management of asthma in general practice that follows, we have examined the prescriptions, procedures and referrals that took place during these 6,583 encounters.

Provision of prescriptions

The most frequently prescribed medication during asthma-related GP encounters between April 2004 and March 2007 was inhaled corticosteroids (either alone or in combination with long-acting beta-agonists). During this time, inhaled corticosteroids were prescribed for the management of asthma at 51.9% (95% CI 50.3–53.6) of asthma-related GP encounters. In comparison, oral corticosteroids were prescribed for asthma at 11.5% (95% CI 10.5–12.5) of asthma-related encounters, while leukotriene receptor antagonists (1.7%) and cromones (1.0%) were rarely prescribed.

Prescribing patterns among children

Among children aged 0–14 years who visited a GP for their asthma, 38.8% were prescribed inhaled corticosteroids either alone or in combination with long-acting beta-agonists (Figure 5.13). Approximately half (49.4%) of these prescriptions were 'continuing' prescriptions and 28.2% were prescribed for the first time (that is, 'new').

Oral corticosteroids were prescribed for 13.6% of children attending GPs for asthma between April 2004 and March 2007. The majority of oral corticosteroid prescriptions were new (66.3%).

Very few children were prescribed leukotriene receptor antagonists (5.3%) or cromones (2.2%) for their asthma. Among children prescribed leukotriene receptor antagonists, 42.8% of prescriptions were continuing and 31.9% were new. The majority of prescriptions for cromones (47.6%) had an 'unknown' status, hence the remaining 32.6% of continuing and 19.8% of new prescriptions are likely to be underestimated.

Proportion of general practice encounters for asthma (per cent)

Notes: Asthma classified according to International Classification of Primary Care, 2nd edition (ICPC-2) code R96. ICS = inhaled corticosteroids, LABA = long-acting beta-agonists, OCS = oral corticosteroids, LTRA = leukotriene receptor antagonists.

Source: Bettering the Evaluation and Care of Health (BEACH) program.

Figure 5.13: Medications prescribed for the treatment of asthma in general practice, by class of medication and prescription status, children aged 0–14 years, April 2004 to March 2007

5. Use of health services: General practice encounters

Prescribing patterns among adults

Among adults, the pattern of new and continuing medication was similar to that observed for children, however the overall proportions were different (Figure 5.14). The overall proportion of asthma consultations in which any inhaled corticosteroids were prescribed was higher in adults (56.4%) than it was in children. The proportion of asthma prescriptions for inhaled corticosteroids in combination with long-acting beta-agonists (42.6%) was more than triple the proportion of prescriptions for inhaled corticosteroids alone (14.0%). Fifty-six per cent of all inhaled corticosteroid prescriptions prescribed for asthma were continuing while 19.4% were first-time prescriptions for this class of medication.

Oral corticosteroids were prescribed at 10.8% of consultations for asthma among adults while cromones (0.6%) and leukotriene receptor antagonists (0.5%) were very rarely prescribed.

Proportion of general practice encounters for asthma (per cent)

Notes: Asthma classified according to International Classification of Primary Care, 2nd edition (ICPC-2) code R96. ICS = inhaled corticosteroids, LABA = long-acting beta-agonists, OCS = oral corticosteroids, LTRA = leukotriene receptor antagonists.
Source: Bettering the Evaluation and Care of Health (BEACH) program.

Figure 5.14: Medications prescribed for the treatment of asthma in general practice, by class of medication and prescription status, people aged 15 years and over, April 2004 to March 2007

Procedures and treatments

The most common procedures provided by GPs for asthma management were spirometry (lung function) testing and provision of an asthma action/management plan. Between 2004 and 2007, children had an asthma plan provided in 4.2% and lung function testing was performed in 2.8% of all asthma-related GP encounters (Figure 5.15). Among adults, asthma plans were provided less frequently (1.9%), while lung function testing was done more commonly (6.7%). GPs reported providing advice on smoking at 1.7% of all adult asthma-related encounters.

Proportion of general practice encounters for asthma (per cent)

Note: Asthma classified according to International Classification of Primary Care, 2nd edition (ICPC-2) code R96. Lung function test includes all procedures listed under rubric R39—that is, peak flow, pulmonary function, spirometry, lung function, physical function; respiratory, forced expiratory volume in 1 second (FEV1) and respiratory function.

Source: Bettering the Evaluation and Care of Health (BEACH) program.

Figure 5.15: Procedures, other treatments and counselling for asthma in general practice, April 2004 to March 2007

5. Use of health services: General practice encounters

Referrals

Asthma-related general practice encounters rarely resulted in referral for outside services (Figure 5.16). General practitioners referred children and adults to hospital (including to the emergency department— ED) in less than 1% of all asthma-related encounters. The referral rates to hospital, ED and specialists were higher in children than in adults. Children were referred to a hospital in 0.4% of all asthma-related GP encounters, and to the ED in 0.4%. Among adults, 0.2% were referred to hospital and 0.1% to the ED. Children were also more frequently referred to a specialist (2.1%) than adults (1.4%). Adults were twice as likely as children to be referred for lung function tests, which is to be expected since testing cannot be reliably performed in children under the age of 7 years.
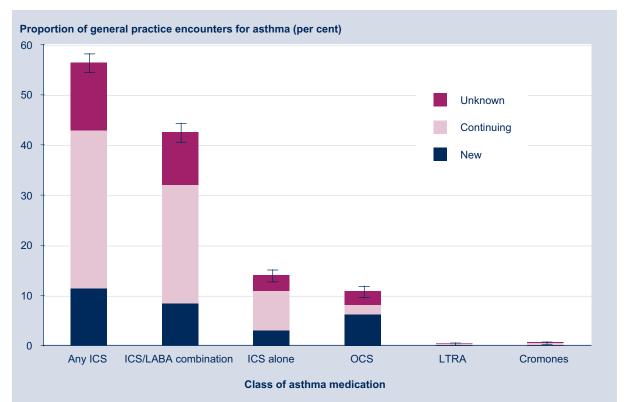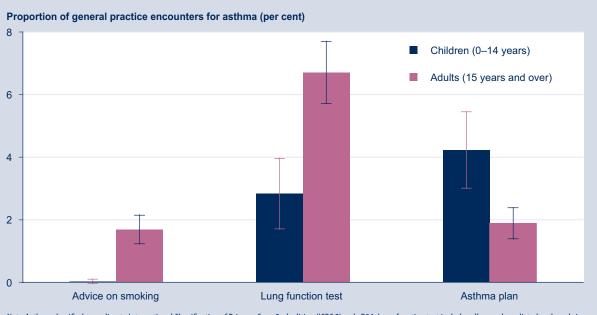

Notes: Asthma classified according to International Classification of Primary Care, 2nd edition (ICPC-2) code R96. Lung function test includes all procedures listed under rubric R39. ED = emergency department.

Source: Bettering the Evaluation and Care of Health (BEACH) program.

Figure 5.16: Referrals provided during asthma-related general practice encounters, April 2004 to March 2007

Summary

Between 1998 and 2008, the rate of asthma-related general practice encounters among children declined by around 37%. The highest rate of asthma-related general practice encounters was seen in boys aged 0–4 years and the lowest rate was among males aged 15–64 years. Prescriptions for inhaled corticosteroids represented 52% of all asthma-related prescriptions provided between 2004 and 2007. Spirometry or other lung function testing was performed by GPs in 6.7% of all adult asthma-related encounters. Asthma action plans were more commonly provided for children than adults. Very few referrals relating to asthma management were provided by GPs. GPs provided advice on smoking at 1.7% of all adult asthma-related encounters.

Since the introduction of the PIP Asthma Cycle of Care (which supersedes the Asthma 3+ Visit Plan) in November 2006, the rate of claims for completing best practice care for patients with moderate to severe asthma through the Asthma Cycle of Care has increased. Access to the Asthma Cycle of Care is highest in young children, particularly males, and in older Australians. People aged 15–34 years, people living in remote areas and people living in areas of a relatively higher socioeconomic status are less likely to access the Asthma Cycle of Care.

5.2 Hospitalisations and emergency department visits

5.2.1 Emergency department visits

People with asthma may visit an emergency department (ED) when they experience an exacerbation or worsening of their disease. Since exacerbations may be a feature of severe or poorly controlled asthma, rates of ED visits for asthma are often considered to reflect the prevalence of severe or poorly controlled asthma in the community (Vollmer et al. 2002). The occurrence of ED visits for asthma may also be a useful indicator of the effects of interventions to improve disease control in patients with asthma (Bateman et al. 2004) and the effect of environmental exposures on asthma control (Forbes et al. 2007).

However, going to an ED is only one of a range of alternatives available for managing less severe flare-ups of asthma. Hence, variation in ED visits may, in part, be attributable to variation in access to general practitioner care (including after hours and home visit accessibility) and in the use of self-management plans for exacerbations. Also, the accessibility of the ED care itself may influence the likelihood that people with worsening of asthma will seek this care. Finally, it should be noted that not all ED visits for asthma are attributable to exacerbations of asthma. There is some evidence to show that people may use EDs as a source of routine primary care (Ford et al. 2001).

In this section we present the time trend in data obtained from the New South Wales Emergency Department Data Collection.

There were marked month-to-month fluctuations in the rate of ED visits for asthma, particularly among children under the age of 15 years (Figure 5.17). Of note, the lowest rate of ED visits for asthma consistently occurred in January when there was also the least difference between age groups. At other times of the year, the rate of visits to an ED for asthma was much higher among children aged 0–14 years than in all other age groups. Both the timing and the size of peaks in rates of ED visits varied with age (Figure 5.17). Among children under the age of 15 years, the peak ED visit rate was in late summer, with several very large peaks occurring, most notably in February 1999, 2001 and 2006. Peaks in ED attendance rates for asthma among children also occurred in May 2002, 2004, 2005 and 2007. Among people aged 65 years and over, and to a lesser extent those aged 35–64 years, the fluctuations in ED visit rates were less marked. Small peaks in ED visit rates for asthma among adults tended to occur in late autumn and winter.

In 2007, there were 22,942 ED visits for asthma in New South Wales. Among all people attending ED for asthma in New South Wales in 2007, 42% were admitted to hospital rather than being discharged home. The rate of admission to hospital for asthma from the ED was higher among children aged 0–14 years (48%) than among people aged 15 years and over (32%).

ED visits per 100,000 population

Notes

1. As the coverage of the emergency department (ED) data is less than 100%, these rates will be an underestimate of the true ED visit rate among people with asthma.

2. Data contains a mix of diagnoses coded using International Classification of Diseases, 9th and 10th revisions (ICD-9 and ICD-10). Comparability factors, calculated from hospitalisation data (see Appendix 1, Section A1.9.3) have been used to adjust for the changes in coding from ICD-9 to ICD-10. ED visits coded to ICD-9 were converted to ICD-10 using the following conversions: ages 0–5 years, no conversion; 5–34 years, converted by a factor of 1.0326; 35–64 years, converted by a factor of 0.7938; 65 years and over, converted by a factor of 0.4813.

Sources: New South Wales (NSW) Emergency Department Data Collection (EDDC) Health Outcomes and Information Statistical Toolkit (HOIST), Centre for Epidemiology and Research, NSW Department of Health; Australian Bureau of Statistics.

Figure 5.17: Emergency department visits for asthma per 100,000 population, by age and month, New South Wales, January 1999 to February 2008

5.2.2 Hospitalisations

Hospitalisation for asthma is required when flare-ups or 'attacks' are life-threatening or when they cannot be managed at home.

Changes in the number of hospitalisations for asthma may be due to changes in the severity and prevalence of the disease in the community and the effectiveness of disease management. The use of hospital care for the management of exacerbations may also be influenced by the relative accessibility of hospital services and of alternative services such as general practitioners, especially after hours (Phelan et al. 1993, 2002). Changes in admission criteria and administrative policies also affect hospital usage data.

The risk of hospitalisation among people with asthma in Australia is low by comparison with other countries. An Australian study found that 3.8% of adults and 4.9% of children with asthma reported having been hospitalised for the condition in the past 12 months (Marks et al. 2007). This was lower

than the rates reported in the global Asthma Insights and Reality surveys conducted in North America, Europe and Asia, where rates ranged from 7.0% for western Europe to 19.1% for central and eastern Europe (Rabe et al. 2004).

The data for this section are derived from the National Hospital Morbidity Database. In these data, the term 'hospital separation' refers to the formal process by which a hospital records the completion of treatment or care for an admitted patient. This includes completion due to discharge, death, transfer to another hospital or change in the type of care. Each separation represents one episode of hospitalisation (or admission). For more information on this database, see Appendix 1, Section A1.9.

There were 36,588 hospital separations with a principal diagnosis of asthma in 2006–07 in Australia. Asthma accounted for 0.48% of all hospital separations during that period.

5.2.3 Time trends in hospital use for asthma

In 2006–07, the overall rate of hospital separations for asthma was 183.2 per 100,000 population, but the rate among children aged 0–14 years (533.6 per 100,000 population) was markedly higher than the rate among people aged 15 years and over (92.7 per 100,000 population).

Since 1993, there has been a substantial reduction in the rate of hospital separations for asthma in both children and adults (Figure 5.18; see also Appendix 2, Table A2.10). Between 1993–94 and 2006–07, hospitalisations for asthma decreased by 42% among those aged 0–14 years and by 45% among those aged 15 years and over.

Notes: Age standardised to the Australian population as at 30 June 2001. Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) code 493 and ICD, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46. Hospital separations coded to ICD-9-CM (1993–97) were converted to ICD-10-AM using the following conversion: ages 5–34 years, converted by a factor of 1.0326; 35–64 years, converted by a factor of 0.7938; 65 years and over, converted by a factor of 0.4813. See Appendix 1 for details about age standardisation (Section A1.1.1) and conversion/comparability factors (Section A1.9.3).

Sources: AIHW National Hospital Morbidity Database; Australian Bureau of Statistics.

Figure 5.18: Hospital separations for asthma per 100,000 population, by broad age group, 1993–94 to 2006–07

5. Use of health services: Hospitalisations

The decline in hospital admissions for asthma is not attributable to any parallel reduction in the prevalence of asthma over this period. It is possible that the decrease in hospitalisations for asthma is due to more effective long-term or preventative management of asthma or more effective out-of-hospital management of disease exacerbations. It is also possible that there has been a decrease in the severity of asthma over this period, due to environmental change. It is not possible to attribute the observed trend with any degree of certainty to any of these factors.

The average length of stay among people admitted to hospital for asthma has also gradually declined since 1998–99 (Figure 5.19). Among children hospitalised with asthma, the average length of stay decreased by 24% between 1998–99 and 2006–07. Among those aged 15 years and over, the average length of stay decreased by 32% during this time.

In 2006–07, the average length of stay for all persons admitted to hospital with asthma was 2.21 days. People aged 15 years and over tended to stay in hospital longer than children. The average length of stay for asthma in 2006–07 was 3.16 days among adults and 1.52 days among children.

Time trends in the rate of patient days for asthma since 1993–94 are shown in Appendix 2, Table A2.11.

Average length of stay (days)

Children (0–14 years)

Adults (15 years and over)

Year

Notes

1. Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded.
2. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46.
3. Excludes separations where length of stay was more than 120 days or less than one day.

Source: AIHW National Hospital Morbidity Database.

Figure 5.19: Average length of stay for asthma, by broad age group, 1998–99 to 2006–07

5.2.4 Seasonal variation

Among children, the peaks for hospitalisations occur in late summer and autumn (Figure 5.20). The reason for these seasonal peaks are not known, though they are likely to be related to a high prevalence of respiratory viral infections, particularly the common cold, around this time. Among adults, hospitalisation rates for asthma are highest in the winter months (Figure 5.20), which probably reflects the impact of the winter rise in respiratory tract infections, and early spring.

Notes: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46. Week one begins Monday 4 January 2004. Queensland is excluded from the data. Y axis has a different scale for adults and children.

Sources: AIHW National Hospital Morbidity Database; Australian Bureau of Statistics.

Figure 5.20: Seasonal variation in hospital separation rates for asthma, by age, children and adults, 2004

5. Use of health services: Hospitalisations

Large seasonal peaks in hospital admission rates for children have been observed in both the Northern and Southern Hemispheres in late summer. In New South Wales, it has been noted that these peaks coincide with the return to school after the holidays (Lincoln et al. 2006). It has been reported that peaks in hospital admissions for asthma are reached within 3.5 weeks of returning to school from the long summer holiday period, usually in February. Peaks in hospital admission rates have also been observed in May after shorter school holiday breaks (Lincoln et al. 2006). Studies conducted in the Northern Hemisphere have also observed increased asthma hospitalisation rates in children in early autumn, following school holidays (Johnston et al. 2005). The consistency of this pattern cannot be wholly explained by weather changes, the presence of allergens, airborne pollutants or viral infections. It has been suggested that the association between asthma admissions and returning to school may be related to the increase in social contacts at this time (Lincoln et al. 2006).

5.2.5 Population subgroups

Age and sex

The highest rate of hospital separations for asthma was observed in children aged 0–4 years, particularly boys where the rate was 1,313 per 100,000 population in 2006–07.

Boys aged 0–14 years were more likely to be admitted to hospital for asthma than girls and, after the age of 15 years, females had a higher rate than males (Figure 5.21).

Hospital separations per 100,000 population

Note: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46.
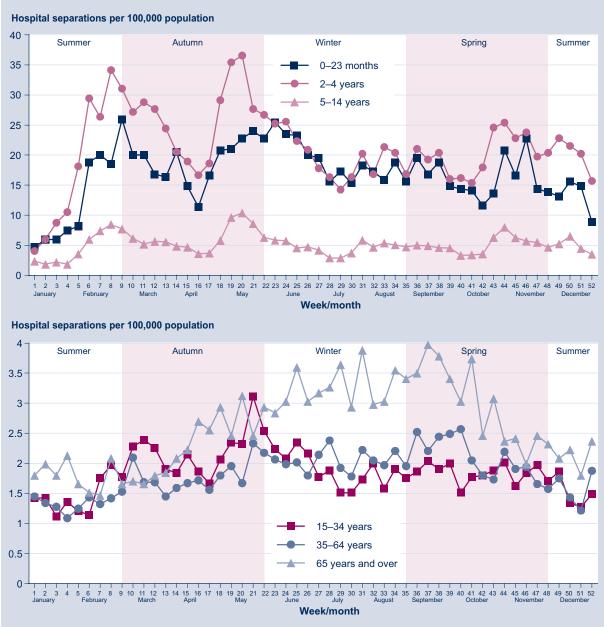
Sources: AIHW National Hospital Morbidity Database; Australian Bureau of Statistics.

Figure 5.21: Hospital separations for asthma per 100,000 population, by age and sex, 2006−07

'Patient days' refers to the total number of full or partial days of stay for patients who were admitted to hospital for an episode of care and who underwent separation during the reporting period. A patient who is admitted and separated on the same day is allocated one patient day. The gender differences in the rate of patient days for asthma followed a similar pattern to hospital separations (data not shown).

These patterns are consistent with prevalence rates as well as the rate of asthma-related GP consultations.

Figure 5.22 further investigates hospital separation rates for asthma by age and sex in an effort to determine the exact age at which the rate declined in boys and increased in girls. From the age of 5–13 years, boys have higher rates of hospital separations for asthma than girls. Both the rates and the difference in rates between boys and girls gradually decline until age 13 years, when the rates are approximately equal. From the age of 14 years, the hospital separation rate for asthma continues to decline among boys and reaches a stable level at 16–18 years. Among girls, the rate starts to rise after 14 years and girls have higher rates of hospital separations for asthma than boys from this age.

Hospital separations per 100,000 population

Notes: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46.

Sources: AIHW National Hospital Morbidity Database; Australian Bureau of Statistics.

Figure 5.22: Hospital separations for asthma per 100,000 population by 1-year age group and sex, ages 5–18 years, 2006–07

5. Use of health services: Hospitalisations

Compared with the general hospitalised population, those hospitalised for asthma are much younger. In 2006–07, more than half (58%) of all hospital separations for asthma were for children aged 0–14 years (Figure 5.23). In comparison, the proportion of all-cause hospital separations attributed to children was only 7%. In contrast, hospitalisations among people aged 65 years and over represented a much larger proportion of all-cause hospital separations than asthma separations (36% versus 9%, respectively).

Proportion (per cent)

Notes: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46.
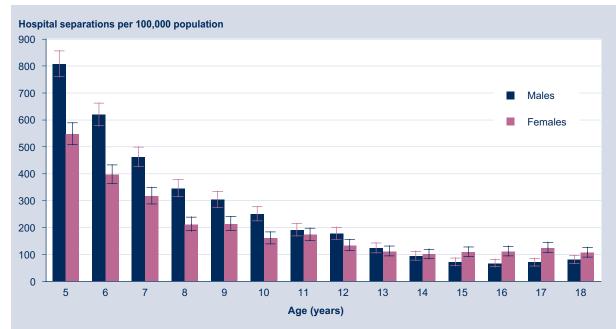
Sources: AIHW National Hospital Morbidity Database; AIHW 2008b, Table 8.1.

Figure 5.23: Age distribution for hospital separations for asthma and all causes, 2006–07

The average length of stay for people hospitalised with asthma increased with age (Figure 5.24). The median length of stay (length of hospital stay for 50% of people) for asthma separations during 2006–07 was 1 day among 0–14 year olds compared to 4 days for people aged 65 years and over.

Proportion (per cent)

Age group (years)

Notes: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46.

Source: AIHW National Hospital Morbidity Database.

Figure 5.24: Relative frequency of length of stay for asthma, by broad age group, 2006–07

5. Use of health services: Hospitalisations

States and territories

Among children, hospital separation rates for asthma in 2006–07 were lower than the national average in Queensland, Western Australia, Tasmania, the Australian Capital Territory and the Northern Territory and were higher than average in New South Wales and South Australia (Figure 5.25). Among adults, there was less variation in rates of hospital separations for asthma between the states and territories, although the rates in the Northern Territory and in South Australia were above the national average.
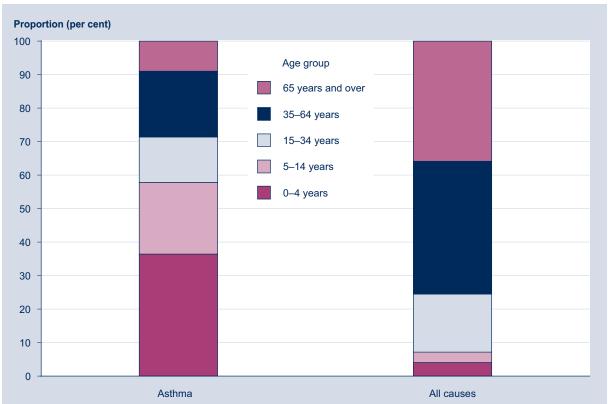
Hospital separations per 100,000 population

Notes: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46. Y axis has different scale for each age group.

Sources: AIHW National Hospital Morbidity Database; Australian Bureau of Statistics.

Figure 5.25: Hospital separations for asthma per 100,000 population among children and adults, by state and territory, 2006–07

Urban, rural and remote areas

Overall, the rate of hospital separations for asthma was 170.3 per 100,000 persons living in major cities and 226.4 per 100,000 persons living in very remote areas.

Among children aged 0–14 years, 72.3% of all hospital separations for asthma occurred in children residing in major cities. Children aged 0–14 years living in major cities had a higher hospital separation rate for asthma than those living in inner or outer regional areas ($p < 0.0001$) (Figure 5.26). In contrast, the hospital separation rate for asthma among people aged 15 years and over increased with increasing remoteness. The rate was significantly higher among those residing in very remote areas compared with those residing in major cities ($p < 0.0001$).

This pattern is consistent with the regional variation observed for all-cause hospital separations (AIHW 2008b).

Notes: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46. 2006 Statistical local area boundaries were used to map to Australian Standard Geographical Classification (ASGC) level of remoteness.

Sources: AIHW National Hospital Morbidity Database; Australian Bureau of Statistics.

Figure 5.26: Hospital separations for asthma per 100,000 population, by age and remoteness, 2006–07

Similar age trends were observed when examining the rate of patient days for asthma according to remoteness of residence (data not shown). For children aged 0–14 years, those living in major cities had a higher rate of patient days for asthma compared with those living in very remote areas. In contrast, there was a higher rate of patient days for asthma among adults living in very remote areas compared with adults living in major cities or regional areas ($p < 0.0001$). Among adults residing in major cities, the rate of patient days for asthma was 265.4 per 100,000 population while among adults residing in very remote areas of Australia, the rate of patient days was 461.9 per 100,000 population.

Among adults, there was also a significant association between the average length of stay for asthma and remoteness of residence (Figure 5.27). Adults residing in major cities had a longer length of stay for asthma (3.3 days) than adults who resided in very remote areas (2.5 days; *p* trend < 0.0001).

Average length of stay (days)

Notes: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46.

Source: AIHW National Hospital Morbidity Database.

Figure 5.27: Average length of stay for asthma, by age and remoteness, 2006–07

Country of birth

Overall, the rate of hospital separations for asthma among those aged 5 years and over was higher among those from an English-speaking background (127.70 per 100,000 population) than among those from a non-English-speaking background (65.86 per 100,000 population) ($p < 0.0001$).

The disparity in hospitalisations for asthma according to country of birth diminished with age (Figure 5.28). Among those aged 65 years and over, there was no difference in the hospital separation rate for asthma according to country of birth ($p = 0.4093$).

Hospital separations per 100,000 population

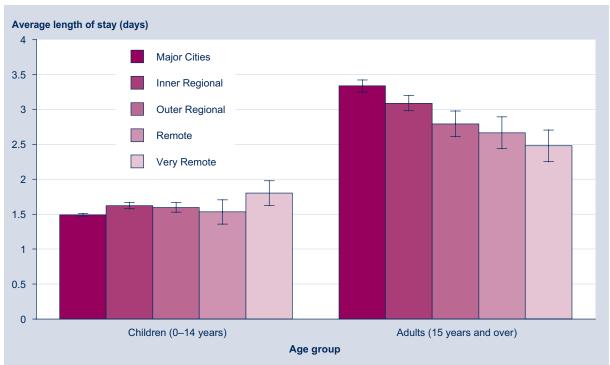*Notes:* Age standardised to the Australian population as at 30 June 2001. Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46. English-speaking background includes anyone born in Australia, New Zealand, Canada, United Kingdom, Ireland, United States of America, South Africa or Zimbabwe. Non-English-speaking background includes all those born in other countries. See Appendix 1, Section A1.12.2 for further information on country of birth classifications.

Sources: AIHW National Hospital Morbidity Database; Australian Bureau of Statistics.

Figure 5.28: Hospital separations for asthma per 100,000 population, by broad age group and country of birth, people aged 5 years and over, 2006–07

Similarly, the overall rate of hospital patient days for asthma among those aged 5 years and over was higher among people of English-speaking background (332.8 per 100,000 population) than those from a non-English speaking background (183.1 per 100,000 population) ($p < 0.0001$).

The age-related differences in rates of hospitalisations for asthma according to country of birth reflect the pattern of prevalence of the condition.

5. Use of health services: Hospitalisations

Socioeconomic disadvantage

Hospital separation rates for asthma increased with increasing socioeconomic disadvantage (*p* trend < 0.0001) (Figure 5.29). Overall, the rate of hospital admissions for asthma was significantly higher among those residing in the most disadvantaged localities (236 per 100,000 population) compared with those residing in least disadvantaged areas (140 per 100,000 population) (*p* < 0.0001). This trend was observed for all age groups.

Hospital separations per 100,000 population

Notes: Age standardised to the Australian population as at 30 June 2001. Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46. Overall p trend < 0.0001. Overall rate of hospital admissions for asthma significantly higher among those living in most disadvantaged localities (p < 0.0001). SEIFA = Socio-economic Indexes for Areas.

Sources: AIHW National Hospital Morbidity Database; Australian Bureau of Statistics.

Figure 5.29: Hospital separations for asthma per 100,000 population, by age and socioeconomic status, 2006–07

There was also a significant association between the level of socioeconomic disadvantage and the rate of patient days for asthma (data not shown). People residing in areas of relative socioeconomic disadvantage had a higher rate of hospital patient days for asthma than those residing in the least disadvantaged areas (*p* trend < 0.0001). Among those living in the most disadvantaged areas, the rate of hospital patient days for asthma was 522 days per 100,000 population, while among those living in the least disadvantaged areas, the rate of patient days for asthma was 297 days per 100,000 population.

5.2.6 Comorbidities in patients admitted to hospital with asthma

The presence of one or more comorbid conditions in people with asthma is likely to compromise their quality of life and may complicate the management of the disease. In this section we investigate comorbidities by looking at the presence of additional diagnoses in people admitted to hospital with a principal diagnosis of asthma. It should be noted that conditions or disorders that do not affect the treatment received by the patient during their hospital stay are not included as additional diagnoses.

In 2005–06, 49% of patients admitted to hospital with a principal diagnosis of asthma had at least one comorbidity associated with their hospital stay. The proportion of patients hospitalised for asthma with at least one comorbidity increased with age from 45% among those aged 0–14 years to 69% among those aged 65 years and over (data not shown). More females (53%) than males (46%) hospitalised for their asthma had at least one comorbid condition.

As expected, the presence of comorbidity is associated with a prolonged length of hospital stay. The median length of stay for asthma was 2 days among those with at least one comorbidity compared with 1 day for those with no comorbidity (excluding same-day patients and those with a length of stay of more than 120 days).

Respiratory comorbidities

Of all hospitalisations due to asthma in 2005–06, 33.4% had an acute respiratory infection (ICD-10-AM codes J0–J22) as an additional diagnosis. In most of these cases, we can assume that the respiratory infection triggered the asthma exacerbation and subsequent hospitalisation. Respiratory infections occurred frequently as an associated diagnosis among children admitted to hospital with asthma. Just over one-third (34%) of all children aged 0–14 years who were hospitalised with asthma in 2005–06 had acute respiratory infections recorded as an additional diagnosis (Table 5.1). However, the occurrence of respiratory infections was also common in other age groups, with 32%, 28% and 28% of asthma admissions in people aged 15–34 years, 35–64 years and 65 years and over, respectively, being associated with such infections. As not all cases of respiratory infection are reported and some may have resolved before the hospital admission, it is likely that these data underestimate the role of respiratory infections as triggers for exacerbations leading to hospitalisation.

Other obstructive lung disease often coexists with a diagnosis of asthma, particularly among older people. Among people aged 65 years and over who were admitted to hospital with asthma, 5.2% had COPD or bronchiectasis as a comorbid condition.

Other comorbidities

This section examines the prevalence of several, specific comorbidities among people hospitalised with a principal diagnosis of asthma (Table 5.1). Among young adults aged 15–34 years admitted to hospital with asthma, mental and behavioural disorders were a common comorbidity, particularly among women (Table 5.1). The prevalence of diabetes as an additional diagnosis increased with age among adults from 2.0% to 11.9% to 18.3% among those aged 15–34 years, 35–64 years and 65 years and over, respectively. 'Heart, stroke and vascular disease' was listed as an additional diagnosis in 11.1% of asthma admissions among those aged 65 years and over.

Table 5.1: Comorbidities in people admitted to hospital with asthma, by age and sex, 2005–06 (per cent)

Age group	Comorbidity	Proportion of all asthma separations (95% CI)		
		Males	**Females**	**Persons**
0–14 years	Respiratory infections	32.5 (31.2–33.8)	36.1 (34.4–37.8)	34.0 (33.0–35.0)
	COPD and bronchiectasis	. .	. .	. .
	Non-infectious upper respiratory conditions	0.6 (0.4–0.8)	0.5 (0.3–0.8)	0.5 (0.4–0.7)
	Diabetes mellitus	0.2 (0.1–0.3)	0.2 (0.1–0.4)	0.2 (0.1–0.3)
	Heart, stroke and vascular disease	n.p.	n.p.	n.p.
	Arthritis and osteoporosis	n.p.	n.p.	n.p.
	Mental and behavioural disorders	0.5 (0.3–0.8)	0.3 (0.2–0.6)	0.4 (0.3–0.6)
	Cancer	n.p.	n.p.	n.p.
15–34 years	Respiratory infections	31.8 (29.2–34.5)	31.5 (29.7–33.4)	31.6 (30.1–33.2)
	COPD and bronchiectasis	1.1 (0.7–1.8)	0.5 (0.3–0.8)	0.7 (0.5–1.0)
	Non-infectious upper respiratory conditions	n.p.	1.2 (0.9–1.6)	0.9 (0.7–1.2)
	Diabetes mellitus	0.9 (0.5–1.4)	2.5 (2.0–3.0)	2.0 (1.6–2.4)
	Heart, stroke and vascular disease	n.p.	n.p.	0.2 (0.1–0.3)
	Arthritis and osteoporosis	0.6 (0.3–1.1)	n.p.	0.3 (0.2–0.5)
	Mental and behavioural disorders	2.0 (1.4–2.7)	3.4 (2.9–4.1)	2.9 (2.5–3.4)
	Cancer	n.p.	n.p.	n.p.
35–64 years	Respiratory infections	25.8 (23.7–28.0)	28.6 (27.1–30.0)	27.7 (26.6–29.0)
	COPD and bronchiectasis	2.3 (1.7–3.0)	2.4 (2.0–2.8)	2.4 (2.0–2.7)
	Non-infectious upper respiratory conditions	1.4 (0.9–1.9)	1.4 (1.1–1.7)	1.4 (1.1–1.7)
	Diabetes mellitus	8.6 (7.4–9.9)	13.4 (12.4–14.4)	11.9 (11.2–12.7)
	Heart, stroke and vascular disease	2.5 (1.9–3.2)	2.1 (1.7–2.5)	2.2 (1.9–2.6)
	Arthritis and osteoporosis	0.7 (0.4–1.2)	1.1 (0.9–1.4)	1.0 (0.8–1.2)
	Mental and behavioural disorders	3.1 (2.4–4.0)	4.3 (3.8–5.0)	4.0 (3.5–4.4)
	Cancer	0.5 (0.3–0.9)	0.4 (0.2–0.6)	0.4 (0.3–0.6)
65 years and over	Respiratory infections	22.6 (19.6–25.9)	29.8 (27.7–32.1)	27.9 (26.2–29.8)
	COPD and bronchiectasis	5.2 (3.8–7.0)	5.2 (4.3–6.2)	5.2 (4.4–6.0)
	Non-infectious upper respiratory conditions	n.p.	1.1 (0.7–1.6)	1.0 (0.7–1.4)
	Diabetes mellitus	19.0 (16.2–22.0)	18.0 (16.4–19.8)	18.3 (16.9–19.8)
	Heart, stroke and vascular disease	11.8 (9.7–14.2)	10.9 (9.7–12.2)	11.1 (10.1–12.3)
	Arthritis and osteoporosis	2.6 (1.7–3.8)	3.9 (3.2–4.7)	3.5 (2.9–4.2)
	Mental and behavioural disorders	2.4 (1.5–3.6)	3.7 (3.0–4.6)	3.4 (2.8–4.0)
	Cancer	2.4 (1.5–3.6)	1.1 (0.7–1.6)	1.4 (1.0–1.9)

n.p. not published (numbers too small to produce a reliable estimate)

. . not applicable

Notes: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma was classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46. Comorbidities reported in Table 5.1 were classified as follows: respiratory infections (J0–J22); chronic obstructive pulmonary disease (COPD) and bronchiectasis (J40–J44, J47); non-infectious upper respiratory conditions (includes rhinitis, sinusitis, laryngitis) (J30–39); diabetes mellitus (E10–E14); heart, stroke and vascular disease (I20–I25, I60–I69, I50, I70–I79); arthritis and osteoporosis (M00–M25, M80–M82); mental and behavioural disorders (F30–F39, F40–F48, F90–F98); and malignant neoplasms (i.e. cancer) (C00–C97). Of all people hospitalised with asthma in 2005–06, 40% had at least one of these selected comorbid conditions. CI = confidence interval.

Source: AIHW National Hospital Morbidity Database.

5.2.7 Asthma as an additional diagnosis in people admitted to hospital with other conditions

Asthma was an additional diagnosis in 33,686 hospital separations in 2005–06, representing 0.5% of all hospital separations in that year where asthma was not the principal diagnosis (7,274,054 separations).

