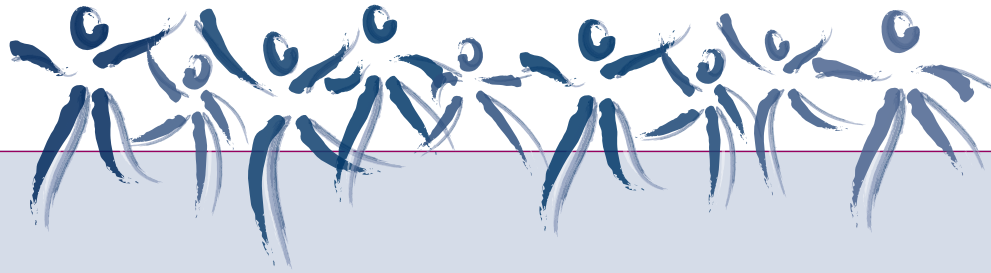
5. Use of health services



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.

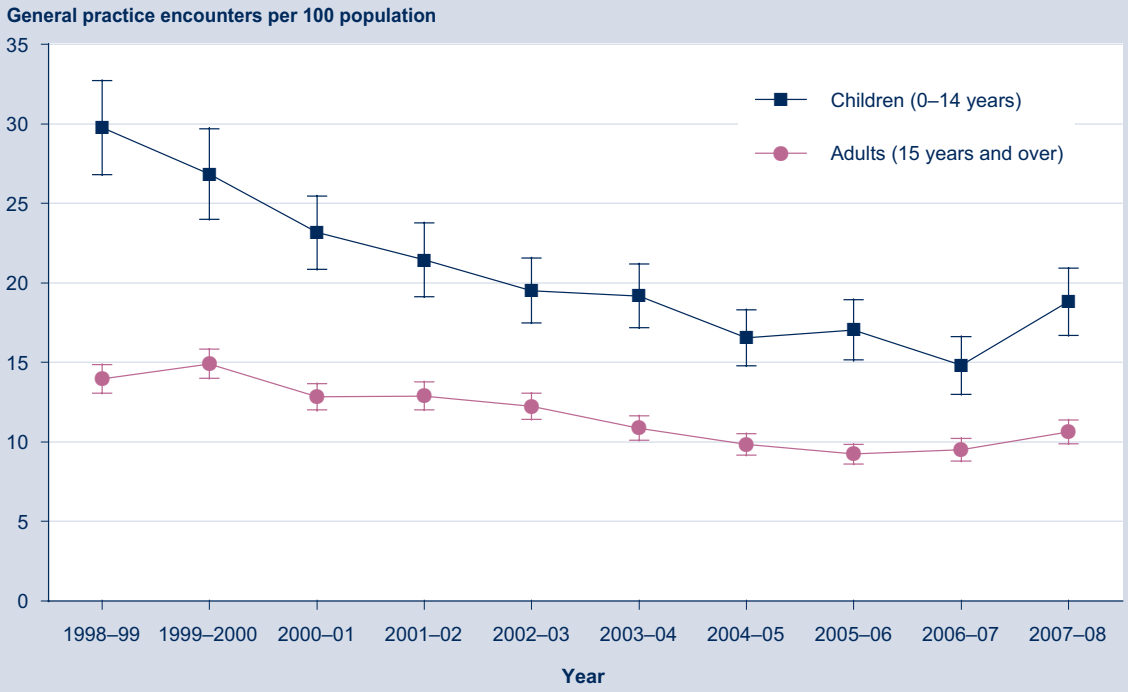
In a study of 1,006 adults with current asthma during 2003 and 2004, 14.3% had an emergency visit to a general practitioner for asthma in the 12 months before being surveyed (Marks et al. 2007). This same study reported that 21.4% of 199 children made an emergency visit to the GP. In another study, 58% 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