For patients admitted to hospital with an additional diagnosis of asthma in 2005–06, the most common principal diagnosis was influenza, pneumonia or other acute lower respiratory tract infection. Admissions with these lower respiratory tract infections accounted for 14% of separations where asthma was recorded as an additional diagnosis. For all patients admitted to hospital with a principal diagnosis of influenza, pneumonia or other acute lower respiratory tract infection in 2005–06, 40% had asthma recorded as an additional diagnosis. The likelihood of having asthma recorded as an additional diagnosis when the principal diagnosis was influenza, pneumonia or other acute lower respiratory tract infection decreased with age (96% of those aged 0–14 years compared with 17% of those aged 65 years and over), and was higher for females (48%) than males (32%).

Only just over 1% of all patients admitted to hospital with a principal diagnosis of COPD or bronchiectasis in 2005–06 had asthma recorded as an additional diagnosis. Younger people (5.3% of those aged 0–14 years) were more likely than older people (0.9% of those aged 65 years and over), and females (1.6%) were more likely than males (0.8%), to have asthma recorded as an additional diagnosis when COPD or bronchiectasis was the principal diagnosis.

The most common principal diagnoses associated with an additional diagnosis of asthma varied with age. The most common principal diagnosis among people aged 35–64 years was diseases of the digestive system while among people aged 65 years and over the most frequent principal diagnosis was circulatory disease. Presumably, these differences reflect the relative importance of these conditions as causes of hospitalisation in these age groups.

Summary

Children have high rates of hospitalisation for asthma compared with adults, but adults tend to stay in hospital for asthma longer than children. There was an overall reduction in the rate of hospital admissions for asthma among children (42%) and among adults (45%) between 1993–94 and 2006–07. A reduction in the average length of stay for asthma admissions was also observed over the same period.

Children represent a far greater proportion of hospital admissions for asthma (58%) than total hospital admissions (7%).

Peaks in hospitalisation rates for asthma occur during winter among adults, while among children, the rate of hospitalisation for asthma is highest in February and May. A broadly similar seasonal pattern is observed in emergency department attendances.

Boys have higher rates of hospitalisation for asthma than girls. However, from age 14 years onwards, this trend is reversed and females have a higher rate of hospitalisation for asthma than males. These patterns are consistent with those observed for asthma prevalence and the rate of GP encounters for asthma.

Among adults, the rate of hospital separations for asthma increases with increasing remoteness. This trend is reversed among children, where the rate of hospital separations for asthma decreases with increasing remoteness.

Hospital separations for asthma are higher among those from an English-speaking background and those residing in disadvantaged localities.

Respiratory infections and asthma are commonly associated causes of admission to hospital.
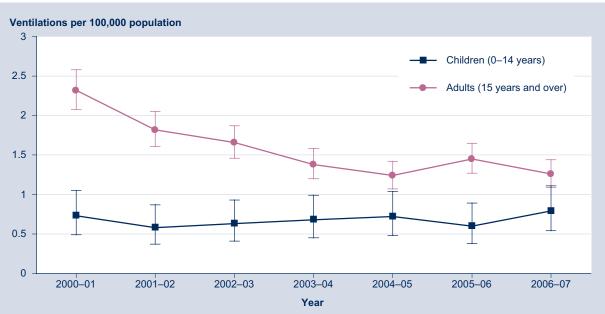
5.3 Invasive mechanical ventilation

A small proportion of people with severe exacerbations of asthma either stop breathing altogether or decrease their breathing to such an extent that they are at risk of stopping breathing. This represents a severe, imminently life-threatening event and can only be averted by the introduction of artificial mechanical ventilation via an endotracheal tube attached to a positive pressure ventilator, otherwise known as a 'life support machine'. This procedure is sometimes referred to as invasive mechanical ventilation to distinguish it from a non-invasive form of ventilation that is used in less severe circumstances. Monitoring trends and differentials in the occurrence of this event, which is routinely recorded in hospital statistics, provides insights into the epidemiology of severe, life-threatening asthma and, possibly, asthma deaths.

Within the National Hospital Morbidity Database, information is included about procedures during hospital care. This section presents data relating to the use of mechanical ventilation where the principal diagnosis was asthma. A list of all the procedure codes included in these analyses is provided in Appendix 1 (Section A1.9.5).

Between 2002–03 and 2006–07, 1,263 people admitted to hospital with a principal diagnosis of asthma required mechanical ventilation, 138 of whom were 'same-day separations'. In 2006–07, the overall age-adjusted rate of mechanical ventilation for asthma was 11.7 per 1,000 hospital separations for asthma.

5.3.1 Time trends

Between 2000–01 and 2004–05, there was a gradual decline in the rate of hospital separations requiring mechanical ventilation among people aged 15 years and over: from 2.32 to 1.24 per 100,000 population (Figure 5.30). In 2006–07, the rate among people aged 15 years and over was 1.26 per 100,000 population. In contrast, the trend among children has remained relatively constant during this same period (range 0.58–0.79 per 100,000 population).

Notes: Age-standardised to the Australian population as at 30 June 2001. Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46.

Sources: AIHW National Hospital Morbidity Database; Australian Bureau of Statistics.

Figure 5.30: Hospital separations for asthma with invasive mechanical ventilation per 100,000 population, by age group, 2000–01 to 2006–07

A similar trend has been observed for the age-adjusted proportion of adults and children admitted with asthma who required mechanical ventilation (Figure 5.31). There was a gradual decline in the proportion of adults admitted with asthma who required invasive mechanical ventilation between 2000–01 and 2004–05 (from 15.9 to 12.4 per 1,000 separations) and then a recent rise (14.3 per 1,000 asthma separations in 2006–07). Over the same period, there was little change in the proportion of children aged 0–14 years who required mechanical ventilation during a hospital stay for asthma.

Notes: Age-standardised to the Australian population as at 30 June 2001. Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46.

Source: AIHW National Hospital Morbidity Database.

Figure 5.31: Proportion of hospital separations for asthma with invasive mechanical ventilation, by age group, 2000–01 to 2006–07

5. Use of health services: Invasive mechanical ventilation

5.3.2 Population subgroups

Age and sex

During 2002–03 to 2006–07, adults aged 35–64 years had the highest age-adjusted proportion of hospital separations for asthma that were associated with a period of invasive mechanical ventilation (Figure 5.32). Patients aged 65 years and over with asthma were significantly less likely than those aged 15–64 years to have undergone invasive mechanical ventilation, which may reflect a lower average level of severity among separations in this age group. However, an active decision on the part of patients, families and clinicians not to instigate invasive mechanical ventilation on certain patients approaching the end of life may also have contributed to this trend.

Males aged 0–14 years with asthma required invasive mechanical ventilation at an age-adjusted rate that was 1.6 times as high as that for females of the same age (2.2 per 1,000 admitted patients compared with 1.3 per 1,000; p = 0.0029). Among people aged 15 years and over, the age-adjusted rate for males aged 35–64 years was 1.2 times as high as the corresponding rate for females (17.5 per 1,000 admitted patients compared with 14.6 per 1,000; p = 0.0373) but there were no major differences between males and females aged 15–34 years or 65 years and over in the likelihood of using invasive mechanical ventilation.

Ventilations per 1,000 hospital separations for asthma

Notes: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46.

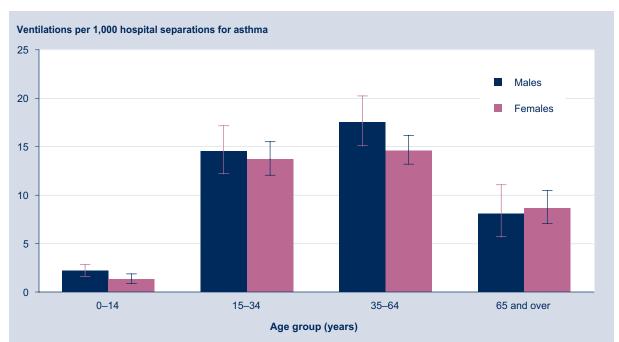*Source:* AIHW National Hospital Morbidity Database.

Figure 5.32: Rate of hospital separations for asthma with invasive mechanical ventilation, by age, 2002–03 to 2006−07

Country of birth

Older adults of non-English-speaking background were more likely to require invasive mechanical ventilation during a hospital separation for asthma than those from an English-speaking background (Figure 5.33). Among those aged 35–64 years, people of non-English-speaking background had an age-adjusted rate of invasive mechanical ventilation that was 1.4 times as high as that for people with an English-speaking background ($p = 0.0026$). This may reflect more severe disease and, possibly, delayed implementation of effective treatment for exacerbations in people aged 35–64 years of non-English-speaking background.

Notes: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46. English-speaking background includes anyone born in Australia, New Zealand, Canada, United Kingdom, Ireland, United States of America, South Africa or Zimbabwe. Non-English-speaking background includes all those born in other countries.

Source: AIHW National Hospital Morbidity Database.

Figure 5.33: Rate of hospital separations for asthma with invasive mechanical ventilation, by age and country of birth, 2002–03 to 2006–07

5. Use of health services: Invasive mechanical ventilation

5.3.3 Mortality and morbidity

While mechanical ventilation for asthma is a relatively rare event, people who are admitted to hospital with asthma and who require mechanical ventilation have a longer length of stay and a greater risk of dying in hospital compared with other patients admitted with asthma.

Between 2000–01 and 2006–07, there were 1,949 people admitted to hospital with a principal diagnosis of asthma who required invasive mechanical ventilation. The average length of stay over this period was much higher among those that required invasive mechanical ventilation (9.5 days) than among those that did not require the procedure (2.4 days) (Table 5.2). Of those who required mechanical ventilation, 7.9% died in hospital compared with 0.1% of those who were hospitalised with asthma but did not require mechanical ventilation. Children aged 0–14 years accounted for a minority (5.3%) of hospital deaths among those requiring mechanical ventilation while 6.3% occurred in people aged 15–64 years.

Table 5.2: Average length of stay and proportion of hospital deaths among those who did and did not require invasive mechanical ventilation during a hospital admission for asthma, all ages, 2000–01 to 2006–07

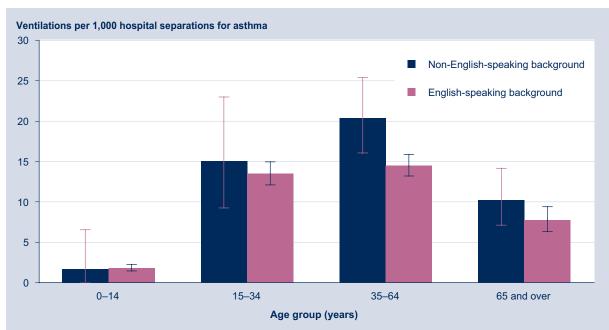|	Mechanical ventilation		No mechanical ventilation	
Year	Average length of stay (days)	Proportion of hospital deaths (%)	Average length of stay (days)	Proportion of hospital deaths (%)
2000–01	10.9	8.6	2.5	0.1
2001–02	10.1	6.9	2.5	0.1
2002–03	9.4	7.4	2.4	0.1
2003–04	8.8	10.1	2.3	0.1
2004–05	8.6	4.8	2.3	0.1
2005–06	9.2	8.0	2.2	0.1
2006–07	8.4	8.7	2.2	0.1
2000–01 to 2006–07	**9.5**	**7.9**	**2.4**	**0.1**

Notes: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46.
Source: AIHW National Hospital Morbidity Database.

Between 2003–04 and 2005–06, the proportion of people aged 65 years and over who died during a hospital admission for asthma in which mechanical ventilation was required was between 21% and 24% but in 2006–07 it decreased to 10%. Over the same period, the proportion aged 15–64 years who died ranged from 3% to 10% (data not shown). Overall, those aged 65 years and over were 3.7 times (95% CI 2.5–5.4) more likely to die in hospital after undergoing invasive mechanical ventilation than those aged 15–64 years ($p < 0.0001$).

Summary

The use of invasive mechanical ventilation signifies active management of a severe, life-threatening exacerbation of asthma. It is a rare event among people admitted with asthma; only 241 out of 36,588 people admitted with asthma required invasive mechanical ventilation during 2006–07. Patients who required invasive mechanical ventilation for asthma in 2006–07 had a much longer average length of stay (8.4 days) and a higher rate of mortality in hospital (8.7%) than those who did not require the procedure during their asthma admission (2.2 days and 0.1%, respectively). Among children, the rate of mechanical ventilation for asthma is very low compared with adults. Older adults from non-English-speaking backgrounds who are admitted to hospital with asthma are more likely to require invasive mechanical ventilation than people from English-speaking backgrounds.

5.4 Health-care expenditure due to asthma

Understanding the contribution of asthma to direct health-care expenditure aids understanding of the economic impact of the disease. Furthermore, knowledge of the relative contribution of the various health care-sectors (admitted patient, out-of-hospital medical care and prescription pharmaceuticals) to overall asthma-related expenditure, as well as changes over time, assists in planning interventions to optimise this expenditure.

Health expenditure is a term used to describe the actual amount spent on health-care services. Here, data from the AIHW disease expenditure database are used to describe health expenditure for asthma in Australia. All health expenditure data reported here represent allocated, recurrent health expenditure. For the purposes of this report, the term 'total allocated health expenditure' will be used to refer to the sum of total allocated health expenditure for all health conditions while 'asthma expenditure' is the component of total allocated health expenditure that is attributed to health care for asthma.

In the 2004–05 financial year, asthma expenditure was $606 million. This represented 1.2% of total allocated health expenditure in that year.

5.4.1   Expenditure by health sector

Health expenditure presented here is assigned to one of four sectors:

1. 'Admitted patient' comprises admitted patient public and private hospital services expenditure (same-day as well as overnight admissions). This category also includes expenditure for medical services provided to private admitted patients in hospitals.

2. 'Out-of-hospital medical' is primarily care in the community from general practitioners as well as specialists, imaging and pathology services. Specifically, it includes MBS unreferred attendances, imaging, pathology, specialist, other medical MBS and any other medical services expenditure for 2004–05 reported in *Health expenditure Australia 2005–06* that has not been counted elsewhere.

3. 'Prescription pharmaceuticals' includes benefit paid pharmaceuticals (Pharmaceutical Benefits Scheme (PBS) and Repatriation Pharmaceutical Benefits Scheme (RPBS) pharmaceuticals), under-copayment prescriptions and private prescriptions.

4. 'Other' expenditure comprises expenditure on optometrical services, dental, community mental health, public health cancer screening and research. For asthma expenditure, the category 'other' only comprises expenditure on research, since the other components are not applicable.

Methods for allocating expenditure to these sectors are provided in more detail in Appendix 1, Section A1.5.

5. Use of health services: Health-care expenditure due to asthma

Over half (59%) of all asthma expenditure in 2004–05 was attributed to prescription pharmaceuticals (Figure 5.34). This was substantially higher than the proportion of total health expenditure attributed to prescription pharmaceuticals (15%). On the other hand, a substantially lower proportion of asthma expenditure was attributed to admitted patient hospital care (16%) compared with total allocated health expenditure (46%).
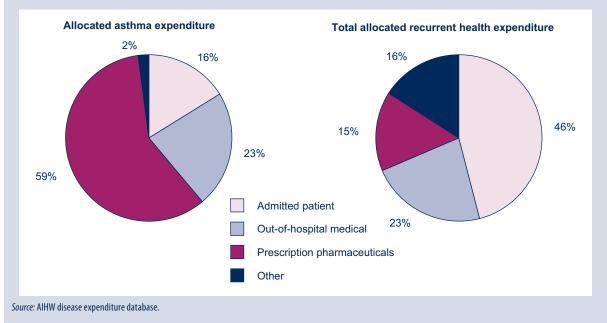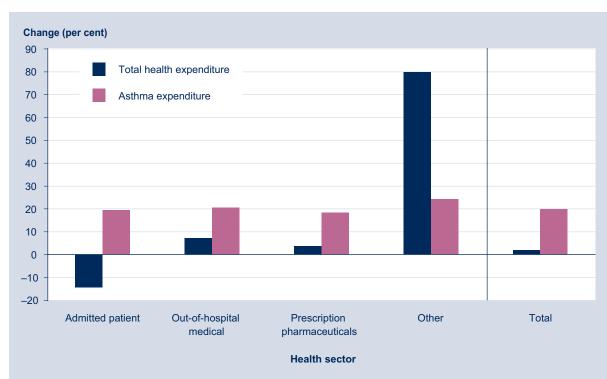

Source: AIHW disease expenditure database.

Figure 5.34: Allocated expenditure for asthma and total recurrent health expenditure, by sector, 2004–05

5.4.2 Changes in expenditure between 2000–01 and 2004–05

After adjusting for inflation, asthma expenditure increased by 1.8% in all sectors combined during the period 2000–01 to 2004–05, which was much less than the 19.7% increase in total allocated health expenditure over this period (Figure 5.35). The largest increase in asthma expenditure was for 'other' expenditure, which rose by 79.9% between 2000–01 and 2004–05, representing an average annual growth of 15.8%. This annual growth in 'other' expenditure for asthma is solely attributable to a relative increase in research funding for asthma. In comparison, the growth in research funding for total allocated health expenditure was 24.2% (5.6% per year). In the admitted patient sector, asthma expenditure decreased by 14.3% while total allocated health expenditure for admitted patients increased by 19.6%.

There was a rise in out-of-hospital medical services expenditure for asthma, which includes unreferred attendances, imaging, pathology and other medical services, between 2000–01 and 2004–05. There was an increase in the cost per service for unreferred attendances, imaging and other medical services over that period. There was also an increase in the number of claims for imaging, pathology and other medical services for asthma in 2004–05 compared to 2000–01. However, there was a decrease in the number of unreferred attendances for asthma over this period. The net increase in the spending on out-of-hospital medical services for asthma between 2000–01 and 2004–05 can be attributed to the combination of these effects.

Change (per cent)

■ Total health expenditure

■ Asthma expenditure

Health sector

Source: AIHW disease expenditure database.

Figure 5.35: Per cent change in allocated health expenditure, total recurrent and asthma, by sector, 2000–01 to 2004–05 (2004–05 prices)

Kenny et al. (2005) quantified the costs of services and products for asthma to both individuals and the health sector using data from a cohort study of people with asthma in New South Wales. Survey participants were identified from the community (*n* = 208) and from people who had attended an emergency department for asthma (*n* = 37). While the sample was not representative of people with asthma in New South Wales, the study provided information about the range of costs and the major cost components. General practitioner visits were the most frequently used health service and the annual cost of these visits ranged from $0 to $649 per person. Medications to manage asthma, including non-prescription drugs, were the most commonly used products, with the annual cost to individuals ranging from $0 to $668 per person. Prescription medications were the only product cost to the health sector and ranged from $0 to $2,757 per person over the year. While only 8% of the study participants were admitted to hospital for their asthma during the year, hospital admissions were the largest component of the cost to the health sector with the annual cost per person ranging from $0 to $23,766.

5.4.3   Other economic impacts of asthma

Direct health expenditure for asthma care is only one component of the costs of asthma. However, at present there are few data on other aspects of the economic burden of asthma: for example, personal expenditure related to asthma and costs incurred by families and carers of people with asthma. The impact of asthma on social and economic participation, including ability to work or study, engage in social interaction and perform other expected roles, also contributes to the economic burden attributable to asthma.

5. Use of health services: Health-care expenditure due to asthma

Methods to value individual components of these 'indirect' costs in financial terms are controversial and not universally regarded as valid (Drummond et al. 1997). The nature of these costs is such that they often do not relate exclusively to asthma, and the component attributable to asthma cannot be reliably determined. One approach to quantifying the economic impact of asthma, and other diseases, more broadly than simply by measuring direct health-care expenditure, is the 'burden of disease approach', which has been implemented in the Global Burden of Disease Study (Murray & Lopez 1994). In this approach, the impact of disease is quantified in terms of impact on survival ('years of life lost') and impact on functional capacity ('years of life disabled'). The combined effect of both of these impacts is summarised as disability-adjusted life years (DALYs), which quantify the burden attributable to a specific disease. One DALY represents one year of lost 'good health'. It is a summary measure that reflects the overall impact of a particular disease due to morbidity and mortality. The DALY is one measure for capturing the indirect costs of specific diseases by quantifying the impact on an individual's experience of life in less-than-ideal good health (AIHW: Mathers et al. 1999).

In 2003, asthma was estimated to account for 2.4% of the total disease burden in Australia as measured by DALYs (AIHW: Begg et al. 2007).

The cost to individuals of having asthma has also been estimated recently in the cohort study of people with asthma in New South Wales described earlier (Kenny et al. 2005). The median costs per person were $89 per year (range $0 to $4,882). The median costs included $8 for services and $40 for medications and asthma-related equipment (Kenny et al. 2005).

Summary

In summary, there are substantial health costs both to government and to individuals attributable to asthma care. However, the overall increase in the direct health-care costs attributable to asthma has been modest, largely due to the decrease in hospital admissions for asthma over recent years.

6. Management

Key points

Asthma action plans

- The majority of people with asthma do not have a written asthma action plan, despite national guidelines recommending their use for the management of asthma for nearly 20 years.
- Young men and those living in socioeconomically disadvantaged areas are less likely to possess a written asthma action plan than others.

Medications used to treat asthma

- Drug therapy is the mainstay of asthma management.
- The use of almost all medications for asthma increases with age.
- The pattern of use of asthma therapies is quite different in children compared with adults.
- Use of inhaled corticosteroids is less common in children than in adults with asthma.
- Most children using inhaled corticosteroids are only dispensed one prescription per year.
- Children are more commonly prescribed the less potent formulations of inhaled corticosteroids while prescriptions for combination formulations containing long-acting beta-agonists are relatively uncommon in children.
- Among adults, the majority of inhaled corticosteroids are prescribed in combination with long-acting beta-agonists.
- There has been a recent reduction in prescribing the most potent formulations of inhaled corticosteroids.
- Intermittent use of inhaled corticosteroids is the most common mode of use in adults and children, despite treatment guidelines recommending regular use in people with persistent asthma.

Introduction

This chapter will review data relating to the use of effective asthma management strategies and their implementation in the Australian population. The two elements of asthma management that are discussed here are the possession of *written asthma action plans* and regular *use of medications* that control the disease and prevent exacerbations. Based on evidence accumulated in the last two decades, these represent key elements in the effective management of the condition.

6.1   Written asthma action plans

A written asthma action plan enables people with asthma to recognise deterioration in their condition promptly and respond appropriately, by integrating changes in symptoms or peak expiratory flow measurements with written instructions to adjust medication. The aim of an asthma action plan is to help the process of early intervention and to prevent or reduce the severity of acute asthma episodes. It has been found that use of a written asthma action plan reduces the need for extra medication, urgent visits to doctors, hospitalisations and deaths as well as improves lung function (Abramson et al. 2001; Gibson et al. 2004). Written asthma action plans have formed part of national guidelines for the management of asthma since 1989 (Woolcock et al. 1989) and have been promoted in public education campaigns by the National Asthma Council Australia (NAC 2006).

6.1.1 Possession of written asthma action plans

Less than one-quarter (22.5%) of Australians with asthma reported possessing a written asthma action plan in 2004–05 (Table 6.1). Of those who possessed a written asthma action plan in 2004–05, more than 90% were obtained from doctors and about three-quarters were considered 'standard', that is, similar to that recommended by the National Asthma Council Australia.

Recent estimates of the possession of asthma action plans from state health surveys vary. Relatively high rates were reported in New South Wales in 2005 and 2006 (46% and 38%, respectively) and Victoria in 2006 (54%) (Table 6.1). Estimates of possession from among adults with asthma in Queensland and South Australia were closer to the national average, at around 18.5–20.8%. Some of the apparent variation between surveys (and, hence, states) may be due to differences in the way asthma action plans were described to participants.

Table 6.1: Possession of asthma action plans by people with current asthma, 2001–2006

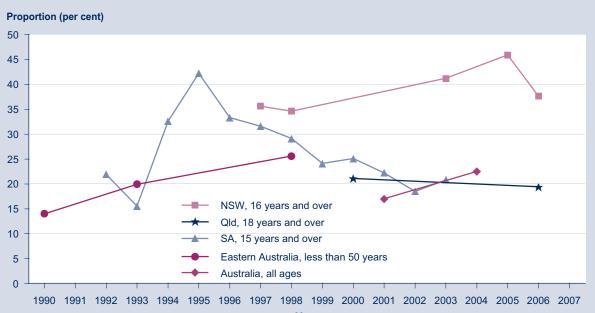| Place	Age (people with current asthma)	Year	Rate (%)	95% CI
Possession of a written asthma action plan				
Australia (1)	All ages (*n* = 2,782)	2004–05	22.5	20.6–24.3
Australia (1)	15 years and over (*n* = 2,202)	2004–05	18.8	16.8–20.8
Possession of a written asthma management plan from doctor on how to treat your asthma				
New South Wales (2)	16 years and over (*n* = 886)	2006	37.6	33.2–42.0
New South Wales (3)	16 years and over (*n* = 1,282)	2005	45.9	42.1–49.7
Possession of a written asthma action plan from doctor				
Victoria (4)		2006	53.7	48.6–58.8
Possession of written instructions from their doctor about how to manage worsening asthma				
Australia (5)	16 years and over (*n* = 1,006)	2003–04	21.6	19.1–24.1
As far as you are aware, do you have a treatment plan for your asthma?				
Queensland (6)	18 years and over (*n* = 382)	2006	19.4	15.5–24.0
Possession of an asthma action plan (written instructions on what to do if asthma is out of control)				
South Australia (7)	15 years and over	2003	20.8	n.a.
South Australia (7)	15 years and over	2002	18.5	n.a.
CHILDREN				
Possession of a written asthma management plan from a doctor on how to treat asthma				
New South Wales (8)	2–12 years (*n* = 1,296)	2001	43.6	40.1–47.2
Proportion who have written asthma action plans				
Victoria (9)	1 to under 13 years	2006	62.6	58.0–67.2

n.a. not available

Notes

1. Only people with current asthma (*n*) were asked about the possession of asthma action plans. The definitions for current asthma were: New South Wales Survey, Victorian Child Health and Wellbeing Survey and Queensland Chronic Disease Survey—doctor diagnosis of asthma plus treatment or symptoms of asthma in the last 12 months; Victorian Population Health Survey—symptoms of asthma in the last 12 months; National Health Survey and South Australian Omnibus—'yes' to the question 'Have you ever been diagnosed by a doctor with asthma?' and 'yes' to 'Do you still have/get asthma?'

2. While the currently accepted term for written instructions on how to manage one's asthma is an 'asthma action plan', it was previously known as an 'asthma management plan'. As a result, the questions used in some surveys reported in the table refer to an 'asthma management plan' while others refer to an 'asthma action plan'.

Sources: (1) Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files; (2) 2006 Report on Adult Health from the New South Wales Population Health Survey (Centre for Epidemiology and Research 2007); (3) 2005 Report on Adult Health from the New South Wales Population Health Survey (Centre for Epidemiology and Research 2006); (4) Department of Human Services, Victorian Population Health Survey 2006; (5) Australian Asthma Survey (Marks et al. 2007); (6) Queensland Chronic Disease Survey; (7) South Australian Health Omnibus Survey (Wilson et al. 2006); (8) New South Wales Child Health Survey (Centre for Epidemiology and Research 2002); (9) Victorian Child Health and Wellbeing Survey 2006.

6.1.2 Time trends

There was a rise in the proportion of adults with asthma who reported they had asthma action plans between 1992 and 1995 (Figure 6.1). Since that time, the rate of ownership declined in the South Australian series. More recent survey results show an increase in the possession of asthma action plans in New South Wales and nationally. In 2005, almost half (46%) of people aged 16 years and over with asthma in New South Wales reported possessing an asthma action plan. Data from the NHS (all ages) show that, overall, significantly more people with asthma had a written asthma action plan in 2004–05 (22.5%) than in 2001 (17%).

Notes: Only people with current asthma were asked about the possession of asthma action plans. Definitions used to identify asthma action plans are—Australia and South Australia: current asthma = 'yes' to the question 'Have you ever been diagnosed by a doctor with asthma?' and 'yes' to 'Do you still have asthma?' then asked 'Do you have an asthma action plan (written instructions of what to do if your asthma is out of control)?'; New South Wales: current asthma = doctor diagnosis of asthma plus treatment or symptoms of asthma in the last 12 months, 'Do you have a written asthma action plan?'; eastern Australia: current asthma = self-reported diagnosis of asthma, 'Do you have a written asthma action plan?'.

Sources: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey confidentialised unit record files, Queensland Chronic Disease Survey, New South Wales Population Health Survey, South Australian Omnibus, Comino et al. 1996; Gibson et al. 2000; Public Health Division 2001; Wilson et al. 2002; Wilson et al. 2003.

Figure 6.1: Possession of asthma action plans by adults with current asthma, Australia, 1990–2007

6.1.3 Population subgroups

Age and sex

Children with asthma who were aged 5–14 years were significantly more likely to have a written asthma action plan than people aged 15 years and over (Figure 6.2). Among those aged 15–64 years, more females than males had a written asthma action plan ($p < 0.0001$).

States and territories

In 2004–05, the proportion of people with current asthma who reported having a written asthma action plan was relatively low in Western Australia (15%) compared with the national average (22.5%) (Figure 6.3).

Proportion (per cent)

Notes: Age-standardised to the Australian population as at June 2001.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files.

Figure 6.2: Possession of a written asthma action plan by people with asthma, by age and sex, 2004–05

Proportion (per cent)

Notes: Age-standardised to the Australian population as at June 2001. The Northern Territory and the Australian Capital Territory are excluded because numbers were too small to produce reliable estimates.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files.

Figure 6.3: Possession of a written asthma action plan by people with current asthma, by state and territory, all ages, 2004–05

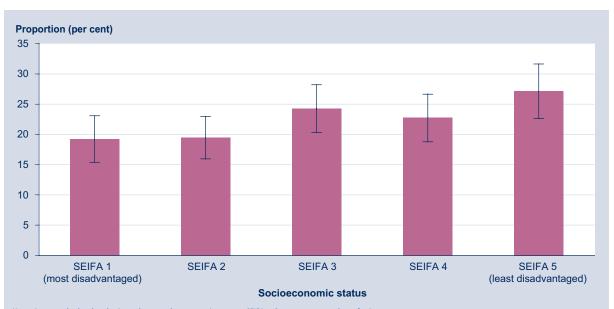**6. Management: Written asthma action plans**

Urban, rural and remote areas

Data from the two most recent National Health Surveys conducted in 2001 and 2004–05 show that, overall, possession of a written asthma action plan did not differ significantly between those living in major cities, inner regional areas or other areas of Australia (data not shown). In New South Wales in 2006, there was also no difference in possession of asthma action plans among people living in urban versus rural areas (Centre for Epidemiology and Research 2007).

Socioeconomic disadvantage

Australian data show a lower rate of possession of written asthma action plans among people with asthma living in localities with greater levels of socioeconomic disadvantage. In 2004–05, the proportion of people with current asthma who reported having a written asthma action plan was highest among those living in the most advantaged localities of Australia (27%) and lowest for those living in the most disadvantaged localities (19%) (Figure 6.4). There was a significant overall trend of increasing rates of possession of plans with higher levels of socioeconomic advantage (p trend = 0.002).

In contrast, data from the New South Wales Health Survey Program show no evidence of significant variation according to socioeconomic disadvantage of locality (Centre for Epidemiology and Research 2007). A study of children in Victoria also found no evidence of such a trend (Vuillermin et al. 2007), with children residing in disadvantaged areas just as likely to have been provided with a written asthma plan than children residing in less disadvantaged areas (p = 0.81).

Notes: Age-standardised to the Australian population as at June 2001. SEIFA = Socio-economic indexes for Areas

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files.

Figure 6.4: Possession of a written asthma action plan by people with current asthma, by socioeconomic status, Australia 2004–05

Summary

Although written asthma action plans have been recommended in national guidelines for the management of asthma for almost 20 years, the majority of people with asthma do not have one. Young adults, particularly men, those living in socioeconomically disadvantaged areas and those living in Western Australia were least likely to possess a written asthma action plan in 2004–05.

6.2 Medications used to treat asthma

Drug therapy is the mainstay of asthma management. Broadly speaking, there are three ways in which medications are used in the treatment of asthma:

1. to relieve symptoms when they occur

2. to control the disease and attempt to prevent symptoms and exacerbations (or 'flare ups')

3. to treat exacerbations of the disease.

The most commonly used class of medications for relief of symptoms are short-acting beta-agonists (salbutamol and terbutaline). However, rapid-onset, long-acting beta-agonist drugs (formoterol; see Box 6.1) (O'Byrne et al. 2005) and short-acting anti-cholinergic drugs (ipratropium) can also be used for this purpose in some management plans.

There is evidence from systematic reviews that inhaled corticosteroids (beclomethasone, budesonide and fluticasone) are highly effective for the second purpose, to minimise symptoms and prevent exacerbations (Adams et al. 2003, 2004a, 2005). Recent analyses of data from clinical trials have demonstrated that most people with asthma can be well controlled with relatively low doses of inhaled corticosteroids, resulting in a low risk of adverse effects (Powell & Gibson 2003). The addition of long-acting beta-agonists to inhaled corticosteroids, now available in combined formulations (salmeterol+fluticasone and formoterol+budesonide), allows equivalent or greater effectiveness in disease control with lower doses of inhaled corticosteroids (Greening et al. 1994). Leukotriene receptor antagonists (montelukast and zafirlukast) are also used for disease control, though they are less effective than inhaled corticosteroids (Ng et al. 2004). Cromones (cromoglycate and nedocromil) have been traditionally used for the prevention of asthma exacerbations in children but evidence for their effectiveness for this purpose is generally lacking.

Oral corticosteroids have long been the mainstay of treatment for *exacerbations* of asthma. The role of intermittent use of inhaled corticosteroids or short-term increases in the maintenance or usual dose of inhaled corticosteroids remains uncertain.

Box 6.1: Formoterol

Note that formoterol has only been shown to be safe to use as a 'reliever' when used in a combination formulation with budesonide and when that formulation is taken regularly, twice daily, as well as on an 'as required' basis (O'Byrne et al. 2005).

Guidelines for the management of asthma (GINA 2006; NAC 2006) generally recommend a stepwise approach to management, aiming to optimise asthma control, with intermittent use of medications to relieve symptoms when they occur, regular (daily or twice daily) use of medications to control the disease and prevent symptoms and exacerbations, and occasional short courses of oral corticosteroids to treat disease exacerbations. Different classes of medications are used for each of these purposes, as outlined above. However, recent evidence has demonstrated that an alternative approach, in which a combined rapid-onset long-acting bronchodilator and inhaled corticosteroid (formoterol+budesonide) is used twice daily to control the disease and also as required for the relief of symptoms (O'Byrne et al. 2005), is also effective in achieving good disease control.

6.2.1 Monitoring use

Since appropriate use of medications for asthma improves disease outcomes, disparities in the use of medication are almost certainly relevant to disparities in outcomes of asthma. Under-use of medication to control the disease does occur in poor areas in the United States of America (USA) and Great Britain. Furthermore, adherence to use of various types of medication, including inhaled corticosteroids, is also lower among those with lower socioeconomic status (Apter et al. 1998; Wamala et al. 2007) and in African Americans compared to others in the USA (Bosworth et al. 2006; Charles et al. 2003a).

A central issue in determining the appropriateness of use of medications for asthma is the underlying severity of asthma and the level of asthma control at the time the medications were prescribed. However, it is usually not possible to determine from survey data or prescription data whether the level of treatment that has been prescribed or dispensed is appropriate for the level of disease severity or control (Khan et al. 2003). In the absence of information on disease severity and control, information on the use of medications must be interpreted with caution.

In this chapter, we review data on use of medications for the treatment of asthma in Australia, focusing in particular on medications used to control the disease, principally inhaled corticosteroids. Data on other principal classes of medications are also presented. Various sources of data have been used for this purpose.

6.2.2 Sources of data

Pharmaceutical Benefits Scheme (PBS) data

Information on reimbursements for the purchase of prescription medications is available from the PBS and the Repatriation Pharmaceutical Benefits Scheme (RPBS) databases. An important limitation of these data is that the databases only include records for prescriptions that were subsidised by the PBS and RPBS. The PBS currently subsidises the cost of approximately 80% of prescription medications dispensed in Australia (DoHA 2006). However, even for these items that are covered by the PBS or RPBS, subsidies are only paid, and hence recorded in the database, where the cost of the medication is more than the copayment amount. The copayment amount is the amount the consumer pays. The government subsidises any additional amount above the copayment. The copayment amount differs substantially between general patients and those who hold government health-care concession cards. For the former, the copayment amount ranged from $22.40 in 2002 to $30.70 in 2007, whereas for people holding concession cards, the copayment amount ranged from $3.60 in 2002 to $4.90 in 2007. This means that many medications are far cheaper to those with concession cards. The implications of this limitation and the way in which we have dealt with it in this report are described below.

All long-acting beta-agonist preparations (except Oxis 6 Turbuhaler in 2005 and 2006; see Appendix 1, Table A1.7) and all combined long-acting beta-agonist and inhaled corticosteroid preparations are at a price higher than the PBS copayment amount for general patients. Hence, the PBS database contains a complete record of prescriptions in Australia for these medication classes.

Most inhaled corticosteroid preparations cost more than the PBS copayment amount for those without a concession card but some formulations cost less and, hence, were not captured on the PBS database (see Appendix 1, Table A1.7). Since the PBS schedule changes frequently throughout the year, the prescriptions covered by the scheme can vary within a year and from year to year.

Short-acting beta-agonists and oral corticosteroids cost less than the PBS copayment amount and are only subsidised by the PBS when the patient is a concession card holder. For this reason, our PBS analysis of short-acting beta-agonist and oral corticosteroid prescriptions has been limited to those dispensed to concession card holders.

Short-acting beta-agonists are also available 'over the counter', that is, without a prescription. However, the over-the-counter cost is greater than the copayment for a concession card holder who uses a prescription, which means there is a financial incentive for concession card holders to purchase short-acting beta-agonists with a doctor's prescription. Therefore, it is assumed that most, though not all, short-acting beta-agonists dispensed to people with a concession card are supplied with a prescription and recorded on the PBS database.

The PBS database, which was designed for administrative purposes, has included patient Medicare numbers with all prescription details since 2002. Use of the Medicare number has allowed us to anonymously identify prescriptions for the same individuals within the PBS data and also to link information on age, sex and home postcode using an encrypted Medicare patient identification number. In this way, it is ensured that patient confidentiality is protected.

IMS Health data

Information on the wholesale supply of medications in the community is available from IMS Health, a commercial market information company. IMS Health collects data from all pharmaceutical wholesalers about the sale of both prescription and non-prescription medications to the hospital and community sectors. Since these are wholesale supply data, they do not include any information about the individuals who purchased the medications. See Appendix 1, Section A1.8, for more details about these data sources.

Unfortunately, data from the PBS and IMS Health do not contain information on the reason for which the drug was prescribed. The medications that are used for asthma are also used for the treatment of some other respiratory illnesses, in particular, chronic obstructive pulmonary disease (COPD) among older people and wheezy bronchitis in young children. For this reason, medication use within the subgroup of people aged 5–34 years is described separately in this chapter. In this age group, COPD is very uncommon and wheezy bronchitis is a relatively uncommon diagnosis and, therefore, the medications were more likely to have been used for asthma.

Health surveys, including the ABS NHS, are the best source of information about *actual use* of medication by people with asthma and we have included some information from the 2004–05 NHS. Information about how asthma medications are prescribed in general practice is provided in Section 5.1.

In the following sections, we describe the rate of medication use for asthma and other respiratory conditions in the community as a whole and assess variation by age group, sex, socioeconomic status and remoteness of residence.

6. Management: Medications used to treat asthma

6.2.3 Time trends in the supply of medications for asthma and other respiratory disorders

Figure 6.5 shows the trend in the supply of various medications from IMS Health (wholesalers) as well as the trend in the PBS data (reimbursement of prescriptions) for medications commonly used to treat asthma since the mid-1990s. The trend data are expressed in units of defined daily doses (DDDs) per 1,000 population per day. This unit of measurement represents a standardised measure of medication dosage, allowing data for different members of the same class to be combined and various classes to be compared, using a common currency. See Appendix 1, Section A1.8.3, for more details of these calculations.

Short-acting beta-agonists, mainly salbutamol and terbutaline, remain the most commonly supplied class of medications among those used to treat respiratory disorders in Australia (Figure 6.5a). This class of medication is commonly dispensed over the counter, that is, without a prescription. Therefore, we have also incorporated information from the Pharmacy Guild Survey in our estimation of reimbursed prescriptions for short-acting beta-agonists (Figure 6.5b) which takes into account over-the-counter purchases. According to this survey, approximately 27–30% of short-acting beta-agonists were purchased over-the-counter between 2002 and 2006 (DoHA 2007b). Short-acting beta-agonists and anti-cholinergics are also commonly used in patients hospitalised with respiratory illness, where they are dispensed by hospital pharmacies. In this case, usage would be recorded in the IMS Health data but not in the PBS and Pharmacy Guild Survey data. Apart from the difference observed in the case of short-acting beta-agonists, the IMS Health data on wholesale supply and combined PBS and Pharmacy Guild Survey data on reimbursed prescriptions agree very closely (Figure 6.5).
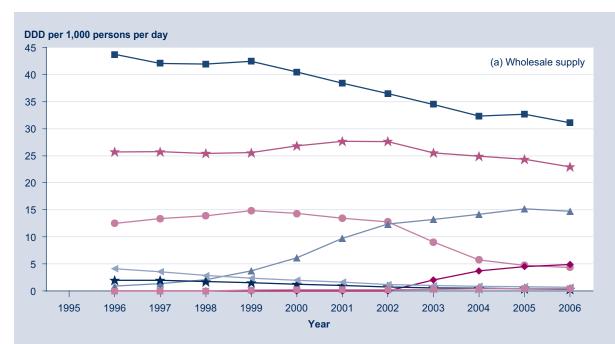
Supply of short-acting beta-agonists has been decreasing since 1999 and, more recently, use of the short-acting anti-cholinergic ipratropium bromide has also been declining. The latter trend has probably been accelerated by the introduction of tiotropium bromide, a long-acting anti-cholinergic medication that is mainly recommended for use by patients with COPD.

The annual total usage of inhaled corticosteroids has been relatively stable over a long period of time. There was a small increase in supply between 1999 and 2002, but since then there has been a small decrease back to pre-1999 levels (Figure 6.5a).

Long-acting beta-agonists first became eligible for reimbursement under the PBS in 2000. Since that year, there has been a rapid increase in the use of this class of medications (Figure 6.5b).

The use of other medications for asthma and other respiratory disorders, cromones (cromoglycate and nedocromil) and theophylline, was low and decreased during 1995–2006. Reimbursement for prescriptions for leukotriene receptor antagonists has only recently been introduced and only children are eligible. The overall usage of this class of medications remains low relative to other respiratory medications.

DDD per 1,000 persons per day

(a) Wholesale supply

DDD per 1,000 persons per day

(b) Reimbursed prescriptions

Year

- ■ Short-acting beta-agonists
- ● Short-acting anticholinergics
- ▲ Long-acting beta-agonists
- ◆ Long-acting anticholinergics
- ★ Cromones
- ★ Inhaled corticosteroids
- ◄ Theophylline
- ■ Leukotriene receptor antagonists

Notes: Respiratory medications classified according to the Anatomical Therapeutic Chemical Classification System (ATC). Reimbursed prescriptions (b) for short-acting beta-agonists were calculated from Pharmaceutical Benefits Scheme (PBS) and Repatriation Pharmaceutical Benefits Scheme (RPBS) data and the Pharmacy Guild Survey (which includes over-the-counter purchases).

Sources: (a) IMS Health; (b) PBS and RPBS (all medication classes) and the Pharmacy Guild Survey (short-acting beta-agonists).

Figure 6.5: Respiratory medications (a)supplied by wholesalers and manufacturers and (b)reimbursed prescriptions, by defined daily dose (DDD) per 1,000 persons per day, 1995–2006

6. Management: Medications used to treat asthma

6.2.4 Current use of medications for asthma

In 2004–05, almost 56% of people with asthma reported using medication for their condition in the last 2 weeks (NHS data). The proportion of people with asthma who used medication increased with age (*p* trend < 0.0001). The lowest reported use was among children aged 5–14 years (45%) and the highest was among those aged 65 years and over (75%).

Among school-entry children in the Australian Capital Territory, 94% of those with parent-reported asthma had used at least one asthma medication in the preceding year (Phillips et al. 2007).

Inhaled corticosteroids

Inhaled corticosteroids are used to reduce airway inflammation; a key feature of asthma. For patients with asthma, this results in better control of symptoms and disease exacerbations. They are most effective when used on a regular basis, either daily or twice daily. Regular use of inhaled corticosteroids is the recommended treatment in people with persistent asthma.

In 2006, there were 23 standard defined daily doses (DDDs) of inhaled corticosteroids supplied per 1,000 persons per day. This represented a continuation of a downward trend in this measure of utilisation from a peak in 2002 (28 DDDs per 1,000) (Figure 6.5 and Figure 6.6).

Among people with current asthma aged 5 years and over in 2004–05, 18.5% reported having used inhaled corticosteroids in the previous 2 weeks (ACAM 2007a). In the subgroup who reported using short-acting beta-agonists in the previous 2 weeks, indicating that they were likely to have experienced symptoms of asthma during that time, only 28% had also used inhaled corticosteroids during this period. Hence, there is evidence that use of inhaled corticosteroids for control of symptomatic asthma is sub-optimal in the community.

The frequency of medication use among children with asthma had remained stable between 2000 and 2005 in the Australian Capital Territory and 53% of all children with asthma that were taking inhaled corticosteroids, mast cell stabilisers or montelukast were using them at least 4 days per week during this time (Phillips et al. 2007).

In 2006, prescription data from the PBS showed that the use of inhaled corticosteroids increased with age (Table 6.2). This is consistent with the trends seen in the use of other classes of medication used in the treatment of asthma and may reflect the changing nature of obstructive lung disease from childhood to older adult life. There were no important differences in rates of use of this class of medication with levels of socioeconomic disadvantage. However, government health-care concession card holders were more likely to be dispensed inhaled corticosteroids (11%) than those without a concession card (4%). The cost of inhaled corticosteroids is approximately six times greater for individuals who do not have a concession card. Therefore, it appears that cost is an important barrier to use of inhaled corticosteroids.

Table 6.2: Proportion of population dispensed inhaled corticosteroids (alone or in combination with long-acting beta-agonists), by demographic characteristics, 2006

Demographic characteristics	All ages		Age 5–34 years	
	Number	Per cent	Number	Per cent
Sex				
Male	492,515	4.8	157,576	3.7
Female	609,154	5.9	164,246	4.0
Age group				
0–4 years	31,796	2.5	..	..
5–14 years	112,326	4.1	112,326	4.1
15–34 years	209,496	3.7	209,496	3.7
35–64 years	437,090	5.4	..	..
65 years and over	310,951	11.4	..	..
Socioeconomic status				
SEIFA 1 (most disadvantaged)	230,512	6.1	65,951	3.9
SEIFA 2	177,694	6.2	49,721	4.0
SEIFA 3	205,713	6.0	60,454	4.0
SEIFA 4	246,691	5.6	73,815	3.8
SEIFA 5 (least disadvantaged)	230,965	5.5	68,874	3.7
Remoteness category				
Major Cities	731,027	5.4	220,913	3.9
Inner Regional	241,034	5.6	64,974	3.9
Other areas[a]	129,026	5.0	35,723	3.4
Concessional status [b]				
Government health concession card holders	552,505	10.7	75,753	6.7
No government health concession card	405,032	4.2	133,743	3.4
All persons	**1,102,343**	**5.3**	**321,822**	**3.8**

.. Not applicable.

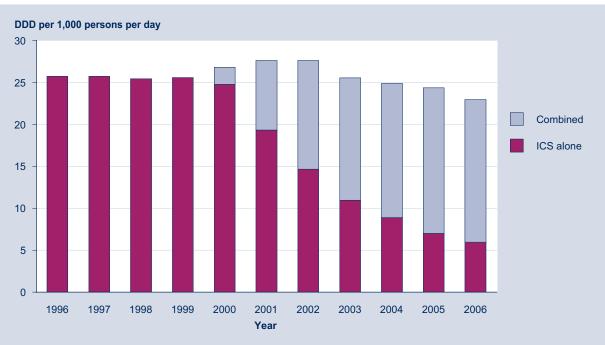(a) Other areas include Outer Regional, Remote and Very Remote.

(b) Limited to persons aged 15 years and over.

Note: SEIFA = Socio-economic Indexes for Areas.

Sources: Pharmaceutical Benefits Scheme; Australian Bureau of Statistics.

6. Management: Medications used to treat asthma

Combined long-acting beta-agonist and inhaled corticosteroid formulations

Inhalation devices that combined long-acting beta-agonists and corticosteroids in the same unit were introduced onto the Australian market in 2000. In subsequent years, the proportion of all inhaled corticosteroids that were supplied by wholesalers in combination with long-acting beta-agonists steadily increased. Two years after their introduction onto the Australian market, combined therapy represented 47% of all wholesale supplied inhaled corticosteroid therapy and, by 2006, the market share had risen to 74% (Figure 6.6).

Note: DDD = defined daily dose, ICS = inhaled corticosteroids.
Source: IMS Health.

Figure 6.6: Inhaled corticosteroids supplied by wholesalers separately or as part of combined therapy, by defined daily dose per 1,000 persons per day, 1996–2006
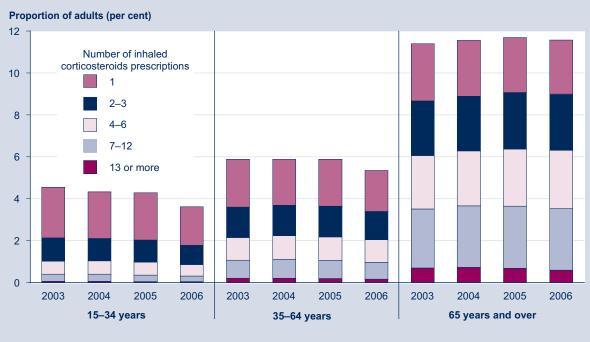
In the Australian population, use of inhaled corticosteroids and long-acting beta-agonists in combination formulations increased with age. Among those aged 0–4 years, only 1.4% were dispensed this type of combined therapy while 8.8% of those aged 65 years and over were dispensed this class of medication. In the population as a whole, there tended to be slightly higher rates of use among people living in areas of greater socioeconomic disadvantage. However, this was not observed when the analysis was limited to people aged 5–34 years. People living in more remote areas had lower rates of use. There were much higher rates dispensed to government health-care concession card holders than to those without a concession card.

Number of inhaled corticosteroid prescriptions

In children, intermittent asthma is much more common than persistent asthma. Hence, inhaled corticosteroids are generally not required for the treatment of asthma in children, particularly in young children. For this reason, we describe the use of this class of medications separately for adults and children.

Adults. Between 2003 and 2006, the use of any inhaled corticosteroids, as indicated by the number of prescriptions dispensed for this class of medication during that time, decreased among people aged 15–64 years, particularly since 2005 (Figure 6.7). This is consistent with the overall decline in supply over this period, as described above. This may be partly attributed to the large (24%) increase in the copayment cost in January 2005. Studies from Western Australia have shown that dispensing of combined asthma medications decreased following the rise in copayment cost at that time (Hynd et al. 2008).

In 2006, 5.7% of persons aged 15 years and over had at least one prescription for inhaled corticosteroids. The use of inhaled corticosteroids increased with age. In 2006, 3.6% of those aged 15–34 years, 5.3% of those aged 35–64 years and 11.6% of those aged 65 years and over had at least one prescription for inhaled corticosteroids. Among persons aged 15–34 years, more than half of those dispensed any inhaled corticosteroids only had one prescription for this class of medication in any one year, compared to 36–39% of those aged 35–64 years (Figure 6.7).
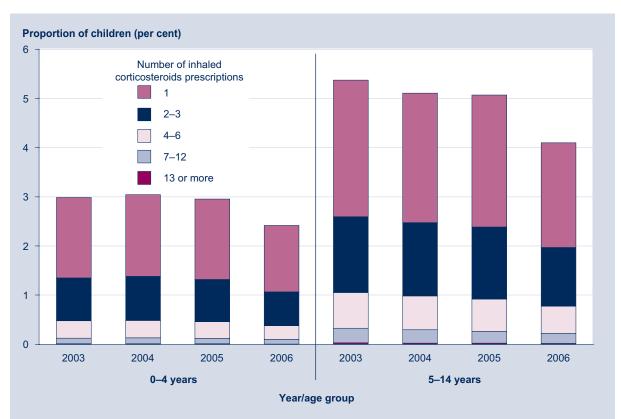

Note: Includes prescriptions for inhaled corticosteroids alone or in combination with long-acting beta-agonists.

Sources: Pharmaceutical Benefits Scheme; Australian Bureau of Statistics.

Figure 6.7: Use of inhaled corticosteroids (alone or in combination with long-acting beta-agonists) in adults, by age, number of prescriptions and year, 2003–2006

People aged 65 years and over had the highest prevalence of having inhaled corticosteroids dispensed and the highest proportion of frequent users. Approximately 30% of people in this older age group who had a prescription for inhaled corticosteroids had seven or more prescriptions. Furthermore, 5–6% had 13 or more prescriptions in any given year (that is, more than one prescription per month). In contrast, only 8–9% of people aged 15–34 years and 18–19% of those aged 35–64 years had seven or more inhaled corticosteroid prescriptions between 2003 and 2006. This is likely to be the minimum rate of prescription consistent with regular use.

6. Management: Medications used to treat asthma

Children. Thirty-one to 39% of children with parent-reported asthma, who were beginning school in the Australian Capital Territory during the period 2000 to 2005, were using inhaled corticosteroids at that time. There was no trend in usage over this period (Phillips et al. 2007). However, data from the PBS demonstrates that overall, between 2003 and 2006, the use of inhaled corticosteroids decreased among children aged 0–14 years, particularly since 2005 (Figure 6.8). This may reflect a decline in the prevalence of asthma in children over this period.

In 2006, 2.4% of children aged 0–4 years and 4.1% of children aged 5–14 years were dispensed at least one prescription of inhaled corticosteroid. In 2006, the overall proportion of children aged 0–14 years who were dispensed any inhaled corticosteroids was 3.6%. More than half of the children dispensed inhaled corticosteroids were dispensed only one prescription in any given year between 2003 and 2006.
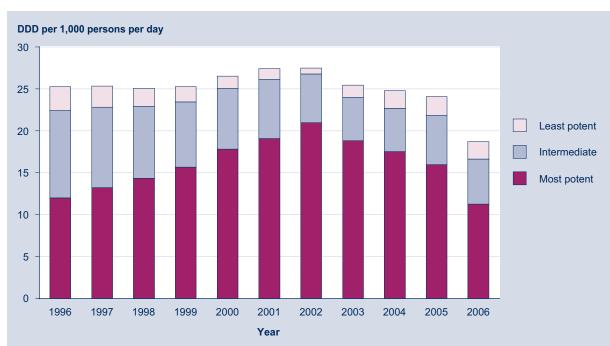

Note: Includes prescriptions for inhaled corticosteroids alone or in combination with long-acting beta-agonists.

Sources: Pharmaceutical Benefits Scheme; Australian Bureau of Statistics.

Figure 6.8: Use of inhaled corticosteroids (alone or in combination with long-acting beta-agonists) in children, by age, number of prescriptions and year, 2003–2006

Overall, both the prevalence and the frequency of use of inhaled corticosteroids were much greater in people aged 15 years and over than in children. This is to be expected given the differences in the patterns of disease observed.

Potency of inhaled corticosteroids

Data on the supply of pharmaceuticals demonstrate that both the total number of doses and the proportion of doses that are the highest potency formulation of inhaled corticosteroids have declined substantially during 2006 (Figure 6.9). However, less potent formulations still represent a minority of those supplied. A similar trend is observed in examining dispensed prescriptions. The majority of prescriptions for inhaled corticosteroids were for the most potent formulations of this class of medication (Figure 6.10).

DDD per 1,000 persons per day

Notes

1. Least potent includes Becotide 100, Becotide MDI 100, Qvar 50, Qvar 50 autohaler, Pulmicort meter aero 100, Pulmicort turbuhaler, Alvesco 80, Flixotide jnr accuhaler, Flixotide jnr Oral pressurised inhalation 50 micrograms per dose (120 doses) CFC-free formulation, Seretide accuhaler 100/50, Seretide MDI 50/25, Symbicort turbuhaler 100/6.
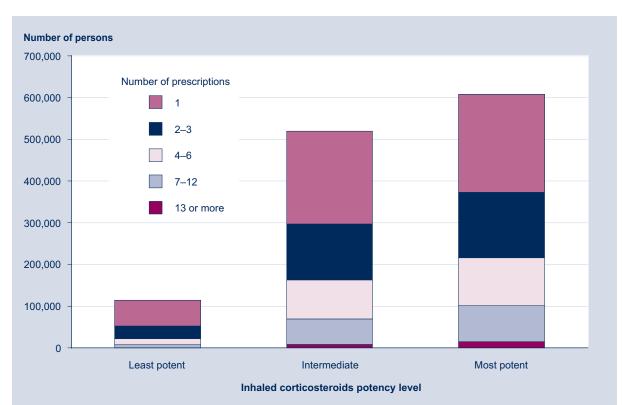
2. Intermediate level includes Respocort inhaler Becloforte MDI 250, Respocort autohaler 250, Qvar 100, Qvar 100 autohaler, Pulmicort respules, Pulmicort meter aero 200, Pulmicort turbuhaler, Alvesco 160, Flixotide accuhaler, Flixotide, Seretide accuhaler 250/50, Seretide MDI 125/25, Symbicort turbuhaler 200/6.

3. Most potent includes Pulmicort respules, Pulmicort turbuhaler, Flixotide accuhaler, Flixotide, Seretide accuhaler 500/50, Seretide MDI 250/25, Symbicort turbuhaler 400/12.

4. DDD = defined daily dose.

Source: IMS Health.

Figure 6.9: Relative potency of inhaled corticosteroids supplied by wholesalers separately or as part of combined therapy, by defined daily dose per 1,000 persons per day, 1996–2006

6. Management: Medications used to treat asthma

Number of persons

Notes

1. Least potent includes Becotide 100, Becotide MDI 100, Qvar 50, Qvar 50 autohaler, Pulmicort meter aero 100, Pulmicort turbuhaler, Alvesco 80, Flixotide jnr accuhaler, Flixotide jnr Oral pressurised inhalation 50 micrograms per dose (120 doses) CFC-free formulation, Seretide accuhaler 100/50, Seretide MDI 50/25, Symbicort turbuhaler 100/6.

2. Intermediate level includes Respocort inhaler Becloforte MDI 250, Respocort autohaler 250, Qvar 100, Qvar 100 autohaler, Pulmicort respules, Pulmicort meter aero 200, Pulmicort turbuhaler, Alvesco 160, Flixotide accuhaler, Flixotide, Seretide accuhaler 250/50, Seretide MDI 125/25, Symbicort turbuhaler 200/6.
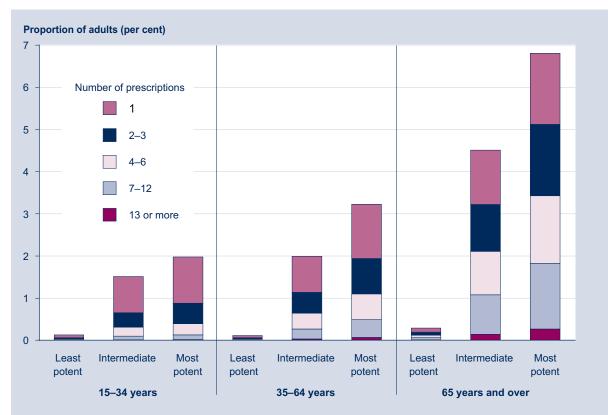
3. Most potent includes Pulmicort respules, Pulmicort turbuhaler, Flixotide accuhaler, Flixotide, Seretide accuhaler 500/50, Seretide MDI 250/25, Symbicort turbuhaler 400/12.

Source: Pharmaceutical Benefits Scheme.

Figure 6.10: Number of prescriptions for inhaled corticosteroids, by potency class, all persons, 2006

Adults. Overall, among persons aged 15 years and over, 54.8% of prescriptions for inhaled corticosteroids were in the most potent category, 42.1% were of intermediate potency and only 3.1% were classified as being in the least potent category.

A higher proportion of older Australians were prescribed inhaled corticosteroids of the most potent formulations compared to young adults and those aged 35–64 years (Figure 6.11). Those aged 65 years and over were also more likely to have 13 or more prescriptions for intermediate and most potent formulations of this class of medication in 2006 than younger adults.

Proportion of adults (per cent)

Number of prescriptions
- 1
- 2–3
- 4–6
- 7–12
- 13 or more

Potency level of inhaled corticosteroids/age group

Notes

1. Least potent includes Becotide 100, Becotide MDI 100, Qvar 50, Qvar 50 autohaler, Pulmicort meter aero 100, Pulmicort turbuhaler, Alvesco 80, Flixotide jnr accuhaler, Flixotide jnr Oral pressurised inhalation 50 micrograms per dose (120 doses) CFC-free formulation, Seretide accuhaler 100/50, Seretide MDI 50/25, Symbicort turbuhaler 100/6.

2. Intermediate level includes Respocort inhaler Becloforte MDI 250, Respocort autohaler 250, Qvar 100, Qvar 100 autohaler, Pulmicort respules, Pulmicort meter aero 200, Pulmicort turbuhaler, Alvesco 160, Flixotide accuhaler, Flixotide, Seretide accuhaler 250/50, Seretide MDI 125/25, Symbicort turbuhaler 200/6.

3. Most potent includes Pulmicort respules, Pulmicort turbuhaler, Flixotide accuhaler, Flixotide, Seretide accuhaler 500/50, Seretide MDI 250/25, Symbicort turbuhaler 400/12.
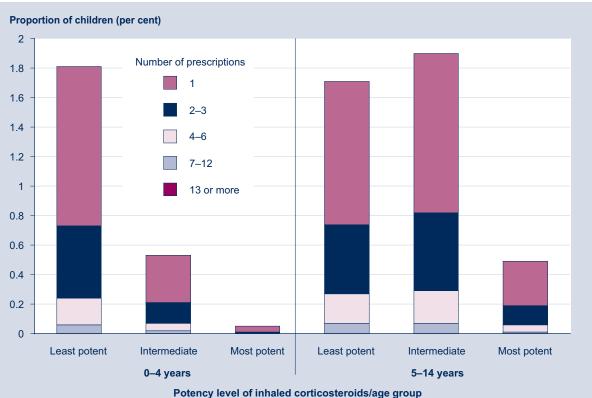
4. Adults have been classified according to the most potent formulation of inhaled corticosteroid prescription they received in 2006.

Sources: Pharmaceutical Benefits Scheme; Australian Bureau of Statistics.

Figure 6.11: Use of inhaled corticosteroids among adults, by potency class, age and number of prescriptions, 2006

6. Management: Medications used to treat asthma

Children. Among children (those aged less than 15 years), 50.6% of prescriptions for inhaled corticosteroids were in the least potent category, 40.2% were of intermediate potency and only 9.3% were classified as being in the most potent category.

There was a much higher proportion of children aged 5–14 years who had prescriptions for intermediate and most potent formulations of inhaled corticosteroids compared to children aged 0–4 years (Figure 6.12). The frequency of use of these more potent formulations was also higher in older children compared to younger children.

Proportion of children (per cent)

Number of prescriptions
- 1
- 2–3
- 4–6
- 7–12
- 13 or more

Potency levels (Least potent, Intermediate, Most potent) for 0–4 years and 5–14 years.

Potency level of inhaled corticosteroids/age group

Notes

1. Least potent includes Becotide 100, Becotide MDI 100, Qvar 50, Qvar 50 autohaler, Pulmicort meter aero 100, Pulmicort turbuhaler, Alvesco 80, Flixotide jnr accuhaler, Flixotide jnr Oral pressurised inhalation 50 micrograms per dose (120 doses) CFC-free formulation, Seretide accuhaler 100/50, Seretide MDI 50/25, Symbicort turbuhaler 100/6.
2. Intermediate level includes Respocort inhaler Becloforte MDI 250, Respocort autohaler 250, Qvar 100, Qvar 100 autohaler, Pulmicort respules, Pulmicort meter aero 200, Pulmicort turbuhaler, Alvesco 160, Flixotide accuhaler, Flixotide, Seretide accuhaler 250/50, Seretide MDI 125/25, Symbicort turbuhaler 200/6.
3. Most potent includes Pulmicort respules, Pulmicort turbuhaler, Flixotide accuhaler, Flixotide, Seretide accuhaler 500/50, Seretide MDI 250/25, Symbicort turbuhaler 400/12.
4. Children have been classified according to the most potent formulation of inhaled corticosteroid prescription they received in 2006.

Sources: Pharmaceutical Benefits Scheme; Australian Bureau of Statistics.

Figure 6.12: Use of inhaled corticosteroids among children, by potency class, age and number of prescriptions, 2006

Short-acting bronchodilators

Short-acting bronchodilators are commonly referred to as 'relievers' due to their mode of use by patients with asthma. Short-acting beta-agonists (salbutamol and terbutaline) are the most commonly used class of short-acting bronchodilators. They are very effective in providing rapid relief of acute asthma symptoms and, since they can be purchased without a prescription, are readily accessible in Australia (ACAM 2005). The duration of action of short-acting beta-agonists is typically 4–6 hours (Lotvall 2002).
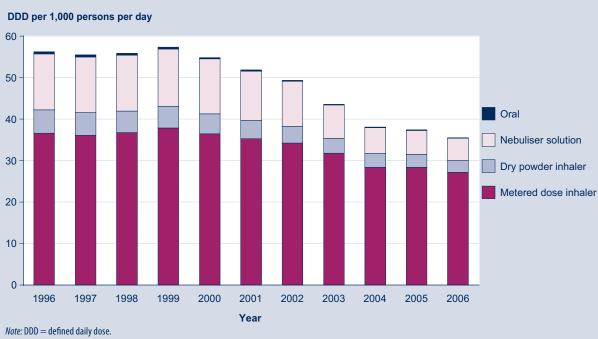
It is recommended that short-acting beta-agonists are used on an as-needed basis for short-term relief of symptoms (NAC 2006). Short-acting anticholinergics (ipratropium) and rapid-onset, long-acting beta-agonists (formoterol; see Box 6.1) may also be used as 'relievers'.

Overall, 12.3% of all adults holding a government health-care concession card had at least one PBS-subsidised prescription for short-acting beta-agonists during 2006. In 2004–05, 47.5% of surveyed people with current asthma who were aged 5 years and over reported using short-acting beta-agonists in the last 2 weeks (NHS confidentialised unit record files—CURFs). Furthermore, among people attending their GP for management of asthma, 94% had used a short-acting beta-agonists in the previous 12 months including 14% who reported using this medication twice daily (13.8%) (AIHW: Britt & Miller 2007, SAND abstract 104). Hence, use of short-acting bronchodilators is very common among people with asthma and related conditions.

Some children who use salbutamol do not have a diagnosis of asthma. Among children beginning school in the Australian Capital Territory who were taking salbutamol, 19% did not have a diagnosis of asthma in 2000 and this proportion had increased to 35% in 2005 (Phillips et al. 2007). It is possible that this increase reflects changes in diagnostic labelling.

Route of administration of bronchodilators

Short-acting bronchodilators are available in oral formulations as well as inhaled formulation. However, oral formulations are associated with reduced efficacy and more side effects and are not recommended for use in patients with asthma. In fact, nearly all short-acting beta-agonist and anti-cholinergic bronchodilator medication is administered by inhalation (Figure 6.13). The most popular devices supplied were metered dose inhalers, or 'puffers'. Between 1996 and 2000, approximately one-quarter of the supply of this class of medication was in the form used for nebulised delivery. This proportion has gradually declined and in 2006 only 15% was supplied in the form of nebuliser solution. The decrease in the use of nebulised bronchodilators is in accordance with current evidence and recommendations (Cates 1999).

Note: DDD = defined daily dose.
Source: IMS Health.

Figure 6.13: Delivery devices supplied by wholesalers for the administration of short-acting beta-agonist and anticholinergic medication, by defined daily dose per 1,000 persons per day, 1996–2006

6. Management: Medications used to treat asthma

Sociodemographic distribution of use

The prevalence of use of short-acting beta-agonists by people with current asthma in 2004–05 was highest among young adults aged 15–34 years (49.0% used this medication class in the previous 2 weeks) and older adults (49.7%) but was also common among children (36.4%) (NHS CURFs).

Prescription of short-acting beta-agonists was slightly more common in females (13.2%) than males (11%) (PBS data for concession card holders, Table 6.3). Use of this class of medications increased with age. Among those aged 65 years and over, 13.5% were dispensed this class of medication compared to only 10% among those aged 15–34 years. Among people aged 15 years and over, those residing in inner regional areas of Australia had a higher proportion of short-acting beta-agonist prescriptions dispensed than those living in major cities or remote areas of Australia (p < 0.0001).

Table 6.3: Proportion of people with government health-care concession cards dispensed short-acting beta-agonists, by demographic characteristics, 2006

Demographic characteristics	Age 15 years and over		Age 15–34 years	
	Number	Per cent	Number	Per cent
Sex				
Male	240,505	11.0	39,839	8.5
Female	391,226	13.2	73,001	11.0
Age group				
15–34 years	112,840	10.0	112,840	10.0
35–64 years	221,093	12.3	..	..
65 years and over	297,798	13.5	..	..
Remoteness category				
Major Cities	391,579	12.3	70,425	10.1
Inner Regional	158,050	13.4	28,324	10.4
Other areas[a]	81,680	10.5	14,007	8.7
All concession card holders	**631,731**	**12.3**	**112,840**	**10.0**

.. Not applicable.

(a) Other areas include Outer Regional, Remote and Very Remote.

Note: The National Health Survey was used to estimate the total number of Australians with a government concession card.

Sources: Pharmaceutical Benefits Scheme; Australian Bureau of Statistics 2004–05 National Health Survey.

The need to limit the analysis of short-acting beta-agonist prescriptions data to concession card holders meant it was not possible to judge the impact of socioeconomic status, since concession card holders already represent a more socioeconomically disadvantaged subgroup. Studies elsewhere have explored this. In Canada, Lynd and colleagues (2004) found that greater levels of socioeconomic disadvantage were associated with higher levels of use of short-acting beta-agonists, even when controlling for level of severity of asthma.

Generally, high rates of use of short-acting beta-agonists are an indicator of poor asthma control. Campaigns that focus on the subgroup of people with asthma who are high users of short-acting beta-agonists may lead to gains in a range of asthma outcomes.

Long-acting beta-agonists

Long-acting beta-agonists (salmeterol and formoterol), which were introduced into clinical use in Australia in 1999, provide approximately 12–24 hours bronchodilatation (Lotvall 2002). Current national (NAC 2006) and international (GINA 2006) guidelines for the management of asthma recommend that adults with asthma that is not adequately controlled on moderate doses of inhaled corticosteroids alone use long-acting beta-agonists in conjunction with inhaled corticosteroids on a regular basis.

Overall, 4.3% of the population used this class of medications in 2006. Use was greater among females (4.7%) and those aged 65 years and over (9.3%) (Table 6.4).

Table 6.4: Proportion of population dispensed long-acting beta-agonists, by demographic characteristics, 2006

Demographic characteristics	All ages		Age 5–34 years	
	Number	**Per cent**	**Number**	**Per cent**
Sex				
Male	398,793	3.9	124,889	2.9
Female	488,520	4.7	130,956	3.2
Age group				
0–4 years	17,554	1.4	..	..
5–14 years	84,495	3.1	84,495	3.1
15–34 years	171,350	3.0	171,350	3.0
35–64 years	359,354	4.4	..	..
65 years and over	254,552	9.3	..	..
Socioeconomic status				
SEIFA 1 (most disadvantaged)	182,503	4.8	50,109	3.0
SEIFA 2	142,949	4.9	38,949	3.1
SEIFA 3	166,370	4.8	48,145	3.2
SEIFA 4	198,700	4.5	59,015	3.0
SEIFA 5 (least disadvantaged)	188,763	4.5	57,225	3.1
Remoteness category				
Major Cities	591,514	4.4	177,132	3.1
Inner Regional	192,330	4.5	50,797	3.0
Other areas[a]	103,008	4.0	27,750	2.7
Concessional status[b]				
Government health concession card holders	446,699	8.7	58,586	5.2
No government health concession card	338,557	3.5	112,764	2.8
All persons	**887,851**	**4.3**	**255,845**	**3.0**

.. Not applicable.