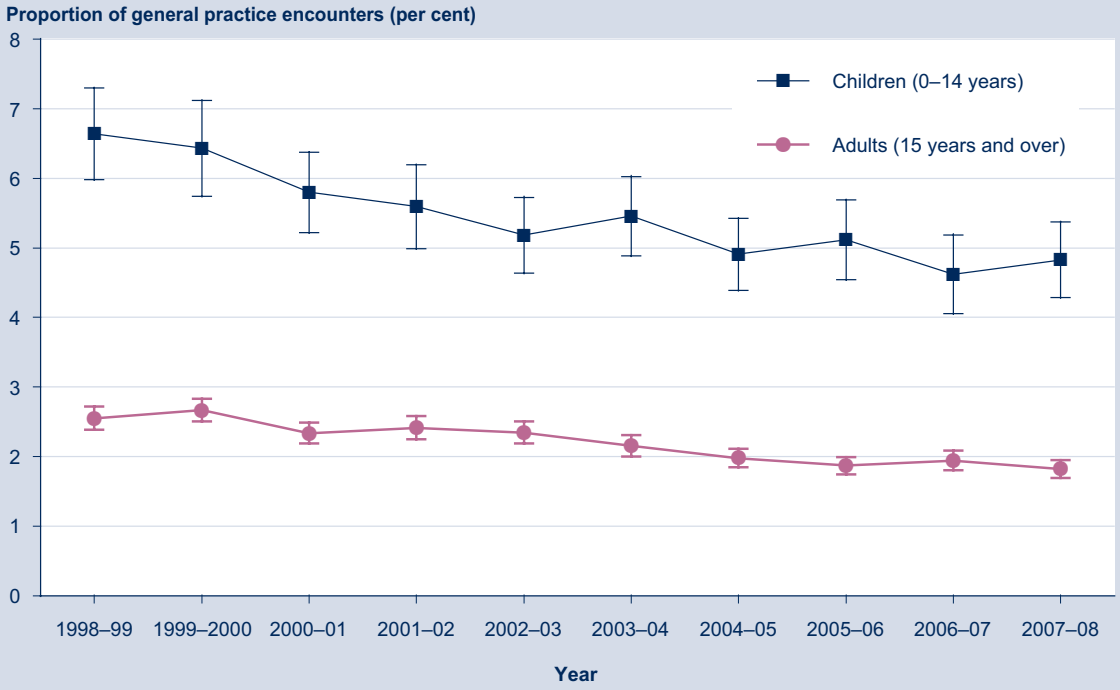
The rate of general practice encounters for asthma has decreased since 1998–99. The largest reduction, expressed as the rate per 100 population, has been among children, where the rate fell by around 37 percentage points between 1998 and 2008 (Figure 5.1). The rate among adults demonstrated a slightly 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.



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



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.

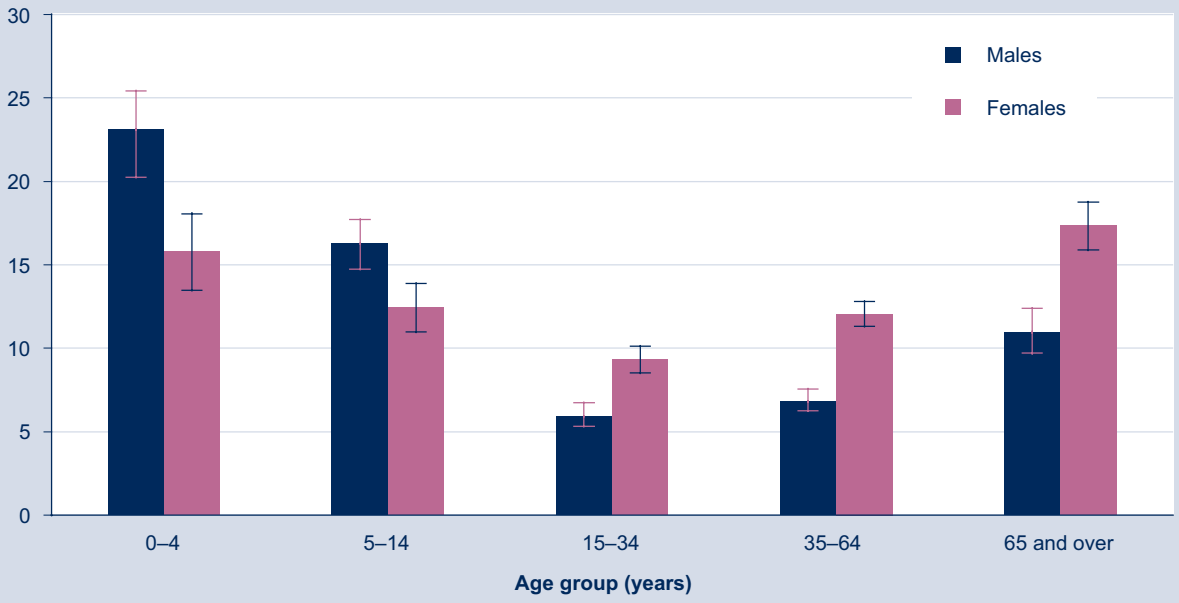
Sources: BEACH Survey of General Practice; Medicare Australia.

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

5.1.2 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.



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.