(a) Other areas include Outer Regional, Remote and Very Remote.

(b) Limited to persons aged 15 years and over.

Notes: The National Health Survey was used to estimate the total number of Australians with a government concession card. SEIFA = Socio-economic Indexes for Areas.

Sources: Pharmaceutical Benefits Scheme; Australian Bureau of Statistics 2004–05 National Health Survey.

6. Management: Medications used to treat asthma

There was little variation in the proportion of users according to socioeconomic status and remoteness of residence. However, there was a higher proportion of government health concession card holders that were dispensed this class of medication compared to those without concession cards. The same trends were seen among persons aged 5–34 years (Table 6.4).

There is evidence that long-acting beta-agonists are less effective in children than in adults and their use is not recommended except in children with asthma that is poorly controlled despite other therapy (Bisgaard & Szefler 2006; Sorkness et al. 2007). Hence, we have described the utilisation of this class of medications separately for adults and children.

Long-acting beta-agonist prescriptions among adults

There has been an increase in the proportion of adults dispensed long-acting beta-agonists between 2003 and 2006 (Figure 6.14). In 2006, 4.7% of all persons aged 15 years and over were dispensed at least one prescription for long-acting beta-agonists.

The proportion of adults using four or more prescriptions per year increased with age (Figure 6.14). In 2006, 0.8% of adults aged 15–34 years had four or more prescriptions for this class of asthma medication compared to 1.8% of adults aged 35–64 years and 5.5% of those aged 65 years and over. Furthermore, during the same year, 0.3% of people aged 15–34 years had seven or more prescriptions for long-acting beta-agonists compared to 0.9% of adults aged 35–64 years and 3.3% of those aged 65 years and over.

Notes

1. Includes all those using long-acting beta-agonists alone and in combined formulation with inhaled corticosteroids.

2. Oxis Turbuhaler 6μg; 60 doses (Pharmaceutical Benefits Scheme (PBS) item code 8239P) is included for all adults pre-2005 but only for concession card holders in 2005 and 2006. This is due to the fact that the price for this item was below the general PBS threshold from 2005 onwards (see Appendix 1, Table A1.7).
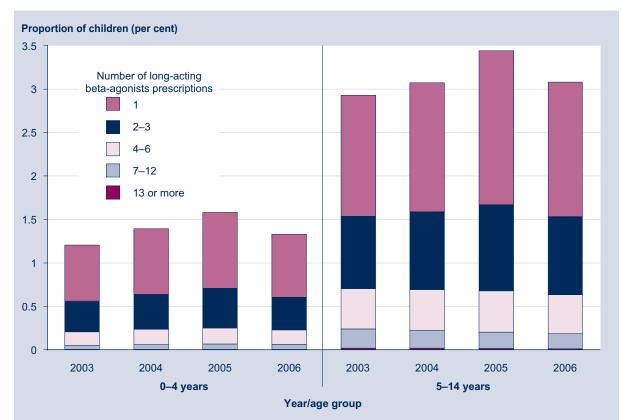
Sources: Pharmaceutical Benefits Scheme; Australian Bureau of Statistics.

Figure 6.14: Use of long-acting beta-agonists among adults, by age group, number of prescriptions and year, 2003–2006

Long-acting beta-agonist prescriptions among children

The proportion of children dispensed long-acting beta-agonists also increased between 2003 and 2005 (Figure 6.15). Between 2005 and 2006, there was a decrease in the rate of prescriptions for this class of medication among children.

In 2006, 2.5% of all children aged 0–14 years were dispensed at least one prescription for long-acting beta-agonists. Usage was much lower in younger children. In contrast to adults, approximately half of the children prescribed long-acting beta-agonists were dispensed only one prescription in any given year (Figure 6.15). Very few children averaged one or more prescriptions for long-acting beta-agonists per month.

Note: Includes all those using long-acting beta-agonists alone and in combined formulation with inhaled corticosteroids.

Sources: Pharmaceutical Benefits Scheme; Australian Bureau of Statistics.

Figure 6.15: Use of long-acting beta-agonists among children, by age group, number of prescriptions and year, 2003–2006

6. Management: Medications used to treat asthma

Oral corticosteroids

During episodes of more severe asthma (known as 'exacerbations'), oral corticosteroids may be used to gain control of the disease. A very small number of people with asthma need long-term treatment with oral corticosteroids to control their disease.

Among concession card holders who had a prescription for any asthma medication in 2006, 3.4% were dispensed oral corticosteroids (Table 6.5). The use of oral corticosteroids increased with age, with 1.5% of those aged 15–34 years compared to 4.6% of those aged 65 years and over being dispensed oral corticosteroids in 2006.

Table 6.5: Proportion of concessional population dispensed oral corticosteroids, by demographic characteristics, 2006

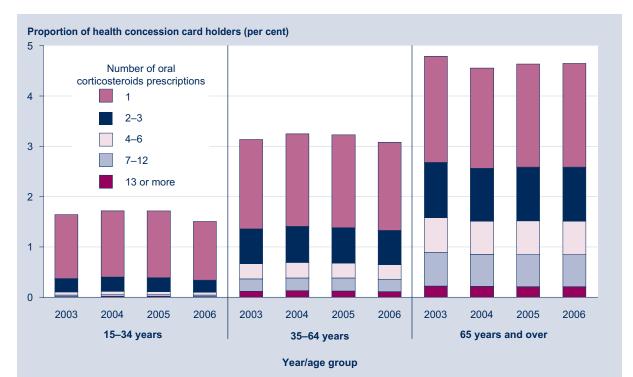| Demographic characteristics	Age 15 years and over		Age 15–34 years	
	Number	Per cent	Number	Per cent
Sex				
Male	67,013	3.1	5,098	1.1
Female	108,141	3.7	11,954	1.8
Age group				
15–34 years	17,052	1.5	17,052	1.5
35–64 years	55,552	3.1	..	..
65 years and over	102,550	4.6	..	..
Remoteness category				
Major Cities	108,015	3.4	10,581	1.5
Inner Regional	44,605	3.8	4,343	1.6
Other areas[a]	22,433	2.9	2,114	1.3
All concession card holders	**175,154**	**3.4**	**17,052**	**1.5**

.. Not applicable

(a) Other areas include Outer Regional, Remote and Very Remote.

Note: The National Health Survey was used to estimate the total number of Australians with a government concession card.

Sources: Pharmaceutical Benefits Scheme; Australian Bureau of Statistics 2004–05 National Health Survey.

The use of oral corticosteroids by people being treated for asthma increased with age but has remained stable over the period 2003–2006 (PBS data for concession card holders who had been dispensed at least one other medication for asthma, Figure 6.16). In 2006, 1.5%, 3.1% and 4.6% of people with a concession card aged 15–34 years, 35–64 years and 65 years and over, respectively, were dispensed one or more prescription for oral corticosteroids. Most adults who were dispensed oral corticosteroids filled only one prescription for this class of medication in any one year. Furthermore, the proportion of adults with multiple prescriptions for oral corticosteroids increased with age.

Proportion of health concession card holders (per cent)

Note: Data restricted to patients with government health concession card.

Sources: Pharmaceutical Benefits Scheme; Australian Bureau of Statistics 2001 and 2004–05 National Health Survey for the population estimate for government health concession card holders.

Figure 6.16: Use of oral corticosteroids among adults with a government health concession card, by age group, number of prescriptions and year, 2003–2006

6. Management: Medications used to treat asthma

Summary

The most important change in the nature of the pharmacological treatment for asthma over the last 5 or 6 years has been the gradual increase in use of long-acting beta-agonists in combination with inhaled corticosteroids. This has been accompanied by a reduction in the use of short-acting beta-agonists over this period, possibly indicating a trend to improved levels of control of the disease.

However, there are important age-related differences in treatment for asthma. The use of almost all medications for asthma increases with age. The pattern of use of asthma therapies is quite different in children compared with adults. Use of inhaled corticosteroids is less common in children than in adults with asthma. Most children using inhaled corticosteroids are only dispensed one prescription per year. Furthermore, the majority of inhaled corticosteroids prescribed to children are among the less potent formulations and combination with long-acting beta-agonists is relatively uncommon in children, particularly in young children. In the last year of data (2006), there was a reduction in the use of inhaled corticosteroids.

Among adults, the majority of inhaled corticosteroids are prescribed in combination with long-acting beta-agonists. Clinical trials have shown that this combination should allow equivalent effectiveness for controlling asthma with a lower dose of inhaled corticosteroids. There is some evidence that, in the most recent year of data (2006), there was a reduction in the prescription of the most potent formulations of inhaled corticosteroids. It is clear that intermittent use of inhaled corticosteroids is the most common mode of use in adults, as well as children, despite treatment guidelines recommending regular use in people with persistent asthma.

The explanation for the reduction in both supply of, and prevalence of use of, inhaled corticosteroids in the last 3 or 4 years cannot be directly deduced from the available data. Possible explanations include (a) steroid sparing effects of combination with long-acting beta-agonist; (b) a reduction in the prevalence or severity of asthma in the community; (c) greater recognition of intermittent asthma, particularly in children, for whom regular inhaled corticosteroids may not be indicated; and (d) less appropriate use of inhaled corticosteroids due to the cost of medications and other barriers to their effective use.

7. *Tobacco smoke and occupation as risk factors for asthma*

Key points

- People with asthma continue to smoke at least as commonly as people without asthma, despite the known adverse effects.
- The prevalence of smoking is higher among younger people with asthma than older people with asthma.
- Socioeconomic position is a strong determinant on the risk of smoking among people with asthma.
- An estimated 11% of children with asthma reside in homes where smoking occurs inside the home.
- Nearly 10% of adult-onset asthma is caused by occupational exposures and, hence, could be avoided if exposure to triggering agents in the workplace was eliminated.
- Occupational asthma is the one truly preventable form of the disease.

Introduction

While the underlying causes of asthma are still not well understood, environmental and lifestyle factors, as well as constitutional factors such as an allergic tendency, may increase the risk of developing asthma. Among those with the condition, airway narrowing and symptoms can be triggered by a wide range of exposures and other factors. These include specific allergens, such as house dust mites, pollens, mould spores, animal dander and occupational allergens, viral infections, irritants, such as tobacco smoke and other air pollutants, exercise and some food additives.

The environmental causes of asthma have been extensively investigated and reviewed (NSW Health Dept 1997; Peat 1994; Rural and Regional Health and Aged Care Services Division 2004). The subject remains controversial with conflicting evidence on the effects of exposure to pets and other allergen sources, the protective effects of breastfeeding and other aspects of diet and feeding, overweight and obesity, and the role of infections in childhood. A number of randomised controlled trials evaluating the effects of specific interventions for the prevention of asthma have been conducted but the findings are either negative or inconclusive. Without clear evidence of an important, avoidable causal role in asthma, these factors are not suitable targets for surveillance and have not been included in this report. Apart from environmental tobacco smoke exposure in children and smoking in adults, this publication does not report on these factors.

On the other hand, exposure to occupational allergens has been conclusively linked both to the development of asthma, *de novo*, and to progression of the disease. Since this is a potentially avoidable cause of asthma, exposure to occupational allergens and the occurrence of occupational asthma are important targets for surveillance.

In this chapter, we present data on smoking among people with asthma and exposure to environmental tobacco smoke among children with asthma. We also discuss occupational exposure as a risk factor for the development of asthma in adulthood.

7.1 People with asthma who smoke

The harmful effects of both active and passive smoking are well known. People with asthma who smoke have particular problems (Siroux et al. 2000) and find their asthma more difficult to control than non-smokers. In part, this may be because smoking impairs the effectiveness of inhaled corticosteroids (Chalmers et al. 2002), even at high doses (Pedersen et al. 1996). In addition, both smoking and asthma accelerate the rate of decline in lung function with age (James et al. 2005).

7.1.1 Prevalence

In 2004–05, the prevalence of smoking at least once a week in people aged 18 years and over was 24.5% among those with current asthma and 22.3% among those without current asthma (Table 7.1). Survey data from the states and territories confirm that the rate of smoking among people with asthma (15.8–35.5%) is the same, if not higher than, the rate among people without asthma (Table 7.1). The proportion of ex-smokers is generally similar among those with and without asthma.

Table 7.1: Smoking status among people with and without current asthma, most recent survey results, 2004–2007

Population (study)	Year	Age (years)	Smoking status	People with asthma		People without asthma	
				Rate (%)	95% CI	Rate (%)	95% CI
Australia (1)	2004–05	18 and over	Current smoker	24.5	22.3–26.7	22.6	21.9–23.4
			Ex-smoker	31.6	29.1–34.0	29.8	29.0–30.6
			Never smoked	43.4	40.6–46.1	47.2	46.3–48.1
				(n = 2,053)		(n = 17,448)	
New South Wales (2)	2006	16 and over	Current smoker	19.0	16.1–21.8	n.a.	n.a.
				(n = 1,522)			
Victoria (3)	2006	18 and over	Current smoker[a]	15.8	12.4–19.3	21.1	19.6–22.5
			Ex-smoker	22.1	18.4–25.7	24.4	23.0–25.7
			Non-smoker	62.1	57.5–66.8	54.6	52.9–56.3
Queensland (4)	2006	18 and over	Daily smoker	30.4	23.4–38.4	15.4	13.2–17.8
			Occasional smoker	5.1	2.4–10.2	4.7	3.5–6.4
			Ex-smoker	18.7	13.9–24.6	27.5	25.0–30.2
			Ex-smoker (tried few times)	6.3	3.6–10.8	12.1	10.2–14.3
			Never smoked	39.6	32.2–47.6	40.4	37.4–43.4
				(n = 215)		(n = 1,305)	
Western Australia (5)	2006–07	16 and over	Current smoker	15.8	11.7–21.1	15.8	14.4–17.4
			Ex-smoker	14.5	11.1–18.8	15.2	13.9–16.6
			Never smoked	69.7	63.8–75.0	69.0	67.1–70.8
				(n = 619)		(n = 5,312)	
South Australia (6)	2006–07	16 and over	Current smoker	17.1	14.6–19.9	16.7	15.7–17.8
			Ex-smoker	36.3	33.0–39.8	35.8	34.5–37.2
			Never smoked	46.6	43.0–50.1	47.4	46.0–48.8
				(n = 764)		(n = 4,935)	

n.a. Not available

(a) Includes people who reported smoking daily or occasionally.

Note: CI = confidence interval.

Sources: (1) Australian Centre for Asthma Monitoring (ACAM) analysis of the Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files; Data excludes people who smoked less than weekly (0.6% of people with asthma and 0.4% of people without asthma). (2) New South Wales (NSW) Population Health Survey, Centre for Epidemiology and Research, NSW Health; (3) Department of Human Services, Victorian Population Health Survey 2006 (unpublished data); (4) Queensland Omnibus, Epidemiology Services Unit, Queensland Health; (5) WA Health and Wellbeing Surveillance System, Epidemiology Branch, Department of Health, Government of Western Australia; (6) South Australian Monitoring and Surveillance System (SAMSS), Population Research and Outcome Studies, Health Intelligence, Department of Health, Government of South Australia.

7. Tobacco smoke and occupation as risk factors for asthma

A South Australian study incorporating over 10 years of aggregated omnibus data found that asthma was associated with ex-smoking status. The prevalence of asthma among ex-smokers was 1.29 times (95% CI 1.15–1.44) as high as the prevalence of asthma among non-smokers (Wilson et al. 2006). Furthermore, the prevalence of asthma among female smokers was 1.27 times (95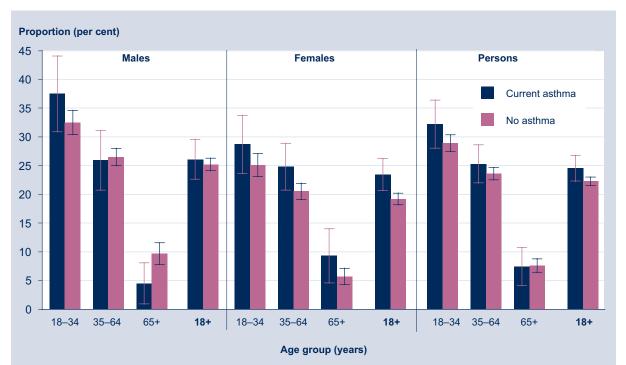% CI 1.08–1.51) as high as the prevalence among non-smokers. Similarly, among males, the prevalence of asthma among ex-smokers was 1.47 times (95% CI 1.20–1.80) as high as the prevalence among non-smokers.

It is clear that many people with asthma continue to smoke. However, it is also possible that the very high rates of smoking (and particularly ex-smoking status) reflect the causal pathway. In other words, some people may have asthma-like symptoms or have been diagnosed with asthma due to the adverse effects of smoking.

7.1.2   Population subgroups

Age and sex

The prevalence of current smoking in adults decreases with age but, among men, the prevalence of ever having smoked increases with age. As a consequence, and as expected, a far higher proportion of older people, particularly men, are ex-smokers (ACAM 2007a). In 2004–05, nearly 38% of young men aged 18–34 years with asthma continued to smoke despite their illness (Figure 7.1).

The relatively high, or at least similar, rates of smoking in people with asthma compared to people without asthma is observed in both males and females (Figure 7.1). Among adult females, 23.5% of those with asthma compared to 19.2% of those without asthma reported being current smokers. Among adult males, 26.1% of those with asthma were smokers compared to 25.2% of those without the condition.

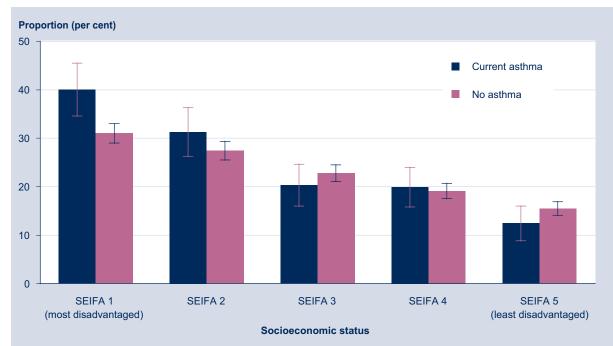*Note:* Age-standardised to the Australian population as at June 2001.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) 2004–05 National Health Survey confidentialised unit record files.

Figure 7.1: Prevalence of current smoking among adults aged 18 years and over, by asthma status, age group and sex, 2004–05

Socioeconomic disadvantage

The prevalence of smoking among people with asthma in 2004–05 was over three times higher (40.0%) among those living in more socioeconomically disadvantaged areas than among those living in less disadvantaged localities (12.4%) (rate ratio 3.2; 95% CI 2.4–4.2) (Figure 7.2). This differential was less marked among people without asthma (rate ratio 2.0; 95% CI 1.8–2.2).

Among those living in the most disadvantaged localities, the prevalence of smoking among people with asthma (40.0%) was substantially higher than that observed among people without the condition (31.0%). However, there were no statistically significant differences in the prevalence of smoking among people with and without asthma living in the least disadvantaged areas.

Notes: Age-standardised to the Australian population as at June 2001; SEIFA = Socio-economic Indexes for Areas.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) 2004–05 National Health Survey confidentialised unit record files.

Figure 7.2: Prevalence of current smoking among adults aged 18 years and over, by asthma status and socioeconomic status, 2004–05

7. Tobacco smoke and occupation as risk factors for asthma

7.2   Passive smoke exposure in children with asthma

Exposure to environmental tobacco smoke, commonly referred to as 'passive smoke', in childhood is a risk factor for the development of asthma symptoms and also for the worsening of pre-existing asthma. It has been shown that exposure to environmental tobacco smoke increases the risk of wheezing illness in young children (Martinez et al. 1992; Young et al. 2000) and that the association between exposure and childhood wheezing illness is most consistent at high levels of environmental tobacco smoke exposure (NHMRC 1997). These findings are supported by evidence from international studies which conclude that parental smoking is associated with more severe asthma in children (Pattenden et al. 2006; Strachan & Cook 1998) and that exposure to environmental tobacco smoke after birth is a likely cause of wheezing or other acute respiratory illness in young children (Strachan & Cook 1997).

Cohort studies have shown that children with pre-existing asthma who are exposed to environmental tobacco smoke have increased morbidity and asthma symptoms (Murray & Morrison 1989), more frequent exacerbations (Chilmonczyk et al. 1993), more severe asthma symptoms (Murray & Morrison 1993; Strachan & Cook 1998), impaired lung function (Chilmonczyk et al. 1993; Murray & Morrison 1989) and increased airway reactivity (Murray & Morrison 1989; Oddoze et al. 1999) or peak flow variability (Fielder et al. 1999; Frischer et al. 1993). There is also evidence that children exposed to environmental tobacco smoke are more likely to attend emergency departments with asthma (Evans et al. 1987). It has been shown that prevention of indoor smoking leads to a reduction in hospital admissions in children with asthma (Gurkan et al. 2000). Recovery after hospitalisation, measured by use of reliever medication and number of symptomatic days, is also impaired in children exposed to passive smoke (Abulhosn et al. 1997).

A Brisbane study conducted between 1981 and 1998 showed that 14-year-old girls, but not boys, had an increased risk of having asthma symptoms (odds ratio 1.96; 95% CI 1.25–3.08) if their mother reported smoking heavily (defined as 20 or more cigarettes per day) both during pregnancy and 6 months after the birth of their daughter (Alati et al. 2006). Smoking during pregnancy was the most important risk factor.

There is some evidence that early life exposure to tobacco smoke may have long-term consequences. A recent study has reported that as much as 17% of adult-onset asthma is attributable to maternal smoking in childhood (Skorge et al. 2005). Several other international studies have reported associations with passive smoke exposure in childhood and asthma in adulthood. A Swedish study showed that the prevalence of adult asthma among people who never smoked was higher among subjects who had been exposed to environmental tobacco smoke as a child (Larsson et al. 2001). Findings from the European Community Respiratory Health Survey showed a higher prevalence of respiratory symptoms and poorer lung function among adults whose mother smoked during pregnancy or had childhood exposure to maternal smoking (Svanes et al. 2004).

Other studies have reported that subjects who were exposed to passive smoke during their childhood are more likely to take up smoking themselves (Cook & Strachan 1999; Larsson et al. 2001) and this may increase their risk of developing asthma.

The large body of evidence regarding the harmful consequences of passive smoke exposure has resulted in the introduction of smoking bans in many public areas. Recent legislative changes in Australia prohibit smoking in places such as bars, cafes and restaurants, shopping centres, entertainment venues and the workplace. South Australia recently became the first state to ban smoking in cars carrying children under the age of 16 years. In New South Wales in 2006, 88% of adults reported that their car was smoke-free (Centre for Epidemiology and Research 2007). Unfortunately, young children, who are most vulnerable to the effects of passive smoke exposure, are most likely to be exposed to passive smoke in their home, where smoking bans do not apply. There is evidence, though, that the proportion of homes in which smoking was *not permitted* inside the house increased in Australia from 71.6% in 1999 to 80.1% in 2004 (Valenti et al. 2005).

This section provides data on the proportion of children with asthma who live in homes where smoking occurs inside the home.

7.2.1 Exposure to passive smoke inside the home

Australian children with asthma continue to be exposed to environmental tobacco smoke in the home despite the known adverse effects. In 2004–05, 39.1% of children aged 0–14 years with asthma *lived with one or more cigarette smokers*. This proportion was marginally higher than that observed among children without asthma (36.2%). Furthermore, 11.0% of children with asthma were residing in homes where *smoking occurred inside the home* (Table 7.2). This rate was significantly higher than that observed for children without asthma (9.4%; p = 0.04). Results from health surveys conducted in Victoria, Western Australia and South Australia support these findings (Table 7.2).

Table 7.2: Exposure to passive smoke among children, 2004–2007

Population (study)	Year	Age (years)	Household smoking status	Children with asthma		Children without asthma	
				Rate (%)	95% CI	Rate (%)	95% CI
Australia (1)	2004–05	0–14	One or more regular smokers usually smoke inside the house	11.0	8.1–13.9	9.4	8.3–10.4
Victoria (2)	2006	1 to under 13	No smoker	65.0	60.7–69.4	68.1	66.3–69.9
			Regular smoker/s	35.0	30.6–39.3	31.9	30.1–33.6
				(n = 652)		(n = 3,933)	
Victoria (2)	2006	1 to under 13	Always or usually smoke outside the house	88.1	83.0–93.1	85.8	83.4–88.2
			Sometimes smoke inside and sometimes smoke outside	9.4	4.8–14.1	10.0	8.1–11.8
			Usually smoke inside and sometimes smoke outside	2.5	0.3–4.6	4.2	2.6–5.7
				(n = 255)		(n = 1,287)	
Western Australia (3)	2006–07	Under 16	My home is smoke-free	97.3	94.0–98.8	96.0	94.1–97.3
			People occasionally smoke inside the house	2.2	0.9–5.6	2.0	1.2–3.3
			People frequently smoke inside the house	0.5	0.2–1.7	2.0	1.1–3.7
				(n = 127)		(n = 1,051)	
South Australia (4)	2006–07	2–15	My home is smoke-free	92.5	87.9–95.5	95.2	93.8–96.3
			People occasionally smoke inside the house	1.9	0.7–5.0	3.3	2.4–4.5
			People frequently smoke inside the house	5.5	3.1–9.8	1.5	0.9–2.4
				(n = 189)		(n = 1,087)	

Note: CI = confidence interval.

Sources: (1) Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files; (2) Victorian Child Health Survey, Child Outcomes Monitoring, Statewide Outcomes for Children Branch, Office for Children, Department of Human Services; (3) Epidemiology Branch, Analysis and Performance Reporting Directorate, Department of Health, Government of Western Australia; (4) South Australian Monitoring and Surveillance System (SAMSS), Population Research and Outcome Studies, Health Intelligence, Department of Health, Government of South Australia.

7. Tobacco smoke and occupation as risk factors for asthma

High rates of exposure to environmental tobacco smoke were observed for children of all ages with and without asthma (Figure 7.3).
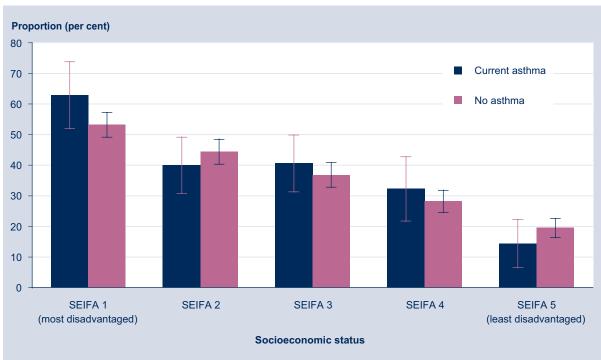

Proportion (per cent)

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) 2004–05 National Health Survey confidentialised unit record files.

Figure 7.3: Proportion of children aged 0–14 years residing with one or more cigarette smokers who usually smoke inside the house, by age group and current asthma status, 2004–05

Socioeconomic disadvantage

In the most socioeconomically disadvantaged localities, nearly two-thirds of children with current asthma reside with a smoker. This proportion declines to 14% in the least socioeconomically disadvantaged localities (Figure 7.4).

Notes: Age-standardised to the Australian population as at June 2001; SEIFA = Socio-economic Indexes for Areas

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) 2004–05 National Health Survey confidentialised unit record files.

Figure 7.4: Proportion of children aged 0–14 years with one or more cigarette smokers in the household, by socioeconomic status and current asthma status, 2004–05

7.3   Occupational asthma

Occupational asthma represents the most prevalent occupational lung disease in the developed world (Nicholson et al. 2005). The term refers to asthma caused, or made worse, by exposures in the workplace. International studies suggest that 9–15% of cases of asthma in adults of working age are either caused or aggravated by occupational factors (Nicholson et al. 2005).

There are over 400 substances that are recognised as triggers for asthma in the workplace including various chemicals used in paints, manufacturing and cleaning products, latex gloves, animals and dusts from grain, flour and wood (Nicholson et al. 2005). These agents pose most risk for people employed in the plastics, rubber and chemical industries, nurses, timber workers and welders, and jobs involving painting (particularly spray painting), dyeing, cleaning, baking and food processing, farming, laboratory work and working with animals (NAC 2006; Nicholson et al. 2005).

The importance of occupational asthma is that it is relatively common and it is preventable. A population-based study in Canada (Johnson et al. 2000) concluded that the removal of exposure to known triggers could prevent as much as 18% of adult-onset asthma in that country, although a

subsequent, similar study in Australia found a lower proportion of cases attributable to workplace exposures (see section on 'Prevalence of occupational asthma' below). Early removal from exposure is important for treatment and preventing persistent disease. Reducing or eliminating exposure to the triggering agent(s) will usually reduce the severity of symptoms or, in some cases of early intervention, it may eliminate symptoms completely. Persons who remain exposed are more likely to have persistent and troublesome asthma. The AIHW has recently published a review of occupational asthma (AIHW 2008e) that summarises known occupational risk factors for asthma, current knowledge about incidence and prevalence and approaches to prevention and disease monitoring, with particular reference to the Australian context. Here we present a brief coverage of those issues.

7.3.1   Current surveillance

Since occupational exposure represents a potentially avoidable cause of asthma, exposure to occupational allergens and the occurrence of occupational asthma are important targets for surveillance. Therefore, the prevalence of occupational asthma has been identified as one of the 24 national health indictors for asthma (AIHW: Baker et al. 2004). The intent of the indicator is to:

- monitor exposure to, and the impact of, occupational risk factors for asthma
- evaluate population health interventions to prevent the onset and exacerbations of asthma (in the occupational setting)
- monitor the provision of a safe environment for people with asthma.

In spite of its identification as an asthma indicator, there is no consistent, thorough and reliable scheme to monitor the prevalence of occupational asthma in Australia at the present time.

Conventional monitoring for chronic diseases is largely based on measures of late-stage events such as hospitalisation and mortality and on cross-sectional prevalence surveys. Unfortunately, both of these sources provide very limited and potentially biased evidence about the impact of occupational asthma.

Causal exposures are very rarely recorded in hospitalisation and mortality data and, hence, there is virtually no information on the contribution of occupational exposures to these outcomes of asthma. Furthermore, these outcomes represent only the 'tip of the iceberg' of this issue.

A more fundamental problem is that the disease may be transient and the main impact may be to cause someone to leave his or her job. People who find that their work is causing or aggravating asthma (or other symptoms) tend to seek alternative employment or leave the workforce altogether. Some cross-sectional surveys have been performed to estimate the prevalence of occupational asthma. These have generally asked respondents about previous employment or exposures that may have caused asthma or asthma-like symptoms. Australian data from two surveys are reported below in the section entitled 'prevalence of occupational asthma'.

Since some industries are at particularly high risk for cases of occupational asthma, there may be value in conducting surveillance in specific workplaces. However, workplace-based cross-sectional surveys are particularly likely to underestimate the burden of the disease since many of the affected workers will have left the workplace. The remaining workers will tend to be the healthy ones. This bias is a major problem in surveillance for occupational disease and is known as the 'healthy worker effect'.

In order to accurately estimate the impact of occupational asthma in the community or in a specific workplace, it is necessary to measure the incidence of asthma in a cohort followed over time. Well-conducted cohort studies will not be affected by the healthy worker bias described above. Some examples of measures of the incidence of occupational asthma in Australia are cited in the section below entitled 'Incidence of occupational asthma'.

7.3.2 Prevalence

It has been estimated that occupational exposures cause of 9.5% of cases of adult-onset asthma in New South Wales (Johnson et al. 2006). This estimate was based on data from a self-completed postal questionnaire administered to a randomly selected sample of adults in New South Wales. Information on adult-onset asthma and ever being employed in occupations identified as being of high risk for the development of occupational asthma were collected. The triggering agents associated with the greatest risk of adult-onset asthma were exposure to ammonia (odds ratio 2.54; 95% CI 1.72–3.78) and photographic development (odds ratio 2.25; 95% CI 1.04–4.85). One of the strengths of this study is its population-based design, which allows for the inclusion of people who have had occupational asthma and have left the workplace.

In 2001, 1.6% (95% CI 1.0–2.2%) of respondents with asthma in the NHS aged 15 years and over stated that their asthma was work-related. In 2004–05, the prevalence of work-related asthma among those with asthma was 2.2% (95% CI 1.5–2.8%). Among those aged 35–64 years, 3.1% (95% CI 1.9–4.3) of all asthma cases in 2004–05 were attributed to work while among those aged 15–34 years, 0.7% (95% CI 0.1–1.3) of people with asthma reported that their condition was work-related.

The estimate for the proportion of adult-onset asthma attributable to occupational exposures in New South Wales falls towards the lower end of the range observed in international studies (Nicholson et al. 2005).

7.3.3 Incidence

Population-based surveillance for incident cases of occupational asthma has been established in three Australian states.

The Surveillance of Australian Workplace-Based Respiratory Events (SABRE) is a voluntary notification scheme that has been in operation in Victoria and Tasmania since 1997 and in New South Wales since 2001. In this scheme, respiratory physicians, occupational physicians and, in the case of New South Wales, accredited general practitioners report newly diagnosed cases of occupational respiratory diseases.

Since the scheme started, the incidence of occupational asthma was 5 cases per million employed people per year in Tasmania and Victoria combined and 2 cases per million employed people per year in New South Wales (Hannaford-Turner et al. 2007). On an international scale, this is a relatively low incidence rate.

Unfortunately, the voluntary nature of this scheme means that this is almost certainly an underestimate of the true incidence. As there is no legislative requirement to report benign occupational lung disease (as there is for certain infectious diseases and for cancer, for example) and there is no comprehensive compensation scheme for people with occupational asthma, there is no incentive for patients or health-care professionals to notify new cases. Furthermore, the notification scheme does not impose a standard for the diagnosis of occupational asthma. Hence, estimates of the incidence of occupational asthma based on these notifications may be inaccurate. The net effect is likely to be an underestimate.

The lower incidence in New South Wales compared with other settings may be attributable to underestimation. For example, in Finland, physicians are required by law to report all cases of known or suspected work-related disease to a national register. In addition, all employees in Finland must carry insurance for occupational diseases. Reports of disease and accident diagnoses, recorded by the insurance companies, are provided to the national register. It has been reported that the mean annual incidence of occupational asthma in Finland, where all cases of occupationally-related disease are captured in the Finnish Registry of Occupational Diseases, is 174 cases per million employed workers (Karjalainen et al. 2000). International estimates of the incidence of occupational asthma average around 47 cases per million workers (range 12–174 cases per million workers) (Karjalainen et al. 2000; Nicholson et al. 2005).

7. Tobacco smoke and occupation as risk factors for asthma

7.3.4 Improving surveillance

Cross-sectional community-based population studies do provide some valuable information on the prevalence of occupational asthma in the population. However, they are only successful if they are truly population-based—that is, they include individuals who have left the workforce and they include a detailed historical record of respondents' occupational exposures. Since this is very time-consuming, it is best achieved using a nested survey design in which this information is only sought from respondents with adult-onset asthma and a sample of controls without asthma.

Workplace and community surveillance for incident cases is the 'gold standard' for monitoring the impact of occupational asthma and also for managing the problem in real time. For the reasons outlined above, community-level surveillance has been difficult to achieve in Australia. Improved rates of notification require incentives in the form of a legislative requirement or, preferably, a link to compensation payments, and the application of standards for the diagnosis.

Summary

Despite the known adverse effects of smoking, people with asthma continue to smoke at least as commonly as people without asthma. Smoking is more common among younger people with asthma than older people with asthma. These results imply that developing asthma does not immediately encourage people to quit smoking, which probably reflects the highly addictive qualities of nicotine products. It is also plausible that some of the observed association between smoking and self-reported asthma is attributable to the association with smoking-related respiratory disease, including chronic obstructive pulmonary disease.

Socioeconomic position has an important effect on the risk of smoking among people with asthma. Although smoking is more common in all people living in more disadvantaged localities than those living in more advantaged localities, this discrepancy is much greater in the population with asthma. Disadvantaged localities may benefit from a targeted approach to health promotion aimed at reducing smoking.

Children with asthma continue to be exposed to passive smoke in their home. Almost 40% of children with asthma lived with smokers and an estimated 11% of children with asthma were living in homes where smoking occurred inside the home. There was a substantial socioeconomic gradient in exposure to environmental tobacco smoke. Children living in areas where socioeconomic position was lower were more likely to be exposed to environmental tobacco smoke, and this association was strongest among children who had asthma.

Asthma caused or aggravated by exposures at work is the one truly preventable form of the disease. It is estimated, based on data from New South Wales, that around 9.5% of adult-onset asthma is caused by occupational exposures and, hence, could be avoided if exposure to triggering agents in the workplace was eliminated. There are limited surveillance data on occupational asthma in Australia and there is a need to improve the completeness of notification to existing voluntary schemes in Victoria, Tasmania and New South Wales.

8. *Quality of life*

Key points

- Asthma is associated with poorer quality of life.
- People with asthma rate their health worse than people without the condition.
- People with asthma report a substantially higher proportion of days of reduced activity than those without the condition.
- Most of the impact of asthma is on physical functioning and on the ability to perform social roles.
- Australians with asthma report worse psychological health than those without asthma and the difference is more pronounced in females and in older persons.

Introduction

Traditional measures of disease impact, such as prevalence and mortality rates, are important but are of limited use in understanding the extent of the effect a disease has on an individual. 'Health-related quality of life' (HRQoL) is a term often used to describe an individual's perception of how a disease or condition affects their physical, psychological (emotional) and social wellbeing. This can be used to measure the impact of asthma on a person's health and everyday functioning. Generic measures of quality of life are frequently used in health surveys to evaluate the overall impact of a person's health status on their health and everyday functioning.

Among people with asthma, disease severity, the level of disease control and the impact of the disease on HRQoL are interrelated. People with severe asthma can be expected, on average, to have worse outcomes and, hence, worse HRQoL than people with less severe disease. During periods of poor asthma control, people with asthma report poorer HRQoL (Vollmer et al. 1999). A number of aspects of the physical impact of disease and its effect on social functioning or role performance can also be considered as markers of disease control. These include reduced activity days, restricted physical activity, reduced functioning ability and days lost from work or school.

This chapter presents information on HRQoL using data from the ABS NHS and state health surveys. Comparisons in HRQoL are made among people with and without asthma and the impact of asthma on overall, social, emotional and physical wellbeing are described.

8.1   Impact of asthma on self-assessed health

The presence of asthma is associated with worse self-assessed health status (Table 8.1). In the ABS 2004–05 NHS, 42% of adults with asthma rated their health as 'excellent' or 'very good', compared with 58% of people without asthma. At the other end of the scale, 27% of people with asthma rated their health as 'fair' or 'poor' compared with only 15% of people without the condition.

Although the definitions of asthma varied, in all surveys listed in Table 8.1, the distribution of responses on self-assessed health status was shifted towards a more adverse health status among people with asthma.

This relationship also exists among children. Data from the Victorian Child Health Survey show that parents of 73% of children with asthma compared with 91% of children without asthma reported that their child's general health was 'excellent' or 'very good'.

Table 8.1: Self-assessed health in people with and without current asthma, 2002–2007

Population (study)	Response	Results (rate; %)			
		With asthma	95% CI	Without asthma	95% CI
In general, would you say your health is: excellent, very good, good, fair or poor?					
Australia, 2004–05 (1)	Excellent	11.2	9.6–12.7	22.1	21.4–22.8
Age 15 years and over	Very good	31.1	28.7–33.5	35.8	35.0–36.6
	Good	30.3	27.9–32.7	27.5	26.7–28.3
	Fair	17.4	15.5–19.4	10.7	10.2–11.2
	Poor	10.0	8.5–11.5	3.9	3.6–4.2
		(n = 2,202)		(n = 18,578)	
New South Wales, 2005 (2)	Excellent	12.5	10.0–15.1	22.4	21.2–23.5
Age 16 years and over	Very good	24.2	20.9–27.5	32.3	31.0–33.5
	Good	30.8	27.2–34.4	27.8	26.6–29.0
	Fair	21.5	18.4–24.6	12.0	11.2–12.8
	Poor	8.5	6.6–10.5	4.5	4.0–5.1
	Very poor	2.3	1.4–3.1	1.0	0.7–1.2
		(n = 1,301)		(n = 10,173)	
New South Wales, 2003 (2)	Excellent	14.6	11.8–17.5	23.3	22.2–24.5
Age 16 years and over	Very good	25.9	22.5–29.3	31.0	29.7–32.2
	Good	30.1	26.6–33.5	27.6	26.5–28.8
	Fair	19.4	16.6–22.2	12.6	11.7–13.4
	Poor	7.5	5.8–9.1	4.2	3.7–4.7
	Very poor	2.5	1.6–3.4	1.2	0.9–1.4
		(n = 1,524)		(n = 11,484)	
New South Wales, 2002 (2)	Excellent	13.0	10.4–15.5	24.5	23.3–25.7
Age 16 years and over	Very good	24.5	21.2–27.8	30.0	28.7–31.2
	Good	31.6	28.0–35.3	27.8	26.6–29.0
	Fair	19.9	16.8–23.1	12.3	11.4–13.2
	Poor	8.2	6.4–9.9	4.0	3.5–4.5
	Very poor	2.8	1.9–3.7	1.3	1.0–1.7
		(n = 1,468)		(n = 11,154)	
Victoria, 2006 (3)	Excellent	7.3	4.7–10.0	13.3	12.2–14.4
Age 18 years and over	Very good	31.7	26.7–36.8	35.2	33.5–36.8
	Good	37.0	32.2–41.9	37.1	35.4–38.7
	Fair	18.9	15.2–22.5	11.2	10.0–12.2
	Poor	4.9	3.0–6.8	3.1	2.6–3.7
		(n = 787)		(n = 6,713)	

(continued)

Table 8.1 (continued): Self-assessed health in people with and without current asthma, 2002–2007

| Population (study) | Response | Results (rate; %) | | | |
		With asthma	95% CI	Without asthma	95% CI
Queensland, 2006 (4)	Excellent	17.3	11.7–24.9	17.4	15.2–19.9
Age 18 years and over	Very good	28.2	22.0–35.5	44.5	41.5–47.6
	Good	40.5	33.1–48.4	28.7	26.1–31.5
	Fair	9.2	5.9–14.2	8.2	6.7–10.0
	Poor	4.4	1.8–10.2	1.3	0.8–2.0
	Don't know	0.3	0.1–2.4	0	. .
		(n = 215)		(n = 1,305)	
Queensland, 2004 (4)	Excellent	10.4	7.1–13.7	17.4	15.7–19.1
Age 18 years and over	Very good	34.2	29.1–39.3	38.1	35.9–40.3
	Good	33.6	28.6–38.7	30.0	27.9–32.1
	Fair	15.5	11.6–19.4	10.9	9.5–12.3
	Poor	5.4	3.0–7.8	3.5	2.7–4.3
	Don't know	0.9	0–1.9	0	..
		(n = 336)		(n = 1,895)	
Western Australia, 2006 (5)	Excellent	16.0	10.8–23.2	19.7	18.1–21.4
Age 16 years and over	Very good	35.5	29.7–41.8	42.5	40.4–44.6
	Good	30.0	24.9–35.7	27.8	26.0–29.6
	Fair	12.3	9.2–16.4	8.0	7.0–9.0
	Poor	6.1	3.4–10.8	2.1	1.6–2.6
		(n = 619)		(n = 5,313)	
South Australia, 2006–07 (6)	Excellent	10.4	8.4–12.7	19.4	18.3–20.5
Age 16 years and over	Very good	34.5	31.2–38.0	41.0	39.7–42.4
	Good	28.1	25.1–31.4	24.4	23.2–25.6
	Fair	17.8	15.2–20.6	12.0	11.2–13.0
	Poor	9.2	7.4–11.5	3.2	2.7–3.7
		(n = 764)		(n = 4,935)	
Overall, how would you rate your health during the past 4 weeks? Excellent, very good, good, fair, poor or very poor?					
Victoria, 2006 (7)	Excellent/ very good	73.3	69.2–77.4	90.6	89.5–91.7
Age 1 to under 13 years	Good	19.7	16.0–17.4	8.2	7.1–9.2
	Fair/poor	7.0	4.7–9.3	1.2	0.8–1.6
		(n = 652)		(n = 3,933)	

. . Not applicable

Notes: The definitions for current asthma were: NSW Health Survey, Queensland Omnibus Survey and WA Health and Wellbeing Surveillance System: doctor diagnosis of asthma plus treatment or symptoms of asthma in the last 12 months; Victorian Population Health Survey: doctor diagnosis of asthma plus symptoms of asthma in the last 12 months; National Health Survey: 'yes' to the question 'Have you ever been diagnosed by a doctor with asthma?' and 'yes' to 'Do you still get asthma?' CI = confidence interval.

Sources: (1) Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files; (2) New South Wales Population Health Survey, Centre for Epidemiology and Research 2006; Centre for Epidemiology and Research (NSW Department of Health) 2003, 2004; (3) Department of Human Services, Victorian Population Health Survey 2006 (unpublished data); (4) Queensland Omnibus Survey 2006, 2004, unpublished data, Health Information Branch, Queensland Health; (5) Western Australia Health and Wellbeing Surveillance System unpublished data, 2007, Health Information Centre, Department of Health, Government of Western Australia; (6) South Australian Department of Health, South Australian Monitoring and Surveillance System (SAMSS, unpublished data); (7) Department of Human Services, 2006 Victorian Child Health and Wellbeing Survey (unpublished data).

The disparity in self-rated health status between people with and without asthma increased with increasing age among both males and females (Figure 8.1). Females with current asthma rated their health marginally better than males with current asthma, particularly among those aged 15–34 years.

Note: Age-standardised to the Australian population as at June 2001.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files.

Figure 8.1: Self-assessed health status in people aged 15 years and over, by sex, current asthma status and age group, 2004–05

8. Quality of life

8.2 Impact of asthma on the domains of HRQoL

Health-related quality of life measures are commonly described in terms of physical, psychological and social domains. Available evidence suggests that in all these domains the HRQoL of people with asthma is worse than that observed in people without the disease. Here we review data on the impact of asthma on the psychological and social domains of HRQoL.

8.2.1 Psychological domain

The psychological component of quality of life encompasses thoughts, emotions and behaviours. Asthma has an impact on this domain of quality of life.

In a South Australian study, people with asthma had a higher prevalence of depression than people without asthma (Goldney et al. 2003). Furthermore, people with more severe symptoms of asthma (shortness of breath, waking at night with asthma symptoms or morning symptoms) were more likely to suffer from major depression than those without severe symptoms.

General measures of the psychological component of quality of life (such as the mental component summary of the SF-12 Health Survey—12-item short form) are able to detect small differences in the psychological health of people with and without asthma. Specific measures of anxiety and depression, such as the Kessler Psychological Distress Scale, have been used in surveys of people with and without asthma. In this section, we present Australian data from both generic and specific measures of the psychological component of HRQoL and compare these among people with and without asthma.

Some studies have found worse mood and higher levels of anxiety and depression in people with asthma compared with people without asthma (Table 8.2)

Table 8.2: Psychological component of quality of life, adults, 2000–2007

Population (study)	Response	Results (rate; %)			
		With asthma	95% CI	Without asthma	95% CI
Kessler-10 Psychological Distress Scale					
Australia, 2004–05 (1)	Low (<16)	50.2	47.4–53.0	63.7	62.8–64.6
Age 15 years and over	Moderate (16–21)	27.5	25.1–29.9	24.0	23.2–24.8
	High (22–29)	14.3	12.5–16.1	8.9	8.3–9.5
	Very high (≥30)	8.0	6.6–9.4	3.4	3.1–3.7
		(n = 2,050)		(n = 17,424)	
New South Wales, 2005	Low (10–15.9)	57.4	53.2–61.6	70.2	68.8–71.6
Age 16 years and over (2)	Moderate (16–21.9)	20.7	17.3–24.1	19.0	17.8–20.3
	High (22–29.9)	14.2	11.3–17.0	7.9	7.1–8.7
	Very high (≥30)	7.7	5.6–9.8	2.9	2.4–3.4
		(n = 1,301)		(n = 10,173)	
Victoria, 2006 (3)	Low (<16)	52.8	47.8–57.9	64.8	63.2–66.5
Age 18 years and over	Moderate (16–21)	30.3	25.6–35.1	21.4	19.9–22.8
	High (22–29)	11.0	8.1–13.8	7.4	6.5–8.3
	Very high (≥30)	3.2	1.9–4.4	2.8	2.2–3.5
		(n = 787)		(n = 6,713)	

(continued)

Table 8.2 (continued): Psychological component of quality of life, adults, 2000–2007

Population (study)	Response	Results (rate; %)			
		With asthma	95% CI	Without asthma	95% CI
Victoria, 2003 (4)	Low (<16)	53.6	49.2–56.9	68.1	66.5–69.7
Age 18 years and over	Moderate (16–21)	26.9	23.0–30.8	20.0	18.6–21.4
	High (22–29)	11.7	8.8–14.6	7.8	6.8–8.8
	Very high (≥30)	5.6	3.8–7.4	2.2	1.8–2.6
		(n = 877)		(n = 6,623)	
Western Australia, 2004 (5)	Low (<16)	57.3	52.9–61.6	74.9	73.6–76.3
Age 18 years and over	Moderate (16–21)	23.9	20.0–27.6	16.8	15.6–17.9
	High (22–29)	11.3	8.2–15.1	6.0	5.2–6.7
	Very high (≥30)	7.7	4.6–11.9	2.3	1.8–2.8
		(n = 399)		(n = 3,208)	
South Australia, 2006–07 (6)	Psychological distress	17.6	15.0–20.4	8.3	7.5–9.1
Age 16 years and over	No psychological distress	82.4	79.6–85.0	91.7	90.9–92.5
		(n = 761)		(n = 4,916)	
South Australia, 2002–04 (7)	Low/ mod (<21)	84.7	82.5–86.3	90.2	89.6–90.8
Age 16 years and over	High/ very high (≥22)	15.6	13.3–17.6	9.8	9.2–10.4
		(n = 1,433)		(n = 11,450)	
Mental component summary (MCS) for SF-12					
Western Australia, Northern Territory and South Australia, 2000 (8)	MCS (mean score)	50.9	47.6–54.4	52.2	50.8–53.2
		(n = 834)		(n = 6,609)	p < 0.05
Age 18 years and over					

Notes: The definitions for current asthma were: NSW Health Survey, SA Monitoring and Surveillance System and WA Health and Wellbeing Surveillance System: doctor diagnosis of asthma plus treatment or symptoms of asthma in the last 12 months; Victorian Population Health Survey: doctor diagnosis of asthma plus symptoms of asthma in the last 12 months; National Health Survey: 'yes' to the question 'Have you ever been diagnosed by a doctor with asthma?' and 'yes' to 'Do you still have asthma?'

Sources: (1) Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files; (2) New South Wales Health Survey, Centre for Epidemiology and Research 2006; (3) Department of Human Services, Victorian Population Health Survey 2006 (unpublished data); (4) Department of Human Services, Victorian Population Health Survey 2003; (5) Health Information Centre, Department of Health, Government of Western Australia (Western Australia Health and Wellbeing Surveillance System, unpublished data); (6) South Australian Department of Health, South Australian Monitoring and Surveillance System (SAMSS, unpublished data); (7) SAMSS, Avery et al. 2004; (8) WANTS Survey 2000; Adams et al. 2004b.

In the general population, females were more likely than males to have high or very high psychological distress (odds ratio 1.4; 95% CI 1.3–1.5). Among people with current asthma, the disparity in psychological distress between the sexes was even more pronounced. Females with current asthma were 1.8 times (95% CI 1.4–2.3) more likely to have high or very high psychological distress than males with current asthma (Figure 8.2). Furthermore, among females, those with current asthma were 2.2 times (95% CI 1.9–2.5) more likely to have high or very high psychological distress than those without asthma.

A Canadian study showed that, compared to the general population, the prevalence of both depressive disorders and anxiety disorders among adults with asthma was at least double the prevalence observed in the general population (Lavoie et al. 2006).

Notes: The Kessler-10 scores corresponding to the levels of psychological distress are: low = 10–15; moderate = 16–21; high = 22–29; very high = 30–50. Age-standardised to the Australian population as at June 2001.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files.

Figure 8.2: Prevalence of low to very high psychological distress, by asthma status and sex, people aged 15 years and over, 2004–05

Recently, the World Mental Health Survey was conducted across 17 countries covering the Americas, Europe, the Middle East, Africa, Asia and New Zealand (Scott et al. 2007). Those who had ever received a doctor-diagnosis of asthma were 1.7 times (95% CI 1.4–2.1) more likely to have generalised anxiety than those without 'ever asthma', 1.7 times (95% CI 1.4–2.0) more likely to have agoraphobia (fear of open/public spaces) or panic disorder and 1.8 times (95% CI 1.4–2.3) more likely to have post-traumatic stress disorder.

8.2.2 Social domain

The social domain of HRQoL refers to the ability to perform roles and activities. This has most commonly been measured as time away from work or other usual activities.

Asthma accounts for a large proportion of days lost from work or study (Table 8.3).

Table 8.3: Social component of quality of life, adults and children, Australia, 2002–2007

Population/study	Response	Results (rate; %)			
		With asthma	95% CI	Without asthma	95% CI
Days away from work, school or usual activities					
Australia, 2004–05 (1)	Any days away from work/ study in last 2 weeks (for any reason)	16.6	14.4–18.8	10.7	10.1–11.3
Age 5 years and over		(n = 1,801)		(n = 14,772)	
	Any days away from work/school **due to asthma** in last 2 weeks	1.2	0.7–1.6	. .	. .
		(n = 2,660)			
Number of days asthma has made you so unwell that you could not work or study or manage your day-to-day activities in last 12 months					
Queensland, 2006 (2)	Less than once a week	97.0	94.6–98.4	. .	. .
Age 18 years and over	1–2 times a week	2.3	1.1–4.7	. .	. .
	3 or more times a week	0.7	0.2–2.1	. .	. .
	Every day	0	. .	. .	. .
		(n = 382)			
Had any days lost from work in previous 12 months					
South Australia (3)	2003	18.9	n.a.	n.a.	n.a.
Age 15 years and over	2002	22.5	n.a.	n.a.	n.a.
	2001	17.5	n.a.	n.a.	n.a.
	2000	17.6	n.a.	n.a.	n.a.
Asthma interfered with ability to study or work or manage your day-to day activities in last 12 months					
Queensland, 2006 (2)	Yes	39.9	34.7–45.2	. .	. .
Age 18 years and over	No	58.6	53.2–63.8	. .	. .
	Don't know/refused	1.6		. .	. .
		(n = 382)			
Activity limitations					
Australia, 2004–05 (1)	Any other days of reduced activity in the last 2 weeks (other than days off work/school)	19.0	17.2–20.8	10.0	9.5–10.4
Age 5 years and over		(n = 2,782)		(n = 23,124)	
	Any other days of reduced activity **due to asthma** in last 2 weeks (other than days off work/school)	1.9	1.3–2.5	. .	. .
		(n = 2,660)			
Level of interference with daily activities in the last 4 weeks					
New South Wales, 2006 (4)	None	82.4	78.9–85.8	n.a.	n.a.
Age 16 years and over	A little bit	5.4	3.1–7.6	n.a.	n.a.
	Moderately	6.4	4.2–8.6	n.a.	n.a.
	Quite a lot	3.6	2.0–5.2	n.a.	n.a.
	Extremely	2.2	1.1–3.3	n.a.	n.a.
		(n = 893)			

(continued)

8. Quality of life

Table 8.3 (continued): Social component of quality of life, adults and children, Australia, 2002–2007

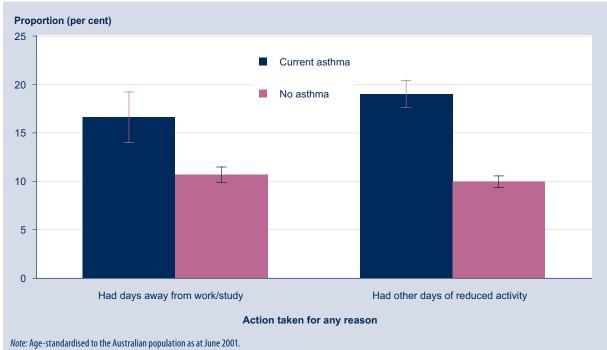| Population/study	Response	Results (rate; %)			
		With asthma	95% CI	Without asthma	95% CI
Level of interference with daily activities in the last 4 weeks					
New South Wales, 2005 (5)	None	85.1	82.6–87.5	n.a.	n.a.
Age 16 years and over	A little bit	4.7	3.3–6.2	n.a.	n.a.
	Moderately	4.8	3.4–6.2	n.a.	n.a.
	Quite a lot	3.9	2.6–5.2	n.a.	n.a.
	Extremely	1.5	0.7–2.3	n.a.	n.a.
		(n = 1,301)			
Totally unable to work or carry out normal duties because of health in the last 4 weeks					
South Australia, 2006–07 (6)	No	75.8	72.7–78.8	84.7	83.7–85.7
Age 16 years and over	At least one day	24.2	21.2–27.3	15.3	14.3–16.3
		(n = 764)		(n = 4,935)	
Able to work and carry out your activities, but had to cut down what you did, or did not get as much done as usual because of your health in the last 4 weeks					
South Australia, 2006–07 (6)	No	68.8	65.4–72.0	77.8	76.6–78.9
Age 16 years and over	At least one day	31.2	28.0–34.6	22.2	21.1–23.4
		(n = 764)		(n = 4,935)	
CHILDREN					
During the last 4 weeks, did your asthma interfere with your ability to manage your day-to-day activities?					
New South Wales, 2003–04 (7)	None	66.9	59.0–74.8	. .	. .
	A little bit	13.9	7.8–20.0	. .	. .
Age 2–15 years	Moderately	12.4	6.9–17.8	. .	. .
	Quite a lot	4.9	1.5–8.2	. .	. .
	Extremely	2.0	0.0–4.4	. .	. .
How many days (other than holidays) child has been away from school for any reason in the previous month					
South Australia, 2006–07 (6)	None	46.4	38.8–54.2	54.1	50.8–57.4
Age 5–15 years	At least one day	53.6	45.8–61.2	45.9	42.6–49.2
		(n = 156)		(n = 858)	

. . Not applicable

n.a. Not available

Note: The definitions for current asthma were: NSW Health Survey and Queensland Chronic Disease Survey: doctor diagnosis of asthma plus treatment or symptoms of asthma in the last 12 months; SA Omnibus Survey and National Health Survey: 'yes' to the question 'Have you ever been diagnosed by a doctor with asthma?' and 'yes' to 'Do you still have/get asthma?'

Sources: (1) Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) 2004–05 National Health Survey confidentialised unit record files; (2) Queensland Chronic Diseases Survey 2006, unpublished data, Health Information Branch, Queensland Health; (3) SA Omnibus Survey, Wilson et al. 2006; (4) New South Wales Population Health Survey, Centre for Epidemiology and Research 2007; (5) New South Wales Population Health Survey, Centre for Epidemiology and Research 2006; (6) Department of Health, Government of South Australia, South Australian Monitoring and Surveillance System (SAMSS,unpublished data); (7) New South Wales Population Health Survey, New South Wales Department of Health, Centre for Epidemiology and Research.

In the ABS 2004–05 National Health Survey, the proportion of people with current asthma who had taken time off work or study in the previous 2 weeks because of any illness (16.6%) was higher than the proportion of people without asthma who had taken time off for any illness (10.7%; p<0.0001; see also Figure 8.3). The proportion of people with asthma who actually attributed their days off work or study to asthma was 1.2%.
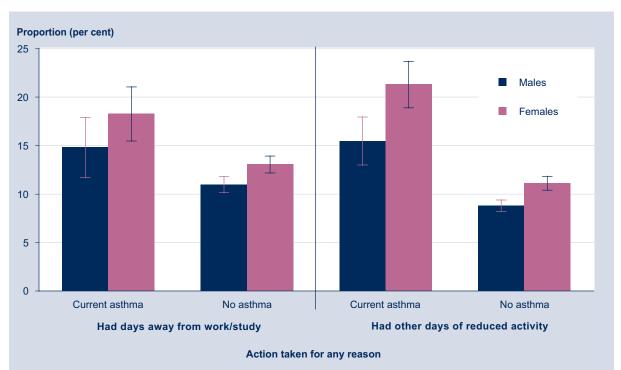
Among participants in the 2004–05 NHS, more people with current asthma had days off work or school compared with people without current asthma (Figure 8.3). Almost twice as many people with current asthma had other days of reduced activity compared with those without current asthma (19.0% versus 10.0%) (p < 0.0001). It has been demonstrated that people with severe asthma tend to have greater absenteeism from work on account of their disease in comparison to those with mild-to-moderate asthma (ENFUMOSA Study Group 2003).

Note: Age-standardised to the Australian population as at June 2001.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files.

Figure 8.3: Action taken in last 2 weeks for any reason, by asthma status, people aged 5 years and over, 2004–05

More females reported other days of reduced activity compared with males (Figure 8.4), although the disparity was more prominent among people with current asthma (21.3% of females versus 15.5% of males) compared with people without current asthma (11.1% of females versus 8.9% of males). A similar pattern was observed for days away from work or study.

Note: Age-standardised to the Australian population as at June 2001.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files.

Figure 8.4: Action taken in last 2 weeks for any reason, by asthma status and sex, people aged 5 years and over, 2004–05

Among those with asthma aged 5 years and over, 1.4% (95% CI 0.9–1.9%) had days off work or study and 1.9% (95% CI 1.3–2.5%) had other days of reduced activity because of their asthma in 2004–05 (data not shown).

Summary

Asthma has a measurable impact on how people assess their overall health status. Asthma is associated with poorer self-assessed health, and a substantially higher proportion of days of reduced activity. Most of the impact of asthma is on physical functioning and on the ability to perform social roles. The effects of asthma can include sleep disturbances and tiredness, as well as reduced participation in the workforce and sporting and other leisure activities.

There is also an important association between depression and asthma. Australians with asthma report worse psychological health than those without asthma, and the difference is more pronounced in females and in older persons.

Appendix 1: Data sources, definitions and population groups

The purpose of this appendix is to provide information on the data sources from which we have collated information for the analyses presented in this report and also to provide details of the methods used when preparing data for this report. A more detailed description of statistical methods used by the Australian Centre for Asthma Monitoring (ACAM) can be found in the report *Statistical methods for monitoring asthma* (ACAM 2008).

A1.1 Analysis methods

A1.1.1 Rates

Rates are used to describe the incidence of an event or the prevalence of a condition in a population or a population subgroup. Incidence rates refer to the number of events occurring in a population over a specified time interval divided by the size of the population. Prevalence rates refer to the number of people with a specified condition within a population divided by the size of the population. For rare events, rates per 100,000 persons have been calculated. For less rare events or conditions, other bases (e.g. per 100 persons or percentage) have been used.

Population-based rates have been calculated using relevant Australian Bureau of Statistics (ABS) Estimated Resident Population data, which were provided by the Australian Institute of Health and Welfare (AIHW).

Population-based rates

Crude rates

Crude rates have been calculated by dividing the number of people with a condition in a population or the number of events that occurred in a population in a year by the size of that population at the middle of that year. The mid-year population is an estimate of the average population during the whole year.

$$n/\text{population} \times 100,000$$

where n = number of persons with a condition or number of events, and population is the mid-year population for the relevant year.

Age- and sex-specific rates

Where required, rates have been estimated separately for individual age groups and for males and females. In this case, the relevant cases or events (for the numerator) are those within the specific age–sex group and the relevant population (for the denominator) is the specified age–sex group within the whole population.

Age-standardised rates

Age-standardised rates are used in this report to adjust for differences in population age structures when comparing rates for different periods of time, geographical areas and population subgroups. For the purposes of this report we have age-standardised all age groups except the 0–4 year age group.

Direct age-standardisation

Direct age-standardisation has been used when the populations under study were large and the age-specific rates were considered to be reliable.

Age-standardised rates have been calculated using the following formula:

Age standardised rate (ASR) = $\sum(r_i P_i)/\sum P_i$

where

r_i is the sex- and age-group specific rate for sex and age group *i* in the population being studied

P_i is the population of age group *i* in the standard population

The Australian population as at 30 June 2001 was the standard population in all analyses.

For trend data that are presented in broad age groups (e.g. 5–14 years, 15–34 years, 35–64 years, 65 years and over) the rates for these broad groups are age-standardised to adjust for variation in age structure within them.

The standard error (se) for an age-standardised rate per 100,000 population was calculated as:

$$se(ASR) = \sqrt{\left(\sum\left[\left(r_i \times P_i^2\right)/n_i\right]\times 100000\right]/P^2\right)}$$

where r_i = age-specific rate per 100,000 for age group *i*

n_i = population for age group *i*

P_i = standard population for age group *i*

$P = \sum P_i$ = total standard population

The 95% confidence interval (CI) for an age-standardised rate was calculated as:

95% CI = ASR ± [1.96 × se(ASR)]

When the number of cases was small, confidence intervals for direct age-standardised rates were estimated using a Poisson approximation (Anderson & Rosenberg 1998).

Indirect age-standardisation

In cases where the populations under study were small or where there was some uncertainty about the stability of age-specific rates—for example, when comparing mortality rates due to asthma between Indigenous and other Australians—we have used indirect age-standardisation. This method removes the influence of age structure, but does not provide a measure of prevalence in terms of a rate. Rather, the measure is a ratio of the number of observed cases to the number expected if the age-specific prevalence rates of the standard population are applied to the study population (Anderson & Rosenberg 1998). It is, therefore, interpreted as an age-adjusted rate ratio.

Asthma case-based rates

For some analyses, in which the event or condition is only relevant to people with asthma (for example, management or asthma-specific outcomes), rates are expressed as case-based rates in which the population with asthma is the denominator. These are based on the number of people with asthma as estimated from the most recent ABS NHS conducted in 2004–05.

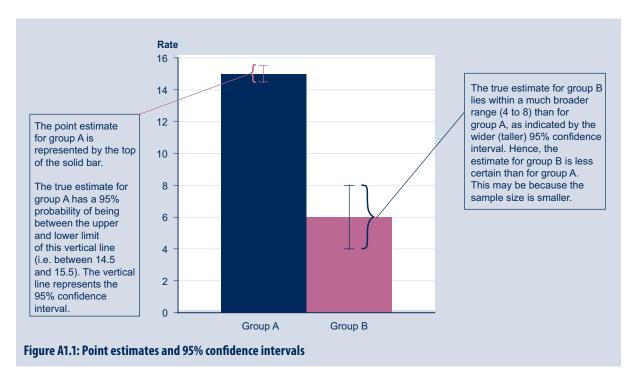**Appendix 1: Data sources, definitions and population groups**

For some analyses, both population-based rates and case-based rates are presented. This demonstrates the extent to which variation in population-based rates (for example, in hospitalisations for asthma) are attributable to variation in the prevalence of asthma.

It should be noted that, for reasons discussed in this report, the estimation of the prevalence of asthma entails inherent uncertainty. Hence, rates that include this estimate as a denominator are subject to this uncertainty.

A1.1.2   Confidence intervals

The rates and proportions contained within this report represent estimates derived from the available enumerated sample or aggregated data. These estimates contain inherent uncertainty, which is larger where the size of the sample or population from which it was estimated is smaller. Confidence intervals are used to demonstrate the extent of this uncertainty (that is, the precision of the estimates). The 95% confidence interval (CI) is an estimate of the range of values within which the 'true' population value is expected to lie, with 95% certainty (see Figure A1.1).

In the tables, 95% CIs are presented as ranges of values (in the form, xx to xx). In the figures, 95% CIs are depicted by vertical lines extending above and below each point or column.

Figure A1.1: Point estimates and 95% confidence intervals

The quadratic method of Fleiss (1981) was used to calculate 95% CIs for crude, age- and sex-specific rates. This method gives an asymptotic CI that does not include logically impossible negative numbers. It differs from the more familiar normal approximation only for rates near zero.

A1.1.3   Tests of statistical significance and association

Linear trends in rates have been tested using the chi-square test for trend. Differences in rates among groups have been tested by the chi-square test.

Multivariate regression methods are used to assess the independent effects of age, gender, socioeconomic disadvantage (SEIFA quintile), remoteness (Australian Standard Geographical Classification; ASGC) and Indigenous status on mortality, hospitalisation rates and smoking status. Logistic models have been constructed in which the independent effects of these characteristics on event rates are estimated. Interactions between factors have been tested and, where these were found to be significant, subgroup analyses have been presented. Results are expressed as adjusted (independent) odds ratios, with 95% CIs and/or as p values for the relevant chi-square test.

A1.2   Asthma definitions used for measuring prevalence

A number of definitions for asthma have been applied in the various surveys cited in this report. These have been used where the estimation of the prevalence of asthma is the primary purpose or where the purpose is to measure the prevalence of outcomes or treatments in people with asthma. In the latter case, the definition of asthma is used to identify a denominator population. Table A1.1 lists the definitions of 'ever asthma' and 'current asthma' that have been used in the surveys most commonly cited within this report.

Table A1.1: Asthma definitions used in the National Health Survey and state surveys

Ever asthma	Current asthma	Survey(s)
Have you ever been told by a doctor or a nurse that you have asthma?	Do you still get asthma?	Australian Bureau of Statistics (ABS) National Health Survey (2001 and 2004–05)
	In the last 12 months, have you had symptoms of asthma? In the last 12 months, have you taken treatment for asthma?	Western Australia Health and Wellbeing Surveillance System
Have you ever had asthma? Was your asthma confirmed by a doctor?	Do you still have asthma?	South Australian Omnibus Survey WANTS Health and Wellbeing Survey
	In the last 12 months, have you taken asthma medication that was prescribed or given to you by a doctor? In the last 12 months have you had whistling or wheezing in the chest at any time?	South Australian Monitoring and Surveillance System
Have you ever been told by a doctor that you have asthma?	In the last 12 months, have you had asthma symptoms of asthma (coughing, wheezing, shortness of breath and chest tightness when you don't have a cold or respiratory infection) or taken medications for asthma?	Victorian Child Health and Wellbeing Survey
Have you ever been told by a doctor or at a hospital that you have asthma?	Have you had symptoms of asthma or taken treatment for asthma in the last 12 months?	New South Wales Health Survey (child and adult) Queensland Omnibus Survey

Notes: State surveys used computer-assisted telephone interviews (CATIs); WANTS = Western Australia, Northern Territory and South Australia.

A1.3 BEACH (Bettering the Evaluation and Care of Health) and SAND (Supplementary Analysis of Nominated Data)

The BEACH data are collected through a continuous survey of general practice activity in Australia, which began in April 1998. BEACH is an activity of the Australian General Practice Statistics and Classification Centre (formerly the General Practice Classification and Statistics Unit), a Collaborating Unit of the Family Research Centre of the University of Sydney and the AIHW. A rolling random sample of general practitioners (GPs) is selected from the Medicare Australia database (AIHW: Britt et al. 2007). To be eligible to participate, GPs must have claimed at least 375 general practice Medicare items in the previous 3 months. Approximately 1,000 GPs participate annually, with about 20 GPs recording each week. Data are collected for 50 weeks each year. Each GP collects information on 100 consecutive encounters using a recording pack containing 100 forms. Each form is divided into two main sections. The first and larger section collects information on the current encounter for the BEACH data (see Section A1.3.1) and the data items/questions do not vary. The bottom section collects data for the SAND collection (see Section A1.3.2).

A1.3.1 BEACH data

The BEACH collection includes information about the following:

the encounter

- date and type of consultation
- up to four diagnoses or problems managed
- Medicare/Veterans' Affairs item number

the patient

- age and sex
- postcode of residence
- health-care card status/Veterans' Affairs card status
- non-English-speaking background status
- whether the patient identifies as Aboriginal and/or Torres Strait Islander
- up to three reasons for the encounter

the management of each problem

- medications prescribed, supplied or advised including brand, form, strength, dosage and drug status ('new' or 'continuing')
- non-pharmacological management including counselling, referrals, procedures, pathology and imaging ordered

the GP characteristics

- age and sex
- years working in general practice
- number of sessions worked per week
- postcode of main practice, etc. (AIHW: Britt et al. 2007).

For further information on BEACH, see <www.fmrc.org.au/beach.htm>.

International Classification of Primary Care

Information on diagnosis and problem managed during GP encounters, obtained from the BEACH data set, has been classified according to the International Classification of Primary Care, 2nd edition (ICPC-2) (AIHW: Britt et al. 2001). An extended vocabulary of terms called ICPC-2 PLUS is available from <http://www.aihw.gov.au/publications/index.cfm/subject/19>.

To classify 'asthma' from BEACH data, we have selected ICPC-2 rubric R96 and excluded code R96006 'extrinsic allergic alveolitis'. The following ICPC-2 PLUS codes were included:

R96001—asthma

R96002—bronchitis; asthmatic

R96003—bronchitis; allergic

R96005—status asthmaticus

R96007—bronchitis; wheezy

R96008—hyperactive airways

Analysis of BEACH data

Estimating the rate of general practice encounters for asthma

The number of general practice encounters where asthma was managed (i.e. general practice encounters for asthma) per 100 encounters was estimated from the BEACH data using a method which adjusts for the cluster (practice-based) sampling used in BEACH and also incorporates post-stratification weights to account for differences in age between the GP sample and the GP population. The data were also weighted for each participant's Medicare activity level, in order to better reflect total GP–patient encounters for Australia. This was implemented using the SURVEYMEANS® procedure in SAS software version 9 (SAS Institute 2005).

The estimated number of general practice encounters for asthma per 100 population was then estimated using the following information and formula:

$$\text{The estimated number of general practice encounters for asthma per 100 population} = \frac{\text{ARGPEs per 100 general practice encounters} \times \text{estimated total number of all general practice visits}}{\text{population}}$$

where

ARGPEs = number of general practice encounters for asthma based on analysis of BEACH data

population = the mid-year population for the relevant year.

The estimated total number of general practice visits was based on Medicare data for Medicare Benefits Schedule (MBS) Category 1 service items. This category includes all unreferred (i.e. primary care) attendances.

Derived variables for analysis of asthma-related BEACH data

Asthma medication

Asthma medication groupings were defined using BEACH in-house classification, the Coding Atlas for Pharmaceutical Substances (CAPS), which is mapped to the Anatomical Therapeutic Chemical (ATC) Classification System, the Australian standard for classifying medications at the generic level (Table A1.2).

Appendix 1: Data sources, definitions and population groups

Table A1.2: Variables for asthma medication groupings by name, ATC code and generic code

Variable	Medications included	ATC code	Generic code (CAPS)
Inhaled corticosteroids	Beclomethasone	R03BA01	R501
	Becloforte		
	Becotide		
	Qvar		
	Respocort		
	Budesonide	R03BA02	R502
	Pulmicort		
	Fluticasone propionate	R03BA05	R506
	Flixotide		
	Ciclesonide	R03BA05	R510
	Alvesco		
Long-acting beta-agonists combined with inhaled corticosteroids	Fluticasone/salmeterol	R03AK06	R508
	Seretide		
	Budesonide/eformoterol	R03AK07	R509
	Symbicort		
Oral corticosteroids	Prednisolone	H02AB06	H203
	Solone		
	Panafcortelone		
	Predsolone		
	Prednisone	H02AB07	H202
	Sone		
	Panafcort		
	Predsone		
	Prednisolone sodium phos. oral	H02AB06	H212
Leukotriene receptor antagonists	Montelukast	R03DC03	R410
	Singulair		
	Zafirlukast	R03DC01	R410
	Accolate		
Cromones	Nedocromil	R03BC03	R505
	Tilade		
	Sodium cromoglycate	R03BC	R503
	Intal		
	Cromese sterinebs		

Note: CAPS = Coding Atlas for Pharmaceutical Substances; ATC = Anatomical Therapeutic Chemical Classification System.

A medication variable was created and for each asthma-related encounter, defined as 'yes' or 'no' depending on whether or not at least one of the prescriptions provided at that encounter belonged to the designated medication class. For example, the inhaled corticosteroids (ICS) variable was assigned a value of '1' (i.e. 'yes') if asthma was managed during the encounter and at least one of the prescriptions

prescribed during that encounter had a generic code of R501, R502, R506 or R510. Otherwise, ICS was assigned a value of '0' (i.e. 'no') if asthma was managed or remained blank (not defined) for non-asthma encounters.

Procedures and referrals for asthma

Variables for procedures and referrals for the purposes of asthma management were defined using the ICPC-2 PLUS classification as described in Table A1.3.

Table A1.3: Variables for asthma-related procedures and referrals

Variable	BEACH data element	ICPC item included	ICPC code/rubric
Advice/consultation; smoking	Procedures, other treatments and counselling for asthma	Advice/consultation; smoking	P45004
			P58008
Lung function test	Procedures, other treatments and counselling for asthma	Test; peak flow	R39
		Test; pulmonary function	
		Test; spirometry	
		Test; lung function	
		Test; physical function; respiratory	
		Test; FEV1	
		Test; respiratory function	
Asthma plan	Procedures, other treatments and counselling for asthma	Asthma plan	R49002
Hospital	Referrals for asthma	Referral; hospital	A67010
		Admission; hospital	A67022, A62010
Emergency department	Referrals for asthma	Referral; A&E	A67011
Specialist	Referrals for asthma	Referral; specialist	A67001
		Referral; physician	A67001
		Referral; paediatrician	A67004
		Referral; allergist	A67005
		Referral; immunologist	B67003
		Referral; respiratory physician	R67002
Lung function test	Referrals for asthma	Test; peak flow	R39
		Test; pulmonary function	
		Test; spirometry	
		Test; lung function	
		Test; physical function; respiratory	
		Test; FEV1	
		Test; respiratory function	
Unspecified referral	Referrals for asthma	Referral	A68011

Note: BEACH = Bettering the Evaluation and Care of Health; ICPC = International Classification of Primary Care; FEV1 = forced expiratory volume in 1 second; A&E = accident and emergency (emergency department).

A procedure/referral variable was created and for each encounter, the variable was defined as 'yes' or 'no' if asthma was managed during that encounter and at least one of the procedures/referrals belonged to the designated procedure/referral group. For example, Specialist variable was assigned a value of 1 ('yes') if asthma was managed during the encounter and at least one of the referrals belonged to the following ICPC-2 list: A67001, A67001, A67004, A67005, B67003 or R67002.

Limitations of BEACH data

The response rate by GPs to the BEACH survey was 31.1% in 2005–06, 28.1% in 2004–05, 23.7% in 2003–04, 28.9% in 2002–03 and 32.3% in 2001–02 (AIHW: Britt et al. 2004, 2007). The proportion of BEACH GPs practicing in remote areas is only 1.3%, hence the sample from remote areas is relatively small (n = 13 in 2005–06) (AIHW: Britt et al. 2004). To improve the representativeness of the sample, BEACH data are weighted for differences between the GP sample and the GP population and for participants' Medicare activity level.

The BEACH Project has a quality assurance program to ensure the reliability of data entry. This includes computer-aided error checks during data entry, the validating of samples of data entered against original recording forms, and further logical data checks during the data cleaning and analysis using specific SAS programming (AIHW: Britt et al. 2002).

Britt and coworkers (AIHW: Britt et al. 1998) compared the recording of morbidity data by GPs for the BEACH Project, with two trained observers independently viewing a videotape of the encounters. They found good agreement (87%) between the GPs observed and the observers (who were also GPs) at the broad disease level (ICPC chapter), but agreement at the condition-specific level (ICPC rubric) was lower (67%). Thus, the labelling of certain conditions varies between GPs. The Australian General Practice Statistics and Classification Centre uses features of the ICPC classification structure to ensure synonymous terms are classified to the correct rubric but this cannot deal with variation among GPs in the way they use the labels 'asthma', 'chronic obstructive pulmonary disease (COPD)' or other respiratory disease labels.

A1.3.2   SAND data

The SAND data are collected as a supplementary data set of the BEACH Project (AIHW: Britt et al. 2001). Organisations sponsoring blocks of SAND data collection ask questions on topics of their choice and have access to the detailed reports. General practitioners participating in SAND ask and record responses to specific questions in targeted patient groups. SAND modules relevant to asthma have been conducted in 1999, 2000–01, 2002–03, 2004–05 and 2006–07 (AIHW: Britt & Miller 2007).

A1.4   Emergency department data

Data on emergency department (ED) visits for asthma have been derived from the New South Wales Emergency Department Data Collection (NSW EDDC). An ED attendance 'index' was calculated for the five age groups in the population as the number of attendances per year per 100,000 population with asthma in that age group.

ED visits for asthma are identified using the 'principal diagnosis' for the visit and are classified using the International Statistical Classification of Diseases and Related Health Problems, 9th Revision (ICD-9) or 10th Revision (ICD-10). Data from the NSW EDDC for the period 1999–2007 were accessed using the Health Outcomes Information Statistical Toolkit (HOIST) system.

A1.4.1   Limitations of emergency department data

In New South Wales, the ED data set includes data from 81 of the 150 EDs in that state. Approximately 75% of ED visits in New South Wales are captured in the data set. Emergency departments in metropolitan Sydney and larger rural hospitals are more likely to be included. Furthermore, the nature of the missing data means that the ED data tend to under-represent people visiting EDs in rural and remote areas.

A1.5   Expenditure data

Expenditure data used in this report were obtained from the Australian Institute of Health and Welfare's Disease expenditure database. This report considers recurrent health expenditure that has been allocated by health sector and disease.

It is not possible to allocate all expenditure on health goods and services by disease. Expenditure on most community and public health programs, for instance, support the treatment and prevention of many conditions and cannot be allocated to one specific disease or injury. This is also true of capital expenditure on health facilities and equipment, which has the added problem of being characterised by large outlays that fluctuate greatly from year to year. The method used to derive the estimates in this report, however, ensures that the estimates add across disease, age and sex groups to the total amount of health expenditure that was able to be allocated by disease in 2004–05—around two-thirds (70%) of total recurrent health expenditure ($52.7 billion) (AIHW 2008d).

The expenditure that was not able to be allocated by disease includes capital expenditure, non-admitted patient hospital services, over-the-counter drugs, all other health practitioner services excluding optometry, community health expenditure (except community mental health), expenditure on public health programs (except cancer screening programs), health administration and health aids and appliances. Therefore, in this report, references to health-care expenditure always imply 'allocated recurrent' health-care expenditure. All expenditure data are in 2004–05 dollars.

A1.5.1   Expenditure for admitted patients

Expenditure for admitted patients comprises admitted-patient public and private hospital services expenditure (same-day as well as overnight admissions). The proportions of total public acute hospital expenditure which relate to admitted patients are estimated using the admitted patient fractions for hospitals in each state and territory and are published in *Australian hospital statistics 2005–06* (AIHW 2007a). Private hospital expenditure data are derived from the Australian Bureau of Statistics Private Health Establishments Survey.

The hospital morbidity expenditure method estimates acute hospital admitted-patient costs by apportioning the total admitted-patient expenditure to individual episodes of hospitalisation with an adjustment for the resource intensity of treatment for the specific episode (using the diagnostic related groups, or DRGs) and the length of stay. The length of stay adjustment is made in such a way as to reflect the fact that some costs are proportional to length of stay (e.g. ward costs and meals), whereas others are independent of length of stay (e.g. theatre costs). The subdivision of episode costs into these cost 'buckets' was made using National Hospital Costs Data Collection data.

An adjustment is also made for the actual hospital where the treatment is provided. The standard DRG method for estimating costs uses state DRG weights, and so assumes that the hospital has the same average costliness as the average for the state. The Public Hospitals Establishments Database contains the actual cost of treating admitted patients at each hospital, so these data are used to scale up or down the estimate that comes from using state DRG weights.

Appendix 1: Data sources, definitions and population groups

For subacute and non-acute patients, where there are no DRG weights, the most recent data on costs come from the July to December 1996 subacute and non-acute patient (SNAP) study (Eagar et al. 1997). Per diem costs were applied and inflated to 2004–05 estimates using the implicit price deflator for final government consumption expenditure on hospital care (AIHW 2006).

Estimates of expenditure on medical services for private patients in hospitals are included in admitted patient hospital costs. Expenditure for private medical services in 2004–05 was $2,746 million (AIHW 2008d). These estimates come from Medicare data.

Hospital encounters for asthma were identified as those where the principal diagnosis was asthma (ICD-10 codes J45, J46 or J82).

A1.5.2   Out-of-hospital medical services expenditure

'Out-of-hospital medical' is primarily care in the community from GPs as well as specialists, imaging and pathology services. Specifically it includes MBS unreferred attendances, imaging, pathology, specialist, other medical MBS and any other medical services expenditure for 2004–05 reported in *Health expenditure Australia 2005–06* (AIHW 2007c) that has not been counted elsewhere.

Data from the GPs survey, Bettering the Evaluation and Care of Health (BEACH), was used to allocate private medical services provided by both GPs and specialists. The ICPC-2 codes used in BEACH were mapped to the disease costing groups to enable medical services expenditure to be allocated by disease.

Three years of the BEACH database, 2003–04, 2004–05 and 2005–06, were used in the analysis, which gave 297,000 encounters overall. The proportions of problems by disease were used to allocate medical expenditures. The total medical expenditures came from Medicare and the AIHW health expenditure database.

Expenditures for 'unreferred attendances', 'imaging' and 'pathology' were allocated to disease on the basis of GP encounters, while expenditure for 'other medical services' (mostly specialist services) was allocated to disease on the basis of the referral pattern in BEACH. Allocation of GP costs where there are multiple presenting conditions in the GP encounter was done on a pro-rata basis.

In-hospital medical expenditure for private patients was not included under medical services, but was allocated as part of admitted patient expenditure.

A1.5.3   Prescription pharmaceuticals expenditure

This includes benefit paid pharmaceuticals, under-copayment prescriptions and private prescriptions.

The Australian Government Department of Health and Ageing (DoHA) provided detailed costing data for pharmaceuticals issued under the Pharmaceutical Benefits Scheme (PBS) and the Department of Veterans' Affairs Repatriation Pharmaceutical Benefits Scheme (RPBS). It also provided volume data for private prescriptions and under-copayment drugs. These data originally came from a Pharmacy Guild survey and were adjusted by the DoHA to represent volume figures for all of Australia. Costing figures were applied to these prescription drugs to obtain a total expenditure figure for each drug. Prescription drugs were coded by the 5th edition of the Anatomical Therapeutic Chemical Classification System developed by the World Health Organization for classifying therapeutic drugs (WHO Collaborating Centre for Drug Statistics Methodology 2003). The codes were mapped to codes for prescription drugs used in the BEACH survey. As a result, data from BEACH were used to allocate expenditure on prescription drugs to each disease group, based on the medical problem in the GP encounter that related to the prescribing of the particular drug. An assumption was made that the pattern of diseases relating to each type of prescription drug is the same when prescribed by a GP and by a specialist.

This assumption was applied because there are no data that permit allocation of specialist-written prescriptions to diseases.

Pharmaceuticals that are dispensed in hospitals are included in the estimates of hospital costs.

A1.5.4   Other costs

'Other' expenditure comprises expenditure on optometrical services, dental services, community mental health, public health cancer screening and research. For asthma expenditure, the category 'other' only comprises expenditure on research, since the other components were not applicable. Therefore, for the purposes of this report, we have only included research funding in the category 'other' for total recurrent health expenditure to ensure comparable growth rates for the category 'other' for asthma and all other diseases.

Total expenditure on 'research' was obtained from *Health expenditure Australia, 2005–06* (AIHW 2007c) and was allocated to disease using data from the latest Australian Bureau of Statistics research and experimental development surveys. Most of the research data are classified at a fairly high level, but it does give a fairly good picture of the distribution of research expenditure at the burden of disease chapter level. Asthma research expenditure was a derived subcomponent of research expenditure on respiratory diseases.

A1.5.5   Limitations of expenditure data

It is important that the interpretation and limitations of these estimates be clearly understood. Expenditure estimates for disease are based on the attribution of allocated recurrent health expenditure using the available information about the mix of diseases by age and gender and health sector utilisation. The accuracy of the expenditure estimates is limited by the accuracy of the source data on health-care utilisation. For further details on the interpretation and limitations of these estimates, refer to the technical notes in AIHW 2008d. In relation to asthma, there are substantial problems with diagnostic misclassification (AIHW: Baker et al. 2004). These problems will particularly influence the estimates of expenditure on asthma in the elderly. Often in this age group, there is no certain clinical basis for distinguishing asthma from chronic obstructive pulmonary disease (COPD). However, the substantially higher cost-weight for COPD compared with asthma (National Centre for Classification in Health 2004) is an incentive for health-care providers to assign admissions to COPD rather than asthma. This may lead to underestimation of hospital bed utilisation and, hence, expenditure for asthma in the elderly. There is less incentive for misclassification in the BEACH survey data but diagnostic uncertainty remains an issue.

Furthermore, in some instances, data were not available regarding how costs should be attributed. For example, there are no data relating to the patterns of prescriptions by specialists, therefore it was assumed these would be the same as for GPs. The validity of this assumption is untested and, hence, these data should be interpreted with some caution.

The Medicare broad type service category 'allied health', which includes outpatient physiotherapy services, has been excluded from these analyses since it was not possible to obtain disease expenditure splits for allied health.

Appendix 1: Data sources, definitions and population groups

A1.6   Health survey data

A1.6.1   National Health Survey

The NHS, conducted by the ABS periodically since 1977, is designed to collect information on the health status, use of health services and facilities, and health and lifestyle characteristics of residents across Australia. It aims to get national information on a range of health issues, provide information on health indicators for National Health Priority Areas and for important population subgroups and, where possible, enable trends to be monitored over time.

Households from all states and territories are sampled randomly using a stratified multi-stage area sample to ensure that all eligible members of the population within a given state and territory have an equal chance of selection. Residents from hospitals, nursing and convalescent homes, boarding schools, prisons, single quarters of military establishments and persons living in Australia but not usually considered part of the Australian population are excluded. Non-private dwellings such as hostels, boarding houses, hotels and motels are also excluded.

In 2004–05, the NHS sampled approximately 19,500 households from non-sparsely settled areas of all states and territories of Australia between August 2004 and July 2005 (ABS 2006a). One adult, aged 18 years or over and, where applicable, one child, were included from each selected dwelling, providing a total sample of approximately 25,900 respondents. Parents or guardians were interviewed on behalf of children or, where possible, children aged 15–17 years were interviewed in person, with parental consent. The average survey time was 40 minutes per household.

In this report, data from the 2004–05 and 2001 surveys were used. The estimate of the prevalence of current asthma was derived from two questions asked in the survey (see Table A1.4). The proportion of the sample that had 'current' asthma (that is, 'still get asthma') has been estimated. This subgroup of the population was asked additional questions from the asthma module of the survey, also described in Table A1.4. In order to make comparisons of various outcomes in people with and without asthma, the authors also analysed data from the NHSs that are designed for the general population (Table A1.5).

The 2004–05 and 2001 ABS NHS data presented in this report have been accessed through the ABS Remote Access Data Laboratory (RADL). This facility is available to authorised users to access confidentialised unit record files (CURFs), which are de-identified record-level data. Grouping variables are incorporated in these data (for example, region of birth, age group) to ensure that information from these records cannot be used to identify an individual.

The 2004–05 NHS CURF contains eight separate files: household, (all) persons in household, (selected) person, alcohol, conditions, medications, injury damage and body part injured. There are two formats of the NHS CURF data—the expanded and the basic. The expanded CURF contains some information that is more detailed than that available in the basic CURF.

The expanded CURF can only be accessed through the RADL, while the basic CURF can be accessed either through the RADL or via CD-ROM (ABS 2006b). For the purposes of this report, the expanded CURF was used, unless stated otherwise.

Table A1.4: Asthma-specific questions from the Australian Bureau of Statistics (ABS) National Health Survey relevant to this report

Question(s)	Section of this report where data presented
Have you ever been told by a doctor or a nurse that you have asthma?	Sections 2.1 and 3.1 (prevalence of ever having asthma)
If yes, do you still get asthma?	Sections 2.1 and 3.2 (prevalence of current asthma)
Do you have a written asthma action plan?	Sections 2.4 and 6.1 (written asthma action plans)
Did you get the asthma action plan from a doctor?	
Did you get the asthma action plan from a nurse?	
Did you get the asthma action plan from a chemist?	
Is your action plan similar to this?	
Have you taken any medication for asthma in the last 2 weeks?	Section 6.2 (use of asthma medications)
What are the names or brands of all the asthma medication you have used in the last 2 weeks?	
During the last 2 weeks, have you used a nebuliser to administer this/any of these medication(s) for your asthma?	
Have you taken any of these actions for your asthma in the last 2 weeks?	Section 8.2 (health-related actions taken for asthma)
Which ones?	Section 8.2 (days of reduced activity)
10. Admitted to hospital as an inpatient	
11. Visited outpatient clinic	
12. Visited emergency/casualty	
13. Visited day clinic	
14. Consulted a doctor (GP or specialist)	
15. Consulted other health professional	
16. Had days away from study/work	
17. Had other days of reduced activities	
18. Taken vitamin or mineral supplements	
19. Used natural/herbal medicines	
Did you consult a general practitioner or a specialist?	

Appendix 1: Data sources, definitions and population groups

Table A1.5: General questions from the Australian Bureau of Statistics (ABS) National Health Survey relevant to this report

Question(s)	Section of this report where data presented
In general, would you say that your health is excellent, very good, good, fair or poor?	Sections 2.6 and 8.1 (self-assessed health status)
Do you currently smoke? Do you smoke regularly, that is, at least once a day? Have you ever smoked regularly (that is, at least once a day)?	Sections 2.5 and 7.1 (people with asthma who smoke)
Does anyone (else) in this household smoke regularly that is at least once a day? How many (other) people in this household smoke regularly? Do you or does anyone else usually smoke inside the house?	Sections 2.5 and 7.2 (passive smoke exposure in children with asthma)
In the past 4 weeks: About how often did you feel tired out for no good reason? About how often did you feel nervous? About how often did you feel so nervous that nothing could calm you down? About how often did you feel without hope/hopeless? About how often did you feel restless or jumpy/fidgety? About how often did you feel so restless that you could not sit still? About how often did you feel depressed? About how often did you feel that everything was an effort? About how often did you feel so sad that nothing could cheer you up? About how often did you feel worthless? Responses: 1. All of the time / 2. Most of the time / 3. Some of the time / 4. A little of the time / 5. None of the time	Used to calculate Kessler-10 score in Section 8.2 (psychological distress)
In the last 2 weeks have you stayed away from your work for more than half the day because of any illness or injury you had? On how many days in the last 2 weeks have you stayed away from your work?	Section 8.2 (days of reduced activity) Used to calculate differences between people with and without current asthma

A1.6.2   National Aboriginal and Torres Strait Islander Health Survey

The NHS included questions about whether the respondent came from an Aboriginal or Torres Strait Islander background. This sample was included in the main analyses. In addition, the NHS has over-sampled in Indigenous Australian populations to enable more reliable estimates of health status in Indigenous Australians since 1995. This component of the NHS is referred to as the NATSIHS. A total sample of 10,439 Aboriginal and Torres Strait Islander Australians was included in the NATSIHS (ABS 2006d). This component of the survey carried out further sampling of 4,904 Aboriginal and Torres Strait Islander Australians in remote Indigenous communities. The response rates for the NATSIHS non-remote and remote samples were 83.4% and 85.5%, respectively. The majority of questions used were the same as those administered in the 2004–05 NHS. However, some asthma-specific questions were not included in the 2004–05 NATSIHS, namely those about respiratory symptoms, type of medication used, nebuliser use or actions taken for asthma (Table A1.6). Furthermore, information about asthma action plans was only collected in non-remote areas.

The 2004–05 and 2001 ABS NATSIHS data presented in this report have also been accessed through the ABS Remote Access Data Laboratory, using the expanded CURF, which is the only format available for the NATSIHS.

Table A1.6: Asthma-specific and other relevant questions included in the National Aboriginal and Torres Strait Islander Survey 2004–05

Data item	Non-remote	Remote
Ever diagnosed asthma	✓	✓
Current asthma	✓	✓
Whether has written asthma action plan	✓	✗
Source of written asthma action plan	✓	✗
Whether has standard asthma action plan	✓	✗
Whether used pharmaceutical medications for asthma in the last 2 weeks	✓	✓
Type of medication used	✗	✗
Use of nebuliser	✗	✗
Action taken for asthma	✗	✗

A1.6.3   State/territory surveys

Most Australian states and territories now regularly conduct general health surveys within their jurisdictions. These are usually carried out using computer-assisted telephone interview (CATI) surveys that sample the population using random digit dialling. In this report, CATI survey data have been provided by New South Wales Department of Health, Queensland Health, South Australian Department of Human Services, Victorian Department of Human Services and Western Australian Health Department. The questions used to define 'ever asthma' and 'current asthma' in these surveys is shown in Table A1.1.

A1.7   Medicare Benefits Schedule (MBS) statistics

Medicare Australia provides statistics on the claims submitted to and paid by the MBS. These include items claimed by general practitioners, doctors and specialists in the community.

A1.7.1   Practive Incentives Program Asthma Cycle of Care (formerly the Asthma 3+ Visit Plan)

Data from Medicare Australia were obtained for the Practice Incentives Program (PIP) Asthma Cycle of Care /Asthma 3+ Visit Plan. Online interactive data reports were accessed at: <http://www.medicareaustralia.gov.au/statistics/mbs_item.shtml> and collated by time period. On 1 November 2006, the PIP Asthma Cycle of Care was introduced to replace the Asthma 3+ Visit Plan, which had been in operation since November 2001. The initiatives, both funded by the Australian Government, were introduced to recognise the key role general practice plays in the monitoring and management of asthma and encourage a structured approach to diagnosis, assessment and management of patients with moderate or severe asthma in general practice (DoHA 2001). The PIP item numbers that were analysed for this report were 2546–2559 and 2664–2677. These items can only be claimed when the requirements of the Asthma Cycle of Care have been met for an individual patient. In other words, the items can only be claimed when two visits have been completed within one year.

More detailed data on the Asthma Cycle of Care were obtained directly from the MBS Policy Development Branch/Medical Benefits Division, DoHA. In particular, this allowed the analysis of claims by socioeconomic status and remoteness of residence.

A1.8   Medication data

A1.8.1   IMS Health pharmaceutical data

Data on sales of pharmaceutical products into the Australian market are collected and provided by IMS Health Australia. The value of these data is that they reflect supply (and, hence, purchases) of specific medications. As many of these medications are sold without prescription or are below the PBS subsidy threshold, equivalent data are not available through the PBS.

We have calculated the annual aggregate number of packs (sale units) distributed each year for each product relevant to the treatment of asthma for the period January 1996 to December 2006. Parenteral forms were excluded. Data reflect sales from major manufacturers and wholesalers operating in Australia. Usage, measured in units of defined daily doses (DDDs) per 1,000 persons per day, was calculated according to methods presented in Section A1.8.3.

Limitations of IMS data

The nature of the IMS data is that they contain no information on the characteristics of the purchasers or consumers. As most of the drugs used by people with asthma are also commonly used by people with COPD, it is not possible to directly ascribe the trends and differentials observed in these data to the population with asthma. Furthermore, socioeconomic and geographical trends and differentials in the utilisations of drugs cannot be assessed using these data.

A1.8.2   Pharmaceutical Benefits Scheme and Repatriation Pharmaceutical Benefits Scheme data

Since early 2002, prescriptions recorded in the Pharmaceutical Benefit Scheme (PBS) database have included the patients' Medicare numbers. Use of the Medicare number has created the ability to anonymously identify prescriptions for the same individuals within the PBS data and also to link information on age, sex and home postcode. This is done using an encrypted Medicare patient identification number (PIN) so that patient confidentiality is protected.

The ACAM has obtained these data from the DoHA for people who were prescribed asthma medications during the period July 2002 to May 2007. In this report, the ACAM has used these newly available PBS data to investigate the patterns of use of asthma medication by Australians.

These data were then used to calculate the defined daily doses (DDDs) per 1,000 persons per day for each PBS item using the methods described in Section A1.8.3.

Limitations of PBS and RPBS data

Most respiratory medications are subsidised under the PBS and the RPBS. However, some 'reliever' medications are frequently purchased without prescription (over-the-counter) and, when purchased on prescription, cost less than the minimum subsidy for general patients. These drugs do attract a subsidy when purchased on prescription by health-care card holders or pensioners. Leukotriene receptor antagonists only attract a PBS/RPBS subsidy when prescribed for children. Hence, for some medications the PBS/RPBS data only record purchase by a section of the Australian population and substantially underestimate total usage.

The PBS does not collect any information on the underlying disease or the reasons for prescribing. Thus, there is no way of identifying whether a patient using these medications has asthma, COPD or an acute respiratory infection.

The patient copayment increases yearly. Prescriptions that were dispensed for some medications that are below the threshold do not get recorded in the PBS database. The following table (Table A1.7) shows the yearly status (from 2002–2006) of some inhaled corticosteroids and long-acting beta-agonists medications, that is, if they were above or below the copayment threshold, and whether or not they were included in the PBS schedule in a particular year.

Table A1.7: Inhaled corticosteroids and long-acting beta-agonists items in the PBS (2003–2006)

Medication (ATC code)	PBS item code	Proprietary name	2003	2004	2005	2006
Inhaled corticosteroids						
Beclomethasone dipropionate (R03BA01)	8406K	Qvar 50 pMDI	<	<	<	<
	8407L	Qvar 100 pMDI	✓	✓	✓	✓
	8408M	Qvar 50 Autohaler	✓	✓	<	<
	8409N	Qvar 100 Autohaler	✓	✓	✓	✓
Budesonide (R03BA02)	2065Q	Pulmicort 0.5 Respules	✓	✓	✓	✓
	2066R	Pulmicort 1.0 Respules	✓	✓	✓	✓
	2070Y	Pulmicort 100 Turbuhaler	<	<	<	<
	2071B	Pulmicort 200 Turbuhaler	✓	✓	✓	✓
	2072C	Pulmicort 400 Turbuhaler	✓	✓	✓	✓
Fluticasone (R03BA05)	8147T	Flixotide jnr 100 Accuhaler	<	<	<	<
	8148W	Flixotide 250 Accuhaler	✓	✓	✓	<
	8149X	Flixotide 500 Accuhaler	✓	✓	✓	✓
	8345F	Flixotide 125 pMDI	✓	✓	✓	<
	8346G	Flixotide 250 pMDI	✓	✓	✓	✓
	8516F	Flixotide jnr 50 pMDI	<	<	<	<
Ciclesonide (R03BA08)	8853Y	Alvesco 80 pMDI	–	–	<	<
	8854B	Alvesco 160 pMDI	–	–	✓	✓
Long-acting beta-agonists						
Salmeterol (R03AC12)	3027H	Serevent 25 Accuhaler	✓	✓	✓	✓
	8141L	Serevent 50 Accuhaler	✓	✓	✓	✓
Eformoterol (R03AC13)	8136F	Foradile 12 Handyhaler	✓	✓	✓	✓
	8239P	Oxis 6 Turbuhaler	✓	✓	<	<
	8240Q	Oxis 12 Turbuhaler	✓	✓	✓	✓
Patient copayment for the year		**No concession**	**$23.10**	**$23.70**	**$28.60**	**$29.50**
		Concession card	**$3.70**	**$3.80**	**$4.60**	**$4.70**

– not included in the PBS schedule

< dispensed price is less than the co-payment for those without a concession card. Therefore, only prescriptions purchased with a concession card are captured in the database.

✓ dispensed price is greater than or equal to the co-payment for those without a concession card. Therefore all prescriptions, regardless of concession card possession, are captured in the database.

Note: PBS = Pharmaceutical Benefits Scheme; ATC = Anatomical Therapeutic Chemical Classification System; pMDI = pressurised metered dose inhaler.

Source: DoHA 2006.

Appendix 1: Data sources, definitions and population groups

A1.8.3 Calculation of defined daily dose per 1,000 population per day

Medication usage, measured as defined daily doses (DDDs) per 1,000 people per day (DDD/1,000/day) is used in this report to compare respiratory drug sales and reimbursed prescriptions dispensed over time and across drug groups where information about actual drug consumption is not available. The information in this report is based on unpublished data prepared and supplied by IMS Health Australia and published data from the PBS and RPBS item reports calculated at the Medicare Australia website.

For each medication, the relevant DDD was obtained from the website of the World Health Organization Collaborating Centre for Drug Statistics Methodology (<http://www.whocc.no/atcddd>) (see Table A1.8). The DDD is defined as 'the assumed average maintenance dose per day for a drug used for its main indication in adults'. The DDD is used internationally as a unit of measurement for drug utilisation studies. Each medication pack or sale unit (for IMS Health data) or maximum quantity dispensed (for PBS or RPBS items) is converted to a number of DDDs per unit or item.

For each of these items, the DDD per 1,000 persons per day (DoHA 2004) is then calculated using the following formula:

$$\text{DDD/1,000 persons/day} = \frac{N \times M \times Q \times 1,000}{\text{DDD} \times P \times D}$$

where

N = total number of subsidised prescriptions dispensed per year (Medicare Australia data) or total number of items sold per year (IMS Health data)

M = mass of each dosage unit (e.g. mg per tablet or mcg per inhaler dose)

Q = total number of dosage units dispensed per prescription or sold unit

P = mid-year Australian population (ABS mid-year population estimates) for year of data collection

D = number of days in the year

The DDD/1,000 persons/day for individual medications are then summed across the members of each class of medications to estimate the total number of DDD/1,000 persons/day for each class. Combined medications contribute DDDs to both classes of medications they contain.

Table A1.8: Classification of respiratory medications

Category	Medications included	DDDs / formulation
Short-acting beta-agonists	Fenoterol	0.6 mg Inhalation aerosol
		0.6 mg Inhalation powder
		4 mg Inhalation solution
	Orciprenaline	60 mg Oral
	Salbutamol	0.8 mg Inhalation aerosol
		0.8 mg Inhalation powder
		10 mg Inhalation solution
	Terbutaline	2 mg Inhalation aerosol
		2 mg Inhalation powder
		20 mg Inhalation solution
Long-acting beta-agonists	Salmeterol	0.1 mg Inhalation aerosol
		0.1 mg Inhalation powder
	(e)Formoterol	24 mcg Inhalation aerosol
		24 mcg Inhalation powder
Short-acting anti-cholinergics	Ipratropium	0.12 mg Inhalation aerosol
		0.12 mg Inhalation powder
		0.3 mg Inhalation solution
Long-acting anti-cholinergics	Tiotropium bromide	18 mcg Inhalation powder
Cromones	Cromoglycate	40 mg Inhalation aerosol
		80 mg Inhalation powder
		80 mg Inhalation solution
	Nedocromil	8 mg Inhalation aerosol
Inhaled corticosteroids	Beclomethasone	0.8 mg Inhalation aerosol
		0.8 mg Inhalation powder
		1.5 mg Inhalation solution
	Budesonide	0.8 mg Inhalation aerosol
		0.8 mg Inhalation powder
		1.5 mg Inhalation solution
	Fluticasone	0.6 mg Inhalation aerosol
		0.6 mg Inhalation powder
		1.5 mg Inhalation solution
Xanthines	Theophylline	0.4 g Oral
	Choline theophyllinate	0.6 g Oral
Leukotriene receptor antagonists	Montelukast	10 mg Oral
	Zafirlukast	40 mg Oral

Note: DDD = defined daily dose.
Source: WHO 2003.

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A1.9 Hospital data

The National Hospital Morbidity Database (NHMD) contains data on episodes of care for patients admitted to hospital, including demographic, procedural and length of stay information. Each of the states and territories collect data for hospital separations and provide a specified subset of these data to AIHW for inclusion in the NHMD. The data are organised in financial year periods. Whilst the data set contains details of principal and additional diagnoses, in this report data relate to the principal diagnosis only, unless otherwise stated.

When analysing hospital data by state and territory, we have used the state of the institution (hospital) rather than the state of residence.

A1.9.1 Limitations of the National Hospital Morbidity Database

There are a number of issues affecting the reliability and validity of hospitalisations attributed to asthma. In particular, the reliability of coding of hospital separations will be influenced by variation in the propensity of attending medical practitioners to diagnose and label patients as having asthma. There has been no recent validation of the coding of diagnosis of asthma during hospital admissions in Australia. International evidence suggests that diagnostic coding of asthma is reasonably accurate in children and younger adults (Krueger et al. 2001; Osborne et al. 1992), but this accuracy decreases with age (Osborne et al. 1992).

A1.9.2 Hospital diagnosis codes

Hospital diagnosis is classified according to the principal diagnosis and was coded using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM), for hospital separations from 1993 to 1997, and the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM), for separations from 1998 onwards. A principal diagnosis is the diagnosis chiefly responsible for the episode of hospital care. Comparability factors were also applied to data on hospital separations before 1998, which were coded under ICD-9, to enable comparison with more recent data coded using ICD-10 (see Section A1.9.3).

A1.9.3 Comparability factors for hospitalisation data

Table A1.9 shows the age-group specific comparability factors calculated by the AIHW for converting ICD-9-CM to ICD-10-AM (AIHW, unpublished data).

Table A1.9: Comparability factors for hospital separations for asthma

Age group	Conversion factor
5–34 years	1.0326
35–64 years	0.7938
65 years and over	0.4813

Source: AIHW, unpublished data.

A1.9.4   Definitions of comorbid conditions

To examine comorbidities among people hospitalised with a principal diagnosis of asthma (ICD-10-AM codes J45 and J46), we applied the following definitions.

Respiratory comorbidities were classified as an additional diagnosis of:

- acute upper respiratory infections (J00–J06);
- influenza or pneumonia (J09–J18);
- other acute lower respiratory infections (J20–J22);
- non-infectious upper respiratory conditions (J30–J39); or
- COPD or bronchiectasis (J40–J44, J47).

Other comorbidities were classified as an additional diagnosis of:

- diabetes mellitus (E10–E14);
- heart, stroke or vascular disease (I20–I25, I50, I60–I69, I70–I79);
- arthritis or osteoporosis (M00–M25, M80–M82);
- mental or behavioural disorders (F30–F39, F40–F48, F90–F98);
- malignant neoplasms (i.e. cancer) (C00–C97); or
- any other additional diagnosis except excluded diagnoses (see below).

We excluded the following conditions as additional diagnoses:

- pregnancy, childbirth and the puerperium (O00–O99)
- certain conditions originating in the perinatal period (P00–P96)
- symptoms ,signs and abnormal clinical and laboratory findings, not elsewhere classified (R00–R99)
- injury, poisoning and certain other consequences of external causes (S00–T98)
- external causes of morbidity and mortality (V01–Y98)
- factors influencing health statistics and contact with health services (Z00–Z99)
- codes for special purposes (U00–U99).

A1.9.5   Mechanical ventilation

The National Hospital Morbidity Database includes information relating to specific aspects of care, such as the use of mechanical ventilation. Invasive mechanical ventilation is a medical intervention used in situations where patients become unable to breathe by themselves. It involves the use of a positive pressure ventilator to maintain respiration via an endotracheal tube. This intervention is generally administered in hospital intensive care units (ICUs). The National Hospital Morbidity Database has collected data on the use of invasive mechanical ventilation since 1993–94. However, due to a change in the coding standards for invasive mechanical ventilation in 2000–01, only data for the period 2000–01 onwards have been analysed in this report.

The data presented in this report do not include episodes of non-invasive ventilation. Available data on non-invasive ventilation are incomplete and not suitable for analysis.

The procedure codes that have been included in these analyses are:

- ICD-10-AM
    - 13882-00—Management of continuous ventilatory support ≤24 hours
    - 13882-01—Management of continuous ventilatory support >24 hours–<96 hours
    - 13882-02—Management of continuous ventilatory support ≥96 hours
    - 13857-00—Continuous ventilatory support, initiation outside of ICU
    - 13879-00—Continuous ventilatory support, initiation in ICU
- ICD-9-AM
    - 96.70—Management of continuous ventilatory support ≤24 hours
    - 96.71—Management of continuous ventilatory support >24 hours – <96 hours; Continuous ventilatory support, initiation outside of ICU; Continuous ventilatory support, initiation in ICU
    - 96.72—Management of continuous ventilatory support ≥96 hours.

It should be noted that the data analysed for this section of the report are based on episodes and not individuals and, hence, may include multiple episodes for the same person.

Same-day separations are included in these analyses. There were 138 same-day separations for invasive mechanical ventilation between 2002–03 and 2006–07.

A1.10   Mortality data

Registration of deaths is the responsibility of individual state and territory Registrars of Births, Deaths and Marriages. Information on the cause of death is provided to the registrar by a medical practitioner certifying a death, or by the coroner to whom a death is reported. This information is, in turn, supplied to the Australian Bureau of Statistics (ABS) for coding cause of death and compilation into aggregated statistics. Death data from all states and territories are supplied by the ABS to the AIHW for the National Mortality Database. As the registration of deaths is a legal requirement in Australia, this data set is considered nearly complete, although there has been no formal validation of completeness. The ABS advises that Aboriginal and Torres Strait Islander Australians are probably under-enumerated in some states and territories.

Although data on multiple causes of death are available, death data throughout this report relate only to the underlying cause of death reported on each certificate.

A1.10.1   Limitations in mortality data

There are a number of issues affecting the reliability and validity of certification of deaths. The reliability of death certification can be influenced by variation in the propensity of attending medical practitioners to diagnose and label patients as dying from asthma. Validation studies of asthma deaths coded on death certificates reveal that adult deaths from asthma can be under-enumerated (Guite & Burney 1996; Hunt et al. 1993; Smyth et al. 1996) or over-enumerated (Jones et al. 1999; Sears et al. 1986; Sidenius et al. 2000). It is generally considered that asthma diagnosis is fairly unambiguous in people aged less than 45 years and data are, therefore, more reliable in these ages. However, a recent study has also demonstrated under-enumeration in children and young adults (Jorgensen et al. 2000). Generally, in older people the attribution of death to asthma, or alternatively to one of a range of illnesses with overlapping clinical features, is problematic and, therefore, the death data for asthma are less reliable in older people (Jones et al. 1999; Sidenius et al. 2000; Smyth et al. 1996). Changes in the classification scheme, or code, have a quantifiable impact on time trends in death data. However, the extent to which changes, over time, in diagnostic fashion affect death data are less well studied.

A1.10.2 Cause of death codes

The classification of asthma as the underlying cause of death was based on the ICD-9 for deaths from 1979 to 1997, and on ICD-10 for deaths from 1998 onwards (Table A1.10). Comparability factors were applied to data classified under ICD-9 to make the data comparable to that coded using ICD-10 (see Section A1.10.3).

Table A1.10: Disease codes

Classification	Codes used	Description
ICD-9	493.0	Extrinsic asthma
Code 493	493.1	Intrinsic asthma
	493.2	Chronic obstructive asthma
	493.9	Asthma, unspecified
ICD-10	J45.0	Predominantly allergic asthma
Codes J45 & J46	J45.1	Non-allergic asthma
	J45.8	Mixed asthma
	J45.9	Asthma, unspecified
	J46.0	Status asthmaticus

Note: ICD-9 and ICD-10 = International Classification of Diseases, 9th Revision and 10th Revision, respectively.

A1.10.3 Comparability factors for mortality data

Table A1.11 shows the age-group specific comparability factors calculated for converting number of asthma deaths from ICD-9 to ICD-10. The method for calculating these comparability factors has been described previously (ACAM 2003, Section A1.3).

Table A1.11: Comparability factors for asthma mortality data

Age group	Conversion factor
Less than 35 years	1.0 (i.e. no conversion)
35–64 years	0.84
65 years and over	0.68

A1.10.4 Definitions of comorbid conditions

To examine comorbidities among people whose underlying cause of death was asthma (ICD-10 codes J45 and J46), we applied the following definitions.

Respiratory comorbidities were classified as an associated cause of death of:

- acute upper respiratory infections (J00–J06)
- influenza and pneumonia (J09–J18)
- other acute lower respiratory infections (J20–J22)
- non-infectious upper respiratory conditions (J30–J39)
- COPD and bronchiectasis (J40–J44, J47).

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Other comorbidities were classified as an associated cause of death of:

- diabetes mellitus (E10–E14)
- heart, stroke and vascular disease (I20–I25, I50, I60–I69, I70–I79)
- arthritis and osteoporosis (M00–M25, M80–M82)
- mental and behavioural disorders (F30–F39, F40–F48, F90–F98)
- malignant neoplasms (i.e. cancer) (C00–C97).

In the section where we have investigated asthma as an associated cause of death when other conditions were listed as the underlying cause of death, the analyses undertaken for this report were confined to seven main causes of death—cancer (C00–C97); diabetes mellitus (E10–E14); mental and behavioural disorders (F30–F39, F40–F48, F90–F98); heart, stroke and vascular disease (I20–I25, I60–I69, I50, I70–I79); influenza, pneumonia and other acute respiratory tract infections (J00–J06, J09–J22); COPD and bronchiectasis (J40–J44, J47); and arthritis and osteoporosis (M00–M25, M80–M82).

A1.11   Population data

This report uses population data sourced from the AIHW, which, in turn, are sourced from the ABS Demography section and are updated as revised or new estimates become available. All population estimates currently produced by the ABS are referred to as estimated resident populations.

Estimated resident populations are based on the 5-yearly Census of Population and Housing, to which three significant adjustments are made:

- All respondents in the census are placed in their state or territory, statistical local area and postcode of usual residence. Overseas visitors counted in the census are excluded.
- An adjustment is made for persons missed in the census (approximately 2%).
- Australians temporarily overseas on census night (these are not counted in the census) are added to the usual residence census count adjusted for undercount.

Estimated resident populations are then updated each year from the census date using indicators of population change, such as births, deaths and net migration. More information is available from the ABS website, <www.abs.gov.au>.

A1.12   Population groups

A1.12.1 Aboriginal and Torres Strait Islander Australians

'Indigenous Australians' refers to people who identify themselves as being of Aboriginal or Torres Strait Islander origin. It is important to identify health disadvantages, with respect to asthma, among Aboriginal and Torres Strait Islander Australians so that those issues can be addressed. It is also important to ensure an acceptable level of reliability and validity of the data that are used for this purpose. Data for Indigenous Australians are currently available via several collections, including the 5-yearly Census, other surveys conducted by the ABS, AIHW, state health departments and other agencies, and administrative data sets such as hospital statistics and mortality collections. However, data quality issues around the identification and enumeration of Indigenous Australians exist across the majority of these collections.

There have been substantial increases in the Indigenous Australian population between census collections that cannot be fully explained by natural increase (Ross 1999). The ABS has introduced an experimental methodology which attempts to account for the changing levels of 'unexplained growth'

in estimating and projecting the Indigenous population. Using this methodology, the ABS has produced consistent series of estimates of the Indigenous population from 1991 to 2009. For further information refer to ABS (2004).

It should be noted that the Indigenous populations used to estimate the 2006 population are based on projections from data from the 2001 ABS Census of Population and Housing. The estimated resident population used underestimates the actual estimated resident population of Indigenous persons as at June 2006 derived from the 2006 ABS Census of Population and Housing. For example, overall the Queensland Indigenous population is underestimated by almost 4 per cent, however, this varies by age group. The cohorts aged under 10 years and 60 years and older are likely to be underestimated by around 10 per cent.

Indigenous identification and the quality of Indigenous data have been improving over time in a number of data sets through efforts at all levels. Despite this, deficiencies in health data for Indigenous Australians continue to exist in the National Mortality Collection and the National Hospital Morbidity Database (NHMD). In 2000–01, all states and territories adopted a standard definition for use in the NHMD. However, currently for mortality data, only Queensland, Northern Territory, Western Australia and South Australia have relatively complete identification of Indigenous deaths (ABS 2005). For hospital morbidity data, the information provided for Indigenous status from the Northern Territory, South Australia, Queensland and Western Australia is considered acceptable from 1998–99 onwards; while from 2004–05 onwards, data from New South Wales and Victoria are also considered acceptable. There are likely to be variations in admission practices between jurisdictions and within jurisdictions. The data are not necessarily representative of the jurisdictions excluded.

Since 1995, the NHS has over-sampled in Indigenous Australian populations to enable more reliable estimates of their health status. The validity and reliability of other general population surveys (including the state CATI surveys) are less certain. Finally, a voluntary Indigenous identifier has been included recently on Medicare forms. This should help improve data about access to health services by Indigenous Australians.

As there is not the same quantity or quality of information about Aboriginal and Torres Strait Islander health as there is for non-Indigenous Australians, it has not been possible in many cases to provide the same level of information on the prevalence of asthma in Australia's Indigenous population or how this is being managed. However, the information about people living in remote regions and people who are socioeconomically disadvantaged may also be applicable to a large number of Indigenous Australians.

In this report, it was possible to make comparisons between Indigenous and non-Indigenous Australians based on data from the ABS 2004–05 National Aboriginal and Torres Strait Islander Health Survey. However, for mortality and hospital morbidity data, it was only possible to make comparisons between Indigenous and 'other Australians', where 'other Australians' included both non-Indigenous persons and persons for whom Indigenous status was not stated, unknown or inadequately described.

A1.12.2 Country of birth

Factors associated with cultural background may have an impact on health status. People whose first language is not English have been identified as population groups who are likely to experience disadvantage when seeking access to health and related services (ABS 1999). As such, it is necessary to describe the health status of people from different backgrounds. The term 'non-English-speaking background' has been used throughout this publication to describe people who have settled in Australia but who come from countries where English is not the primary language spoken.

The Department of Immigration and Multicultural and Indigenous Affairs (DIMIA) has developed a classification from 2001 census data, which places every country into one of four groups based on the relative English proficiency of recent arrivals to Australia (DIMIA 2003).

English-speaking background is defined as those people born in Australia, New Zealand, the United Kingdom, Ireland, the United States of America, Canada, Zimbabwe or South Africa, which corresponds to the DIMIA English proficiency countries in group 1. These are the main countries from which Australia receives overseas settlers who are likely to speak English. Non-English-speaking background is defined as those people whose country of birth was somewhere other than one of these eight countries. This corresponds to the DIMIA English proficiency countries in the remaining groups 2 to 4.

For the purposes of this report we have classified English-speaking and non-English-speaking countries as defined by DIMIA in their 2003 report where possible. For the analysis of the ABS 2004–05 NHS, it was not possible to include Zimbabwe in the English-speaking-background category because of the structure of the country of birth information in the Remote Access Data Laboratory and in the CURFs. Therefore, for Chapter 3 (Prevalence), Zimbabwe is included with non-English-speaking nations. Also for Figure 4.9, where we have analysed the number of deaths due to asthma per 100,000 people with asthma, Zimbabwe was included with non-English-speaking nations since the denominator population was derived from the 2004–05 NHS.

A1.12.3 Socioeconomic disadvantage

Findings from all over the globe continue to provide evidence that people living in socioeconomically disadvantaged localities experience poorer health outcomes than people living in relatively advantaged localities. The relationship is consistent for a range of chronic diseases, the list of which includes asthma. Socioeconomic status encompasses a range of contributing factors including education, income and occupation as well as race or ethnicity.

The Socio-economic Indexes for Areas (SEIFA) Index of Relative Socioeconomic Disadvantage (IRSD) is one of four indexes developed by the ABS to measure socioeconomic characteristics associated with geographical locations (ABS 2006e) based on information from the Australian census. Each index summarises information relating to a variety of social and economic characteristics associated with families and households, personal education qualifications and occupation.

This report uses the SEIFA index as it provides a summary score for a range of key socioeconomic variables that are related to health status, including household income and resources, education, occupation, fluency in English, and Indigenous status. The index is constructed so that relatively advantaged areas have high index values.

Individual records were classified into quintiles of socioeconomic disadvantage according to the SEIFA value associated with the statistical local area (SLA) of usual residence of the individual. Quintile 1 (SEIFA 1) includes the most disadvantaged households and quintile 5 (SEIFA 5) includes the least disadvantaged households.

It is important to note that the index reflects the relative disadvantage of all people living in an area, not an individual. Therefore, this measure probably underestimates the true inequality in health at the individual level.

A1.12.4 Urban, rural and remote areas

Access to health and education services plays an important role in the successful treatment and management of asthma. For the purposes of this report, urban, rural and remote areas have been identified using the Australian Standard Geographical Classification (ASGC) of remoteness.

ASGC categories of remoteness

The ASGC is based on the Accessibility/Remoteness Index of Australia (ARIA), which measures remoteness solely on the basis of geographical accessibility, and excludes urban/rural, socioeconomic and population size factors. This index can be applied to any location in Australia. It is based on physical geography, whereby locations are classified on the basis of their proximity (that is, the distance people must travel on a road network) to the nearest of 738 service centres, which differ in size and, hence, in the availability of education and health services. The centres with small populations generally have a limited choice of general practitioners, specialists and hospital care.

Values of remoteness for populated localities are calculated by measuring the shortest road distance between a locality and the nearest of each of five different categories of service centres. Each of the populated localities across Australia has been assigned an ARIA index score to assess their remoteness from goods, services and opportunities for social interaction. (For full methodology, see ABS 2001.)

Table A1.12: ABS classes of remoteness, by ASGC and their definition

ASGC classification	ARIA index score	Definition
Major Cities of Australia	0.0–0.2	Geographical distance imposes minimal restriction upon accessibility to the widest range of goods, services and opportunities for social interaction
Inner Regional Australia	>0.2–2.4	Geographic distance imposes some restriction upon accessibility to the widest range of goods, services and opportunities for social interaction
Outer Regional Australia	>2.40–5.92	Geographic distance imposes a moderate restriction upon accessibility to the widest range of goods, services and opportunities for social interaction
Remote Australia	>5.92–10.53	Geographic distance imposes a high restriction upon accessibility to the widest range of goods, services and opportunities for social interaction
Very Remote Australia	>10.53–15.00	Locationally disadvantaged. Geographic distance imposes the highest restriction upon accessibility to the widest range of goods, services and opportunities for social interaction

Note: ABS = Australian Bureau of Statistics; ASGC = Australian Standard Geographical Classification; ARIA = Accessibility/Remoteness Index of Austalia.

This report examines data for the five ASGC/ARIA classes where these data are available. However, in some instances, the three broader areas of major cities, inner regional and outer regional or remote areas have been used where cell sizes are too small for accurate estimation in the more detailed classification.

Appendix 2: Statistical tables

Asthma by Indigenous status

Table A2.1: Prevalence of current asthma, by age, sex and Indigenous status, 2004–05

Indigenous status/sex/ age (years)	Estimated number of people with current asthma	Estimated total people	Age standardised per cent of people with current asthma	95% confidence interval
Indigenous				
Males				
0–14	14,349	92,767	15.5	12.8–18.2
15–34	8,114	78,404	10.7	8.1–13.3
35–54	3,450	45,998	7.4	5.4–9.4
55 and over	2,644	15,193	18.7	9.4–27.9
All ages	**28,557**	**232,362**	**12.5**	**10.2–14.8**
Females				
0–14	10,831	87,902	12.4	9.9–15.0
15–34	16,784	83,435	20.2	17.0–23.3
35–54	11,543	52,637	23.2	19.6–26.8
55 and over	3,795	17,974	22.2	15.2–29.3
All ages	**42,953**	**241,948**	**19.9**	**17.8–22.0**
Persons				
0–14	25,180	180,669	14.0	12.1–15.9
15–34	24,898	161,839	15.6	13.6–17.6
35–54	14,993	98,635	15.7	13.6–17.9
55 and over	6,439	33,167	20.7	14.8–26.7
All ages	**71,510**	**474,310**	**16.5**	**14.9–18.1**
Non-Indigenous				
Males				
0–14	246,253	1,934,058	12.7	11.1–14.3
15–34	251,917	2,716,272	9.2	8.0–10.5
35–54	193,299	2,779,807	7.0	6.0–7.9
55 and over	166,798	2,170,272	7.7	6.5–8.9
All ages	**858,268**	**9,600,410**	**9.0**	**8.3–9.6**
Females				
0–14	179,743	1,825,952	9.8	8.3–11.4
15–34	370,248	2,681,281	13.8	12.3–15.2
35–54	305,051	2,825,338	10.8	9.5–12.1
55 and over	246,490	2,359,405	10.5	9.3–11.7
All ages	**1,101,532**	**9,691,976**	**11.4**	**10.7–12.1**
Persons				
0–14	425,996	3,760,011	11.3	10.0–12.6
15–34	622,165	5,397,553	11.5	10.6–12.4
35–54	498,350	5,605,145	8.9	8.1–9.7
55 and over	413,288	4,529,677	9.2	8.3–10.0
All ages	**1,959,800**	**19,292,386**	**10.2**	**9.7–10.7**

Note: Current asthma based on a positive response to 'Have you ever been told by a doctor that you have asthma?' and 'Do you still get asthma?' Prevalence rates were age-standardised to the 2001 Australian population.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of the Australian Bureau of Statistics (ABS) National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) and National Health Survey (NHS) 2004–05, expanded confidentialised unit record files, Remote Access Data Laboratory.

Table A2.2: Prevalence of current asthma, by age and Indigenous status, children aged 0–17 years, 2004–05

Indigenous status/age	Estimated number of children with current asthma	Estimated total children	Age standardised per cent of children with current asthma	95% confidence interval
Indigenous				
0–1	2,106	21,952	9.3	5.0–13.7
2–4	4,844	38,231	12.7	9.0–16.4
5–11	12,146	85,921	14.1	11.5–16.8
12–17	9,941	69,909	14.4	11.5–17.3
0–17 years	**29,037**	**216,013**	**13.5**	**11.9–15.1**
Non-Indigenous				
0–1	14,869	481,057	3.1	1.6–4.7
2–4	71,435	716,981	9.9	7.4–12.5
5–11	244,337	1,837,418	13.2	11.2–15.1
12–17	182,205	1,503,676	12.1	10.2–14.0
0–17 years	**512,845**	**4,539,131**	**11.2**	**10.1–12.3**

Notes: Current asthma based on a positive response to 'Have you ever been told by a doctor that you have asthma?' and 'Do you still get asthma?' Prevalence rates were age-standardised to the 2001 Australian population.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of the Australian Bureau of Statistics (ABS) National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) and National Health Survey (NHS) 2004–05, expanded confidentialised unit record files, Remote Access Data Laboratory.

Table A2.3: Hospital separations for asthma per 100,000 population, by age group and Indigenous status, Australia, 2005–06

	Rate (95% confidence interval)			
	Indigenous		Other Australians	
0–4 years	1,350.5	(1,257.5–1,448.6)	1,095.8	(1,076.9–1,114.8)
5–14 years	315.4	(283.9–349.4)	272.2	(265.8–278.8)
15–34 years	182.7	(161.5–205.9)	91.3	(88.7–93.9)
35–54 years	498.4	(453.8–546.1)	85.8	(83.4–88.3)
55 years and over	586.5	(502.6–682.8)	120.0	(116.8–123.2)
All ages	**458.6**	**(433.5–484.6)**	**187.6**	**(185.6–189.6)**

Notes: Asthma classified according to International Statistical Classification for Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46. Separations for which the care type was reported as Newborn with no qualified days, and records for Hospital boarders and Posthumous organ procurement have been excluded.

Source: AIHW National Hospital Morbidity Database.

Table A2.4: Hospital patient days for asthma per 100,000 population, by age group and Indigenous status, Australia, 2005–06

Age group	Indigenous	Other Australians
0–4 years	2,347.0	1,573.0
5–14 years	573.4	449.2
15–34 years	413.8	193.6
35–54 years	1,426.5	251.3
55 years and over	1,980.0	565.3
All ages (95% CI)	**1,201.7 (1,156.1–1,248.2)**	**418.7 (415.8–421.7)**

Note: Separations for which the care type was reported as Newborn with no qualified days, and records for Hospital boarders and Posthumous organ procurement have been excluded. CI = confidence interval.

Source: AIHW National Hospital Morbidity Database.

Appendix 2: Statistical tables

Prevalence

Table A2.5: Prevalence of ever having doctor-diagnosed asthma, by age group and sex, all ages, Australia, 2004–05

Sex/age (years)	Estimated number of people with ever doctor-diagnosed asthma	Estimated total people	Age-standardised per cent of people with ever doctor-diagnosed asthma	95% confidence interval
Males				
0–4	75,430	639,728	12.3	9.7–14.8
5–9	160,798	668,051	24.2	20.8–27.5
10–14	225,927	703,098	32.0	28.4–35.7
15–24	417,099	1,376,891	30.3	27.8–32.8
25–34	306,853	1,396,464	21.8	19.6–24.0
35–44	236,634	1,468,265	18.2	16.3–20.2
45–54	194,557	1,351,290	14.4	12.6–16.4
55–64	125,119	1,064,419	11.8	9.9–13.8
65–74	102,600	659,396	15.2	12.6–17.9
75 and over	60,743	460,844	13.2	10.9–15.6
All ages	**1,905,755**	**9,788,447**	**19.7**	**18.7–20.7**
Females				
0–4	62,924	607,481	10.1	7.7–12.4
5–9	125,241	635,807	19.7	16.5–22.8
10–14	149,731	666,427	22.6	19.4–25.9
15–24	388,031	1,316,076	29.6	27.1–32.2
25–34	362,650	1,417,181	25.5	23.2–27.9
35–44	314,638	1,490,967	23.7	21.6–25.9
45–54	277,997	1,383,535	20.2	18.0–22.4
55–64	185,945	1,055,806	17.5	15.2–19.8
65–74	127,654	694,274	18.5	15.6–21.3
75 and over	78,909	625,537	12.6	10.4–14.7
All ages	**2,073,720**	**9,893,092**	**20.6**	**19.6–21.6**

Notes: 'Ever asthma' based on a positive response to 'Have you ever been told by a doctor that you have asthma?' Prevalence rates were age-standardised to the 2001 Australian population.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 confidentialised unit record files

Table A2.6: Current prevalence of probable asthma, by age group and sex, all ages, Australia, 2004–05

Age/sex	Estimated number of people with current asthma	Estimated total people	Age-standardised per cent of people with current asthma	95% confidence interval
Males				
0–4	50,000	639,726	8.1	6.0–10.2
5–9	87,617	668,051	13.0	10.4–15.5
10–14	120,489	703,099	16.8	13.9–19.6
15–24	144,882	1,376,889	10.6	9.0–12.3
25–34	112,098	1,396,463	8.0	6.6–9.4
35–44	100,221	1,468,265	7.7	6.4–9.0
45–54	94,544	1,351,290	7.0	5.6–8.3
55–64	74,531	1,064,417	7.0	5.5–8.5
65–74	58,515	659,397	8.6	6.6–10.7
75 and over	33,753	460,844	7.3	5.0–9.7
All ages	**876,649**	**9,788,440**	**8.9**	**8.3–9.5**
Females				
0–4	40,330	607,482	6.5	4.6–8.4
5–9	76,567	635,805	12.0	9.5–14.5
10–14	73,901	666,425	11.2	8.7–13.6
15–24	188,227	1,316,076	14.4	12.4–16.3
25–34	189,381	1,417,183	13.4	11.5–15.2
35–44	160,193	1,490,966	12.1	10.5–13.7
45–54	157,260	1,383,537	11.4	9.7–13.1
55–64	110,575	1,055,806	10.5	8.6–12.3
65–74	85,370	694,273	12.4	10.0–14.8
75 and over	51,756	625,538	8.3	6.2–10.5
All ages	**1,133,560**	**9,893,091**	**11.5**	**10.8–12.2**

Notes: Current asthma based on a positive response to 'Have you ever been told by a doctor that you have asthma?' and 'Do you still get asthma?' Prevalence rates were age-standardised to the 2001 Australian population.

Source: Australian Centre for Asthma Monitoring (ACAM) analysis of Australian Bureau of Statistics (ABS) National Health Survey 2004–05 expanded confidentialised unit record files.

Appendix 2: Statistical tables

Mortality

Table A2.7: Deaths due to asthma, by sex, all ages, Australia, 1979–2006

Year	Males Deaths due to asthma	Population	Age standardised rate per 100,000	95% confidence interval	Females Deaths due to asthma	Population	Age standardised rate per 100,000	95% confidence interval
1979	177	7,253,762	3.21	2.69–3.77	164	7,261,967	2.60	2.20–3.03
1980	201	7,338,060	3.75	3.19–4.37	225	7,357,296	3.49	3.04–3.98
1981	213	7,448,267	3.75	3.21–4.33	213	7,474,993	3.07	2.67–3.52
1982	224	7,580,914	3.94	3.39–4.54	234	7,603,333	3.46	3.02–3.94
1983	236	7,686,346	3.96	3.43–4.53	249	7,707,126	3.52	3.08–3.98
1984	264	7,778,212	4.15	3.63–4.71	257	7,801,179	3.61	3.17–4.08
1985	295	7,882,728	5.05	4.42–5.72	337	7,905,584	4.55	4.07–5.07
1986	315	8,000,187	4.88	4.31–5.49	301	8,018,163	3.97	3.53–4.45
1987	296	8,118,255	4.53	3.99–5.11	363	8,145,619	4.72	4.24–5.23
1988	297	8,248,945	4.51	3.98–5.10	341	8,283,219	4.40	3.94–4.89
1989	334	8,387,589	5.01	4.45–5.60	402	8,426,827	5.01	4.52–5.52
1990	294	8,511,269	4.36	3.84–4.92	335	8,553,859	4.10	3.67–4.57
1991	255	8,615,409	3.73	3.25–4.24	314	8,668,627	3.72	3.31–4.16
1992	253	8,716,147	3.65	3.19–4.14	310	8,778,517	3.63	3.23–4.06
1993	250	8,797,915	3.54	3.09–4.03	336	8,869,178	3.83	3.43–4.27
1994	245	8,888,066	3.66	3.19–4.17	365	8,966,672	4.04	3.64–4.48
1995	212	8,993,604	2.86	2.47–3.29	341	9,078,154	3.68	3.30–4.09
1996	223	9,108,055	3.05	2.64–3.49	314	9,202,659	3.32	2.96–3.71
1997	207	9,203,171	2.71	2.34–3.12	292	9,314,393	2.97	2.64–3.33
1998	187	9,294,674	2.34	2.01–2.71	294	9,416,597	2.94	2.62–3.30
1999	160	9,396,548	2.02	1.71–2.37	264	9,529,307	2.58	2.28–2.92
2000	169	9,505,331	2.00	1.71–2.33	285	9,648,049	2.71	2.40–3.05
2001	175	9,630,652	2.00	1.71–2.32	247	9,782,588	2.27	1.99–2.57
2002	158	9,756,969	1.90	1.61–2.23	239	9,897,906	2.14	1.88–2.43
2003	108	9,882,364	1.23	1.00–1.49	206	10,020,374	1.76	1.53–2.02
2004	108	10,005,472	1.20	0.98–1.45	205	10,134,320	1.72	1.49–1.97
2005	108	10,144,053	1.15	0.94–1.39	210	10,265,093	1.69	1.47–1.94
2006	139	10,290,338	1.52	1.27–1.79	263	10,411,150	2.03	1.79–2.30

Sources: AIHW National Mortality Database; Australian Bureau of Statistics.

Table A2.8: Deaths due to asthma, by sex, people aged 5–34 years, Australia, 1979–2006

Year	Males				Females			
	Deaths due to asthma	Population	Age standardised rate per 100,000	95% confidence interval	Deaths due to asthma	Population	Age standardised rate per 100,000	95% confidence interval
1979	39	3,801,424	1.04	0.74–1.42	26	3,666,212	0.71	0.46–1.04
1980	40	3,838,662	1.04	0.75–1.42	31	3,707,242	0.84	0.57–1.19
1981	37	3,886,621	0.97	0.68–1.33	47	3,755,136	1.25	0.92–1.66
1982	39	3,913,365	0.98	0.70–1.34	40	3,780,951	1.08	0.77–1.48
1983	41	3,925,054	1.06	0.76–1.44	32	3,794,433	0.85	0.58–1.20
1984	58	3,929,234	1.45	1.10–1.88	41	3,799,641	1.08	0.77–1.46
1985	50	3,941,760	1.27	0.94–1.67	56	3,810,544	1.44	1.09–1.87
1986	62	3,963,505	1.52	1.16–1.95	55	3,829,133	1.41	1.06–1.84
1987	55	3,993,308	1.37	1.03–1.79	55	3,862,446	1.40	1.05–1.82
1988	52	4,031,302	1.27	0.95–1.67	40	3,900,786	1.01	0.72–1.38
1989	54	4,071,700	1.31	0.98–1.70	46	3,941,204	1.14	0.83–1.52
1990	44	4,102,245	1.06	0.77–1.43	47	3,971,569	1.16	0.85–1.54
1991	35	4,113,138	0.85	0.59–1.18	41	3,986,925	1.01	0.73–1.37
1992	27	4,121,361	0.66	0.43–0.95	17	3,997,413	0.43	0.25–0.69
1993	38	4,115,544	0.91	0.64–1.25	33	3,993,033	0.83	0.57–1.16
1994	26	4,115,954	0.64	0.41–0.93	37	3,993,799	0.93	0.65–1.28
1995	26	4,124,616	0.63	0.41–0.93	24	4,003,108	0.60	0.39–0.90
1996	24	4,134,908	0.58	0.37–0.86	19	4,017,879	0.47	0.28–0.73
1997	27	4,127,183	0.65	0.43–0.95	22	4,017,855	0.55	0.34–0.83
1998	26	4,120,055	0.63	0.41–0.93	32	4,014,573	0.79	0.54–1.11
1999	27	4,124,427	0.66	0.43–0.95	25	4,022,006	0.62	0.40–0.92
2000	23	4,141,012	0.56	0.35–0.84	25	4,040,411	0.61	0.40–0.90
2001	30	4,166,146	0.73	0.49–1.04	13	4,067,548	0.32	0.17–0.54
2002	16	4,202,311	0.38	0.22–0.62	17	4,092,376	0.41	0.24–0.66
2003	19	4,236,739	0.45	0.27–0.71	12	4,120,607	0.28	0.15–0.49
2004	18	4,265,801	0.43	0.25–0.68	13	4,138,488	0.31	0.16–0.52
2005	13	4,298,647	0.30	0.16–0.52	13	4,163,481	0.31	0.17–0.54
2006	10	4,332,570	0.22	0.11–0.41	8	4,192,639	0.19	0.08–0.37

Sources: AIHW National Mortality Database; Australian Bureau of Statistics.

Appendix 2: Statistical tables

General practice

Table A2.9: General practice encounters for asthma, by age group, Australia, April 1998 to March 2007

Age group/ year	GP encounters for asthma per 100 GP encounters	95% confidence interval	Total annual GP attendances	Population	GP encounters for asthma per 100 population	95% confidence interval
0 to 4 years						
1998–99	5.5	4.6–6.5	8,872,329	1,289,541	38.0	31.7–44.3
1999–2000	5.3	4.5–6.1	8,467,529	1,284,153	34.9	29.8–40.0
2000–01	4.6	4.0–5.3	8,146,090	1,278,970	29.3	25.2–33.5
2001–02	4.3	3.7–4.9	7,779,664	1,282,357	26.1	22.3–29.8
2002–03	4.1	3.5–4.8	7,628,359	1,270,421	24.7	20.9–28.5
2003–04	4.3	3.6–5.0	7,251,901	1,264,617	24.7	20.8–28.5
2004–05	3.4	2.9–3.9	7,078,429	1,280,616	18.8	15.8–21.8
2005–06	3.9	3.2–4.5	6,943,018	1,301,111	20.7	17.2–24.2
2006–07	3.7	3.0–4.4	6,811,572	1,319,180	19.1	15.7–22.6
5 to 34 years						
1998–99	4.1	3.8–4.4	33,322,197	8,134,628	16.8	15.6–18.1
1999–2000	3.9	3.6–4.3	31,963,780	8,146,433	15.5	14.1–16.8
2000–01	3.8	3.5–4.1	30,910,917	8,181,423	14.4	13.2–15.6
2001–02	3.8	3.4–4.1	29,795,442	8,233,694	13.6	12.4–14.8
2002–03	3.4	3.1–3.7	28,935,717	8,312,219	11.8	10.8–12.8
2003–04	3.6	3.3–4.0	27,494,569	8,326,866	11.9	10.8–13.1
2004–05	3.2	2.9–3.5	26,376,406	8,429,031	9.9	8.9–10.8
2005–06	3.1	2.8–3.4	26,488,696	8,492,061	9.6	8.8–10.5
2006–07	3.0	2.7–3.3	25,921,579	8,554,967	9.1	8.2–10.0
35 to 64 years						
1998–99	2.6	2.4–2.8	38,021,641	6,995,872	14.2	12.9–15.4
1999–2000	2.7	2.5–2.9	38,453,076	7,159,795	14.4	13.2–15.5
2000–01	2.2	2.0–2.4	38,694,630	7,313,669	11.8	10.7–12.9
2001–02	2.3	2.1–2.6	38,481,049	7,461,655	12.1	11.0–13.2
2002–03	2.4	2.2–2.6	38,196,778	7,590,140	12.2	11.0–13.3
2003–04	2.0	1.8–2.2	37,488,856	7,734,740	9.6	8.8–10.5
2004–05	2.0	1.8–2.2	37,607,243	7,952,212	9.6	8.7–10.6
2005–06	1.9	1.8–2.1	37,873,486	8,106,982	9.1	8.3–9.9
2006–07	2.0	1.8–2.2	38,115,989	8,256,425	9.4	8.5–10.3
65 years and over						
1998–99	2.2	1.9–2.4	21,764,528	2,291,230	20.6	18.4–22.9
1999–2000	2.5	2.3–2.8	21,875,472	2,335,474	23.6	21.2–26.0
2000–01	2.0	1.8–2.2	22,035,428	2,379,318	18.7	16.7–20.8
2001–02	2.2	1.9–2.4	22,161,005	2,435,534	19.6	17.4–21.8

(continued)

Table A2.9 (continued): General practice encounters for asthma, by age group, Australia, April 1998 to March 2007

Age group/ year	GP encounters for asthma per 100 GP encounters	95% confidence interval	Total annual GP attendances	Population	GP encounters for asthma per 100 population	95% confidence interval
2002–03	2.1	1.8–2.3	22,541,186	2,490,001	18.7	16.4–20.9
2003–04	1.9	1.7–2.2	22,669,052	2,546,423	17.2	15.3–19.2
2004–05	1.7	1.5–1.9	23,258,641	2,603,379	15.3	13.5–17.1
2005–06	1.5	1.3–1.7	23,714,868	2,658,763	13.8	12.0–15.5
2006–07	1.6	1.4–1.8	24,113,349	2,721,425	13.9	12.2–15.5
0 to 14 years						
1998–99	6.6	6.0–7.3	17,662,464	3,943,620	29.7	26.8–32.7
1999–2000	6.4	5.7–7.1	16,527,764	3,960,290	26.8	24.0–29.7
2000–01	5.8	5.2–6.4	15,890,422	3,977,640	23.2	20.9–25.5
2001–02	6.0	5.0–6.2	15,298,258	3,991,803	21.4	19.1–23.8
2002–03	5.2	4.6–5.7	15,052,658	3,999,814	19.5	17.5–21.6
2003–04	5.5	4.9–6.0	14,081,346	4,008,156	19.2	17.2–21.2
2004–05	4.9	4.4–5.4	13,524,047	4,015,470	16.5	14.8–18.3
2005–06	5.1	4.5–5.7	13,452,251	4,040,842	17.0	15.1–18.9
2006–07	4.6	4.1–5.2	13,003,306	4,061,135	14.8	13.0–16.6
15 years and over						
1998–99	2.5	2.4–2.7	81,373,466	14,870,656	14.0	13.0–14.9
1999–2000	2.7	2.5–2.8	84,232,093	15,078,048	14.9	14.0–15.8
2000–01	2.3	2.2–2.5	83,896,643	15,295,004	12.8	12.0–13.6
2001–02	2.4	2.2–2.6	82,918,902	15,544,419	12.9	12.0–13.8
2002–03	2.3	2.2–2.5	82,249,382	15,777,026	12.2	11.4–13.1
2003–04	2.2	2.0–2.3	80,823,032	16,013,551	10.9	10.1–11.6
2004–05	2.0	1.8–2.1	80,796,672	16,249,768	9.8	9.2–10.5
2005–06	1.9	1.7–2.0	81,567,817	16,518,075	9.2	8.6–9.8
2006–07	1.9	1.8–2.1	81,959,183	16,790,862	9.5	8.8–10.2
All ages						
1998–99	3.2	3.0–3.4	90,800,767	18,711,271	15.4	14.5–16.3
1999–2000	3.2	3.0–3.4	89,959,223	18,925,855	15.2	14.3–16.2
2000–01	2.8	2.7–3.0	89,814,608	19,153,380	13.3	12.5–14.1
2001–02	2.8	2.7–3.0	90,767,006	19,413,240	13.3	12.4–14.1
2002–03	2.7	2.6–2.9	90,661,663	19,654,875	12.6	11.8–13.3
2003–04	2.6	2.4–2.7	89,176,063	19,902,738	11.5	10.7–12.2
2004–05	2.3	2.2–2.5	89,671,484	20,139,792	10.4	9.7–11.1
2005–06	2.3	2.1–2.4	90,532,408	20,409,146	10.1	9.4–10.7
2006–07	2.3	2.1–2.4	90,678,610	20,701,488	9.9	9.2–10.6

Note: Data are presented in 'Bettering the Evaluation and Care of Health (BEACH) years', which extend from April to March.

Sources: BEACH Survey of General Practice; Medicare Australia online statistics.

Appendix 2: Statistical tables

Hospitalisations

Table A2.10: Hospital separations for asthma, by age group and sex, Australia, 1993–2007

Age group/ year	Males				Females			
	Hospital separations	Population	Hospital separations per 100,000	95% confidence interval	Hospital separations	Population	Hospital separations per 100,000	95% confidence interval
0 to 4 years								
1993–94	12,928	662,989	1,950	1,917–1,984	6,712	629,533	1,066	1,041–1,092
1994–95	12,857	665,924	1,931	1,898–1,964	6,509	632,113	1,030	1,005–1,055
1995–96	12,608	666,703	1,891	1,858–1,924	6,398	632,821	1,011	986–1,036
1996–97	12,683	665,611	1,906	1,872–1,939	6,594	631,438	1,044	1,019–1,070
1997–98	10,207	665,414	1,534	1,504–1,564	5,174	630,850	820	798–843
1998–99	11,237	662,117	1,697	1,666–1,729	5,979	627,424	953	929–977
1999–2000	8,734	658,830	1,326	1,298–1,354	4,733	625,323	757	736–779
2000–01	9,679	655,870	1,476	1,447–1,505	5,203	623,100	835	813–858
2001–02	8,416	657,499	1,280	1,253–1,308	4,504	624,858	721	700–742
2002–03	7,935	651,556	1,218	1,191–1,245	4,206	619,365	679	659–700
2003–04	8,335	648,266	1,286	1,258–1,314	4,266	616,337	692	672–713
2004–05	8,438	646,962	1,304	1,277–1,332	4,598	614,285	749	727–770
2005–06	9,097	648,825	1,402	1,373–1,431	4,938	615,682	802	780–825
2006–07	8,600	654,879	1,313	1,286–1,341	4,722	620,286	762	740–783
5 to 14 years								
1993–94	9,682	1,305,410	380	372–388	6,373	1,239,594	250	244–257
1994–95	8,008	1,313,601	313	306–320	5,546	1,248,399	216	211–222
1995–96	8,319	1,326,681	322	315–329	5,548	1,261,913	214	209–220
1996–97	7,397	1,339,478	283	277–290	4,921	1,274,788	188	183–193
1997–98	7,335	1,347,206	279	273–285	4,745	1,283,025	180	175–185
1998–99	7,224	1,355,317	273	267–279	4,811	1,291,019	181	176–187
1999–2000	5,662	1,366,184	212	207–218	3,853	1,300,535	144	140–149
2000–01	6,620	1,377,301	246	240–252	4,317	1,309,796	160	156–165
2001–02	4,984	1,386,873	184	179–189	3,032	1,317,968	112	108–116
2002–03	4,322	1,391,412	160	155–165	2,702	1,321,845	100	96–104
2003–04	4,419	1,393,719	164	159–168	2,952	1,323,202	109	105–113
2004–05	4,605	1,392,226	171	166–176	2,965	1,323,271	110	106–114
2005–06	4,497	1,392,226	168	163–173	2,831	1,321,488	105	102–109
2006–07	4,676	1,390,404	336	327–346	3,126	1,319,756	237	229–245

(continued)

Table A2.10 (continued): Hospital separations for asthma, by age group and sex, Australia, 1993–2007

Age group/ year	Males				Females			
	Hospital separations	Population	Hospital separations per 100,000	95% confidence interval	Hospital separations	Population	Hospital separations per 100,000	95% confidence interval
15 to 34 years								
1993–94	3,582	2,810,134	65	62–67	7,188	2,753,439	130	127–133
1994–95	3,002	2,802,353	54	52–56	6,394	2,745,400	116	113–119
1995–96	3,111	2,797,935	56	54–58	6,449	2,741,195	118	115–121
1996–97	3,012	2,795,430	54	53–56	6,269	2,743,091	114	111–117
1997–98	3,339	2,779,977	61	59–63	6,471	2,734,830	118	115–121
1998–99	3,439	2,764,738	63	61–65	6,206	2,723,554	113	111–116
1999–2000	3,314	2,758,243	61	58–63	5,798	2,721,471	106	103–109
2000–01	3,338	2,763,711	61	59–63	5,762	2,730,615	105	102–108
2001–02	2,628	2,779,273	48	46–49	4,475	2,749,580	81	79–83
2002–03	2,133	2,805,935	38	37–40	4,093	2,760,675	74	72–76
2003–04	2,170	2,832,596	39	37–40	4,176	2,777,349	75	73–77
2004–05	1,942	2,855,323	34	33–36	3,641	2,784,453	65	63–67
2005–06	1,785	2,883,842	31	30–33	3,533	2,805,922	63	61–65
2006–07	1,769	2,911,811	61	58–64	3,197	2,819,777	113	110–117
35 to 64 years								
1993–94	2,739	3,132,090	45	43–47	5,857	3,077,546	96	94–99
1994–95	2,696	3,194,835	43	42–45	5,744	3,146,513	93	90–95
1995–96	2,716	3,268,186	43	41–44	6,015	3,224,911	95	93–97
1996–97	2,864	3,348,237	44	42–46	6,402	3,309,585	99	96–101
1997–98	3,152	3,428,459	47	45–49	6,954	3,399,118	104	102–106
1998–99	2,900	3,508,991	42	40–43	7,112	3,486,881	103	100–105
1999–2000	2,953	3,587,294	41	40–43	7,049	3,572,501	99	97–101
2000–01	2,820	3,660,750	77	37–40	6,745	3,652,919	93	90–95
2001–02	2,563	3,730,335	39	33–36	6,205	3,731,320	83	81–85
2002–03	2,249	3,798,334	30	28–31	5,610	3,800,910	74	72–76
2003–04	2,260	3,864,150	29	28–30	5,610	3,870,590	72	70–74
2004–05	2,194	3,928,506	28	27–29	5,481	3,939,572	69	67–71
2005–06	2,298	3,987,078	29	28–30	5,416	4,005,545	67	65–69
2006–07	2,061	4,066,889	51	49–53	5,118	4,087,579	125	122–129

(*continued*)

Table A2.10 (continued): Hospital separations for asthma, by age group and sex, Australia, 1993–2007

Age group/ year	Males				Females			
	Hospital separations	Population	Hospital separations per 100,000	95% confidence interval	Hospital separations	Population	Hospital separations per 100,000	95% confidence interval
65 years and over								
1993–94	1,506	887,292	77	73–81	2,459	1,169,066	117	113–122
1994–95	1,490	911,353	74	70–78	2,486	1,194,247	116	112–121
1995–96	1,561	934,099	76	72–79	2,668	1,217,314	123	118–127
1996–97	1,769	959,299	83	79–87	2,988	1,243,757	135	130–140
1997–98	1,948	982,115	89	85–93	3,331	1,266,570	148	143–153
1998–99	1,454	1,003,511	64	61–68	3,510	1,287,719	152	147–157
1999–2000	1,353	1,025,997	59	56–62	3,557	1,309,477	152	147–157
2000–01	1,177	1,047,699	50	47–53	3,149	1,331,619	132	128–137
2001–02	1,171	1,076,672	48	45–51	3,040	1,358,862	125	120–129
2002–03	1,047	1,105,896	42	39–44	2,933	1,385,051	118	114–122
2003–04	937	1,134,702	36	34–39	2,864	1,411,721	113	109–117
2004–05	923	1,165,489	35	33–37	2,674	1,439,410	104	100–108
2005–06	918	1,198,865	34	31–36	2,616	1,469,136	99	95–103
2006–07	883	1,233,435	72	67–77	2,436	1,500,672	162	156–169
0 to 14 years								
1993–94	22,610	1,968,399	579.3	571.8–586.9	13,085	1,869,127	336.9	331.1–342.7
1994–95	20,865	1,979,525	530.5	523.3–537.7	12,055	1,880,512	308.2	302.7–313.7
1995–96	20,927	1,993,384	530.1	522.9–537.3	11,946	1,894,734	303.8	298.3–309.2
1996–97	20,080	2,005,089	506.4	499.4–513.4	11,515	1,906,226	291.3	286.0–296.6
1997–98	17,542	2,012,620	442.2	435.7–448.8	9,919	1,913,875	250.7	245.8–255.7
1998–99	18,473	2,017,434	465.2	458.5–471.9	10,794	1,918,443	272.5	267.3–277.6
1999–2000	14,396	2,025,014	362.4	356.5–368.4	8,586	1,925,858	216.4	211.9–221.0
2000–01	16,299	2,033,171	410.2	403.9–416.5	9,520	1,932,896	239.6	234.9–244.5
2001–02	13,400	2,044,372	336.1	330.4–341.8	7,536	1,942,826	189.0	184.8–193.3
2002–03	12,257	2,042,968	309.2	303.7–314.7	6,908	1,941,210	174.1	170.1–178.3
2003–04	12,754	2,041,999	322.9	317.4–328.6	7,218	1,939,539	182.5	178.4–186.8
2004–05	13,043	2,041,195	331.2	325.5–336.9	7,563	1,937,556	191.9	187.6–196.2
2005–06	13,594	2,041,051	345.1	339.3–350.9	7,769	1,937,170	197.2	192.8–201.6
2006–07	13,276	2,045,283	335.2	329.5–340.9	7,848	1,940,042	198.4	194.0–202.8

(continued)

Table A2.10 (continued): Hospital separations for asthma, by age group and sex, Australia, 1993–2007

Age group/ year	Males				Females			
	Hospital separations	Population	Hospital separations per 100,000	95% confidence interval	Hospital separations	Population	Hospital separations per 100,000	95% confidence interval
15 years and over								
1993–94	7,827	6,829,516	56.9	55.6–58.1	15,504	7,000,051	111.7	110.0–113.5
1994–95	7,187	6,908,541	52.0	50.8–53.2	14,624	7,086,160	104.8	103.1–106.6
1995–96	7,388	7,000,220	52.7	51.5–53.9	15,132	7,183,420	107.4	105.7–109.2
1996–97	7,645	7,102,966	53.8	52.6–55.1	15,659	7,296,433	109.8	108.1–111.5
1997–98	8,440	7,190,551	58.6	57.3–59.8	16,756	7,400,518	115.9	114.1–117.7
1998–99	7,802	7,277,240	52.9	51.7–54.1	16,842	7,498,154	114.4	112.7–116.2
1999–2000	7,620	7,371,534	50.9	49.8–52.1	16,404	7,603,449	109.9	108.2–111.6
2000–01	7,335	7,472,160	48.3	47.2–49.4	15,656	7,715,153	103.2	101.6–104.8
2001–02	6,362	7,586,280	41.2	40.2–42.3	13,720	7,839,762	88.9	87.5–90.4
2002–03	5,429	7,710,165	34.6	33.7–35.5	12,636	7,946,636	80.7	79.3–82.1
2003–04	5,367	7,831,448	33.6	32.7–34.5	12,650	8,059,660	79.6	78.2–81.0
2004–05	5,059	7,949,318	31.2	30.3–32.1	11,796	8,163,435	73.1	71.8–74.4
2005–06	5,001	8,069,785	30.3	29.5–31.2	11,565	8,280,603	70.6	69.3–71.9
2006–07	4,713	8,212,135	28.1	27.3–28.9	10,751	8,408,028	64.5	63.3–65.7
All ages								
1993–94	30,437	8,797,915	164.2	162.3–166.0	28,589	8,869,178	158.0	156.1–159.8
1994–95	28,052	8,888,066	150.2	148.5–152.0	26,679	8,966,672	146.6	144.8–148.4
1995–96	28,315	8,993,604	150.7	149.0–152.5	27,078	9,078,154	147.8	146.0–149.5
1996–97	27,725	9,108,055	146.8	145.1–148.5	27,175	9,202,659	147.1	145.3–148.8
1997–98	25,981	9,203,171	137.4	135.7–139.0	26,675	9,314,393	143.6	141.9–145.3
1998–99	26,275	9,294,674	137.6	135.9–139.2	27,636	9,416,597	146.9	145.2–148.6
1999–2000	22,016	9,396,548	114.9	113.4–116.4	24,990	9,529,307	131.7	130.1–133.4
2000–01	23,634	9,505,331	122.6	121.1–124.2	25,176	9,648,049	131.2	129.6–132.9
2001–02	19,762	9,630,652	101.8	100.4–103.2	21,256	9,782,588	109.5	108.0–111.0
2002–03	17,686	9,753,133	91.0	89.6–92.3	19,544	9,887,846	99.9	98.5–101.3
2003–04	18,121	9,873,447	93.1	91.7–94.4	19,868	9,999,199	100.7	99.3–102.1
2004–05	18,102	9,990,513	92.8	91.5–94.2	19,359	10,100,991	97.5	96.1–98.9
2005–06	18,595	10,110,836	95.0	93.6–96.4	19,334	10,217,773	96.6	95.2–97.9
2006–07	17,989	10,257,418	91.2	89.9–92.5	18,599	10,348,070	92.0	90.7–93.4

Notes: All hospital separations before 1998–99 data have been converted to International Classification of Diseases, 10th Revision (ICD-10) using the following conversion factors: less than 5 years =1; 5–34 years =1.0326; 35–64 years = 0.7938; 65 years and above = 0.4813. Asthma is classified according to ICD, 9th Revision (ICD-9) code 493, and ICD-10 codes J45 and J46. Separations for which the care type was reported as Newborn with no qualified days, and records for Hospital boarders and Posthumous organ procurement have been excluded.

Source: AIHW National Hospital Morbidity Database.

Patient days

TableA2.11: Hospital patient days for asthma per 100,000 population, by age group, Australia, 1993–2007

	Age group (years)					
	0–4	5–14	15–34	35–64	65 and over	All ages (95% CI)
Sex (data for 2006–07)						
Males	1,836.1	533.9	115.5	133.6	289.0	316.2 (312.7–319.6)
Females	1,102.0	407.6	240.5	400.4	847.2	458.3 (454.2–462.4)
Year						
1993–94	2,968.9	1,375.8	490.3	637.9	1,462.9	956.1 (951.6–960.8)
1994–95	2,838.1	1,122.3	429.6	614.4	1,367.3	873.9 (869.5–878.3)
1995–96	2,688.3	1,098.8	426.4	621.3	1,437.4	871.3 (867.0–875.6)
1996–97	2,575.1	959.8	408.5	616.6	1,601.2	858.0 (853.8–862.3)
1997–98	2,035.5	926.7	410.6	655.6	1,643.6	838.7 (834.5–842.9)
1998–99	2,145.7	868.7	399.3	531.8	1,314.0	745.7 (741.8–749.7)
1999–2000	1,641.7	650.6	344.6	499.1	1,230.2	643.4 (639.8–647.0)
2000–01	1,687.0	717.1	333.2	437.5	1,031.1	603.8 (600.3–607.3)
2001–02	1,423.9	492.1	252.5	389.6	890.8	496.0 (492.9–499.2)
2002–03	1,286.5	410.5	212.3	326.7	820.0	431.1 (428.2–434.0)
2003–04	1,327.3	419.2	212.0	316.3	728.6	419.4 (416.6–422.3)
2004–05	1,318.2	426.1	191.0	299.9	697.2	403.6 (400.8–406.4)
2005–06	1,394.2	399.1	177.4	283.7	661.6	390.2 (387.5–393.0)
2006–07	1,304.3	411.9	156.4	253.7	580.5	355.8 (353.3–358.4)
Remoteness (data for 2006–07)						
Major Cities	1,558.5	478.4	157.0	242.3	594.0	373.1 (369.9–376.3)
Inner Regional	1,305.2	415.5	203.7	277.1	602.1	391.9 (385.9–398.0)
Outer Regional	1,138.5	462.4	238.4	343.4	577.7	419.2 (410.2–428.4)
Remote	839.6	472.7	320.7	409.6	772.7	463.8 (441.3–487.4)
Very Remote	1,041.0	375.8	226.3	615.6	765.7	501.0 (468.1–536.2)
Culturally and linguistically diverse background (data for 2006–07)						
English-speaking background	1,485.0	481.2	200.0	486.5	598.6	408.8 (405.9–411.9)
Non-English-speaking background	880.3	211.8	55.7	267.6	572.8	229.2 (220.2–238.3)
Socioeconomic status (data for 2006–07)						
SEIFA 1 (most disadvantaged)	1,774.8	596.0	258.2	395.9	686.1	521.7 (513.2–530.3)
SEIFA 2	1,599.9	552.0	223.4	346.9	599.9	458.8 (452.6–465.1)
SEIFA 3	1,379.6	437.7	170.4	261.6	561.0	370.0 (364.3–375.9)
SEIFA 4	1,297.0	395.9	152.8	280.0	576.6	328.6 (323.4–333.8)
SEIFA 5 (least disadvantaged)	1,294.0	366.6	110.4	173.7	596.1	296.8 (291.8–301.9)

Notes: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) code 493 and ICD, 10th Revision, Australian Modification (ICD-10-AM) codes J45 and J46. CI = confidence interval; SEIFA = Socio-economic Indexes for Areas.

Source: AIHW National Hospital Morbidity Database.

Abbreviations

ABS	Australian Bureau of Statistics
ACAM	Australian Centre for Asthma Monitoring
ACCHS	Aboriginal community controlled health service
ACT	Australian Capital Territory
AIHW	Australian Institute of Health and Welfare
ARIA	Accessibility/Remoteness Index of Australia
ASGC	Australian Standard Geographical Classification
ASMA	Australian System for Monitoring Asthma
BEACH	Bettering the Evaluation and Care of Health
CATI	computer-assisted telephone interview
CI	confidence interval
COPD	chronic obstructive pulmonary disease
CURF	confidentialised unit record file
DoHA	Australian Government Department of Health and Ageing
ED	emergency department
GINA	Global Initiative for Asthma
GP	general practitioner
HRQoL	health-related quality of life
ICD-9	International Classification of Diseases, 9th Revision
ICD-9-CM	International Classification of Diseases, 9th Revision, Clinical Modification
ICD-10	International Classification of Diseases, 10th Revision
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification
ICPC-2	International Classification of Primary Care, 2nd edition
ICS	inhaled corticosteroids
ISAAC	International Study of Asthma and Allergies in Childhood
MBS	Medicare Benefits Schedule
NATSIHS	National Aboriginal and Torres Strait Islander Health Survey
NHS	National Health Survey
NSW	New South Wales
NT	Northern Territory
PBS	Pharmaceutical Benefits Scheme
PIP	Practice Incentives Program
Qld	Queensland
RPBS	Repatriation Pharmaceutical Benefits Scheme
SA	South Australia
SAND	Supplementary Analysis of Nominated Data
SEIFA	Socio-economic Indexes for Areas
Tas	Tasmania
Vic	Victoria
WA	Western Australia

Glossary

Aboriginal	A person of Aboriginal descent who identifies as an Aboriginal person and is accepted as such by the community in which he or she lives.
Admission	Admission to hospital. In this report, the number of separations has been taken as the number of admissions. Hence, admission rate is the same as separation rate.
Adult	In this document, a person may be classified as an adult from the age of 15 years, rather than strictly according to the legal age of 18 years.
Age-specific rate	A rate for a specific age group. The numerator and denominator relate to the same age group. See Appendix 1 (Section A1.1) for full description.
Age-standardisation	A method of removing the influence of age when comparing populations with different age structures. This is usually necessary because the rates of many diseases vary strongly (usually increasing) with age. The age structures of the different populations are converted to the same 'standard' structure, then the disease rates that would have occurred with that structure are calculated and compared. See Appendix 1 (Section A1.1) for full description.
Airway hyperresponsiveness	Excessive twitchiness or narrowing of the airways in response to certain stimuli. This is a characteristic feature of asthma.
ARIA/ASGC classification	The Accessibility/Remoteness Index of Australia and Australian Standard Geographical Classification provide classification of the level of accessibility to goods and services (such as general practitioners, hospitals and specialist care) based on the proximity to these services (measured by road distance).
Arthritis	A group of disorders in which there is inflammation of the joints, which can become stiff, painful, swollen or deformed. The two main types of arthritis are osteoarthritis and rheumatoid arthritis.
Associated cause of death	Any condition(s), diseases and injuries—other than the underlying cause—considered to contribute to a death. See also *Cause of death*.
Asthma	A chronic inflammatory disorder of the airways in which many cells and cellular elements play a role, in particular mast cells, eosinophils, T lymphocytes, macrophages, neutrophils and epithelial cells. In susceptible individuals, this inflammation causes recurrent episodes of wheezing, breathlessness, chest tightness and coughing, particularly at night or in the early morning. These episodes are usually associated with widespread but variable airflow obstruction that is often reversible either spontaneously or with treatment. The inflammation also causes increases in existing bronchial hyperresponsiveness to a variety of stimuli. (NAEPP 1997).

Asthma action plan	A plan that provides instructions on how to recognise and respond to worsening asthma. It is recommended that these instructions be given in writing ('written asthma action plan'). The action plan is based on symptoms and/or peak expiratory flow measurements and is individualised according to the pattern of the person's asthma. These plans have sometimes been referred to as 'asthma management plans', 'asthma plans', 'self-management plans', 'asthma care plans' or 'personal asthma plans'.
Asthma expenditure	The component of total health expenditure that is attributable to asthma. Compare with *Total health expenditure*.
Asthma management plan	An individualised plan of management for patients with asthma formulated in accordance with the Six Step Asthma Management Plan. (The asthma action plan forms one part of this.)
Asthma Cycle of Care	An incentive scheme funded by the Australian Government aimed at people with moderate to severe asthma. The plan entails two visits to the general practitioner at which asthma is assessed, an individualised asthma management plan is developed and reviewed, and the patient receives appropriate education about asthma.
Average length of stay	The average length of stay for admitted patient episodes. Calculated by dividing total patient days in a given period by the total number of hospital separations in that period. See *Patient days, Hospital separation* and *Length of stay*.
BEACH (Bettering the Evaluation and Care of Health) survey	A continuous cross-sectional paper-based data collection that collects information about the reasons for seeking medical care, the type of patients seen, the types of problems managed and treatment provided in general practice across Australia.
Bronchial challenge tests	Tests designed to detect the presence of airway hyperresponsiveness; include the bronchial provocation challenge test and methacholine challenge. See *Airway hyperresponsiveness*.
Bronchitis	Inflammation of the main air passages (the bronchi). May be acute (because of infection) or chronic (most often because of tobacco smoking).
Cancer	A large range of diseases, in which some of the body's cells become defective, begin to multiply out of control, can invade and damage the area around them, and can also spread to other parts of the body to cause further damage.
Cardiovascular disease	Any disease of the circulatory system, namely the heart (cardio) or blood vessels (vascular). Includes heart attack, angina, stroke and peripheral vascular disease. Also known as circulatory disease.

Glossary

Cause of death	The disease or factor contributing to a death. When used technically, this term is usually applied to the 'underlying cause' listed on the medical certificate issued at death. From information reported on the medical certificate of cause of death, each death is classified by the underlying cause of death according to rules and conventions of the International Classification of Diseases of the day (currently ICD, 10th Revision). The underlying cause is defined as the disease that initiated the train of events leading directly to death. Deaths from injury or poisoning are classified according to the circumstances of the violence that produced the fatal injury, rather than to the nature of the injury. See *Underlying cause of death* and *Associated cause of death*.
Cerebrovascular disease	Any disorder of the blood vessels supplying the brain or its covering membranes. A notable and major form of cerebrovascular disease is stroke.
Chronic bronchitis	Long-term condition with inflammation of the bronchi, the lungs' main air passages, causing frequent coughing attacks and coughing up of mucus.
Chronic obstructive pulmonary disease	Serious, progressive and disabling long-term lung disease where damage to the lungs, usually due to both *Emphysema* and *Chronic bronchitis*, obstructs oxygen intake and causes increasing shortness of breath. By far the greatest cause is cigarette smoking.
Comorbidity	When a person has two or more health problems at the same time.
Confidence interval	A statistical term describing a range (interval) of values within which we can be 'confident' that the true value lies. For example, a 95% confidence interval implies that there is 95% confidence that the true value will be included in this interval.
Country of birth	This term is used to describe the multicultural nature of the Australian population, including those from English-speaking countries and those from countries where English is not spoken as the first language. See also *English-speaking background* and *Non-English-speaking background*.
Defined daily dose	The assumed average maintenance dose per day for a drug used for its main indication in adults.
Diabetes (diabetes mellitus)	A chronic condition in which the body cannot properly use its main energy source, the sugar glucose. This is due to a relative or absolute deficiency in insulin, a hormone produced by the pancreas. Insulin helps glucose enter the body's cells from the bloodstream and then be processed by them. Diabetes is marked by an abnormal build-up of glucose in the blood and it can have serious short- and long-term effects. The three main types of diabetes are type 1 diabetes, type 2 diabetes and gestational diabetes.
Disability-adjusted life year	Years of healthy life lost through premature death or living with disability due to illness or injury.

Emphysema	A chronic lung disease where over-expansion or destruction of the lung tissue blocks oxygen intake, leading to shortness of breath and other problems.
English-speaking background	Includes anyone born in Australia, New Zealand, United Kingdom, Ireland, United States of America, Canada, Zimbabwe or South Africa (Department of Immigration and Multicultural and Indigenous Affairs (DIMIA) English proficiency group 1).
Estimated resident population	An estimate of the resident population derived from the 5-yearly census counts. It is based on the usual residence of the person.
Health-related quality of life	A term used to describe the impact that a disease has on an individual's health status and everyday functioning. It is most often used when referring to chronic diseases.
Health risk factor	Any factor which represents a greater risk of a health disorder or other unwanted condition or event. Some risk factors are regarded as causes of disease, others are not necessarily so.
Health service use	Use of the available health-care services within the population, including hospitals, emergency departments and general practitioners.
Health survey	A research method in which health information is collected from participants at a point in time. In population health monitoring, this typically involves selecting a representative sample of the population and administering questionnaires to the participants. This can be done in person, over the phone or by post. Some surveys have additionally included physiological measurements.
Hospital separation	The formal process by which a hospital records the completion of treatment or care for an admitted patient. The episode of care may be completed by an admitted patient's discharge, death, transfer to another hospital or change in the type of care.
Incidence	The number of new cases (of a disease, condition or event) occurring during a given period. Compare with *Prevalence*.
Indicator	A key statistical measure selected to help describe (indicate) a situation concisely, track progress and performance, and act as a guide to decision-making. It may have an indirect meaning as well as a direct one; for example, Australia's overall mortality rate is a direct measure of mortality but is often used as a major indicator of population health.
Indigenous	A person of Aboriginal and/or Torres Strait Islander descent who identifies as an Aboriginal and/or Torres Strait Islander person and is accepted as such by the community with which he or she is associated.
Indigenous Australians	Refers to people who identify themselves as being of Aboriginal or Torres Strait Islander origin.

Glossary

International Classification of Diseases (ICD)	International Statistical Classification of Diseases and Related Health Problems. The World Health Organization's internationally accepted statistical classification of death and disease. The 10th Revision (ICD-10) is currently in use. In this report, hospital separations before 1998–99 and causes of death before 1997 under previous revisions have been reclassified to ICD-10. ICD-10-AM is the Australian modification of ICD-10, used for diagnoses and procedures recorded for patients admitted to hospitals.
Length of stay	Duration of hospital stay, calculated by subtracting the date the patient is admitted from the day of separation. All leave days, including the day the patient went on leave, are excluded. A same-day patient is allocated a length of stay of one day. See also *Average length of stay*.
Life expectancy	An indication of how long a person can expect to live. Technically it is the number of years of life remaining to a person at a particular age if mortality rates do not change.
Mechanical ventilation, invasive	A medical intervention used in situations where patients become unable to breathe by themselves. It involves the use of a positive pressure ventilator to maintain respiration via an endotracheal tube. This intervention is generally administered in hospital intensive care units.
Median	The midpoint of a list of observations ranked from the smallest to the largest.
Medicare Benefits Schedule	A national, government-funded scheme that subsidises the cost of personal medical services for all Australians and aims to help them afford medical care.
Morbidity	Refers to ill-health in an individual and to levels of ill-health in a population or group.
Mortality	Death.
Neoplasm	An abnormal ('neo', new) growth of tissue. Can be 'benign' (not a cancer) or 'malignant' (a cancer).
Non-English-speaking background	This term is used to describe people who have settled in Australia but who come from countries where English is not the primary language spoken. Includes people born in all countries not identified as English-speaking-background countries (equivalent to DIMIA English proficiency groups 2 to 4). See also *English-speaking-background*.
Non-Indigenous	People who have declared they are not of Aboriginal or Torres Strait Islander descent. Used interchangeably with *Other Australians*.
Outcome (health outcome)	A health-related change due to a preventive or clinical intervention or service. (The intervention may be single or multiple and the outcome may relate to a person, group or population or be partly or wholly due to the intervention.)

Other Australians	People who are not of Aboriginal or Torres Strait Islander descent, or whose status is not known. Used interchangeably with *Non-Indigenous*.
p value	The probability that the observed difference or association could have occurred by chance. If that probability is less than 5% (i.e. $p < 0.05$), it is conventionally held that it did not occur by chance and is a true difference or association.
Patient days	The number of full or partial days of stay for patients who were admitted for an episode of care and who underwent separation during the reporting period. A patient who is admitted and separated on the same day is allocated one patient day. Compare with *Length of stay* and *Average length of stay*.
Pharmaceutical Benefits Scheme (PBS)	A national, government-funded scheme that subsidises the cost of a wide range of pharmaceutical drugs, and that covers all Australians to help them afford standard medications.
Prescription drugs	Pharmaceutical drugs available only on the prescription of a registered medical practitioner and available only from pharmacies.
Prevalence	The number or proportion (of cases, instances, and so forth) present in a population at a given time. Compare with *Incidence*.
Principal diagnosis	The diagnosis describing the problem that was chiefly responsible for the patient's episode of care in hospital.
Quintile	A group derived by ranking the population according to specified criteria and dividing it into five equal parts.
Risk factor	See *Health risk factor*.
Same-day patients	Admitted patients who are admitted to hospital and separated on the same day.
SAND data	Additional questions asked of patients in subsamples of general practice encounters, as part of the BEACH survey.
SEIFA Index of Relative Socioeconomic Disadvantage	An index of socioeconomic status which provides a summary score for a range of key socioeconomic variables that are related to health status, including household income and resources, education, occupation, fluency in English, and Indigenous status.
Separation	See *Hospital separation*.
Six Step Asthma Management Plan	Consensus-based guidelines for the management of asthma. The six steps are: (1) assess asthma severity; (2) achieve best lung function; (3) maintain best lung function: identify and avoid trigger factors; (4) maintain best lung function: optimise medication program; (5) develop an action plan; and (6) educate and review regularly.
Spirometer/spirometry	Spirometry is a measure of lung function performed by a spirometer. Spirometry is used to establish the presence of airflow obstruction and its reversibility in response to bronchodilator, which is an important feature in the diagnosis of asthma.

Glossary

Statistical significance	An indication from a statistical test that an observed difference or association may be significant, or 'real', because it is unlikely to be due just to chance. A statistical result is often said to be 'significant' if it would occur by chance only once in twenty times or less often. See also *P value*.
Torres Strait Islander	A person of Torres Strait Islander descent who identifies as a Torres Strait Islander and is accepted as such by the community in which he or she lives.
Total health expenditure	The sum of health expenditure for all health conditions (i.e. allocated recurrent health expenditure). This excludes expenditure that cannot be allocated to a specific disease (e.g. ambulance services) and capital expenditure (non-recurrent).
Underlying cause of death	The condition, disease or injury initiating the sequence of events leading directly to death; that is, the primary, chief, main or principal cause. Compare with *Associated cause of death*.
Wheeze	Breathing difficulty accompanied by an audible whistling sound.

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