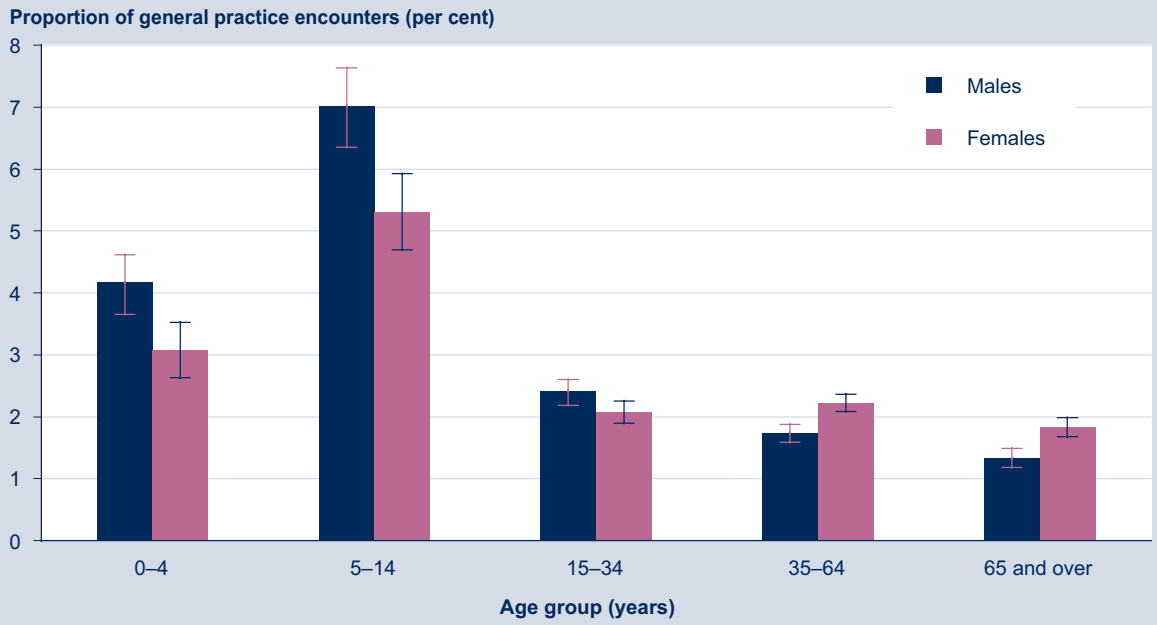
Sources: BEACH Survey of General Practice; Australian Bureau of Statistics.

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).



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

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.

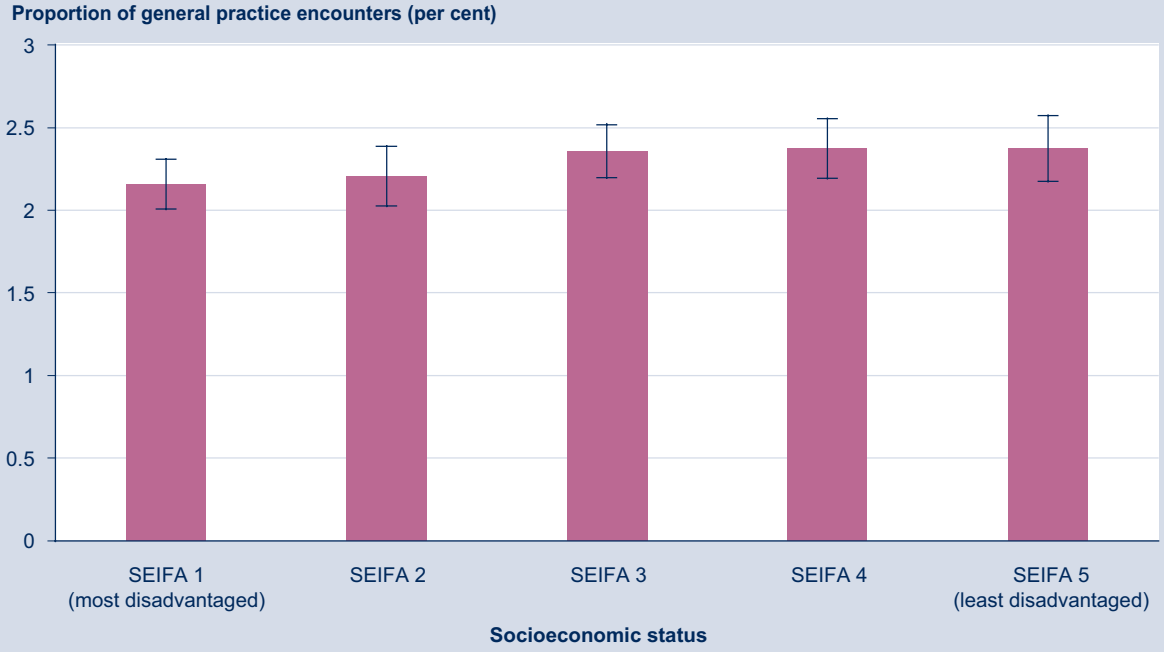
Figure 5.5: General practice encounters for asthma per 100 population, by state and territory, April 2004 to March 2007

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).



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).

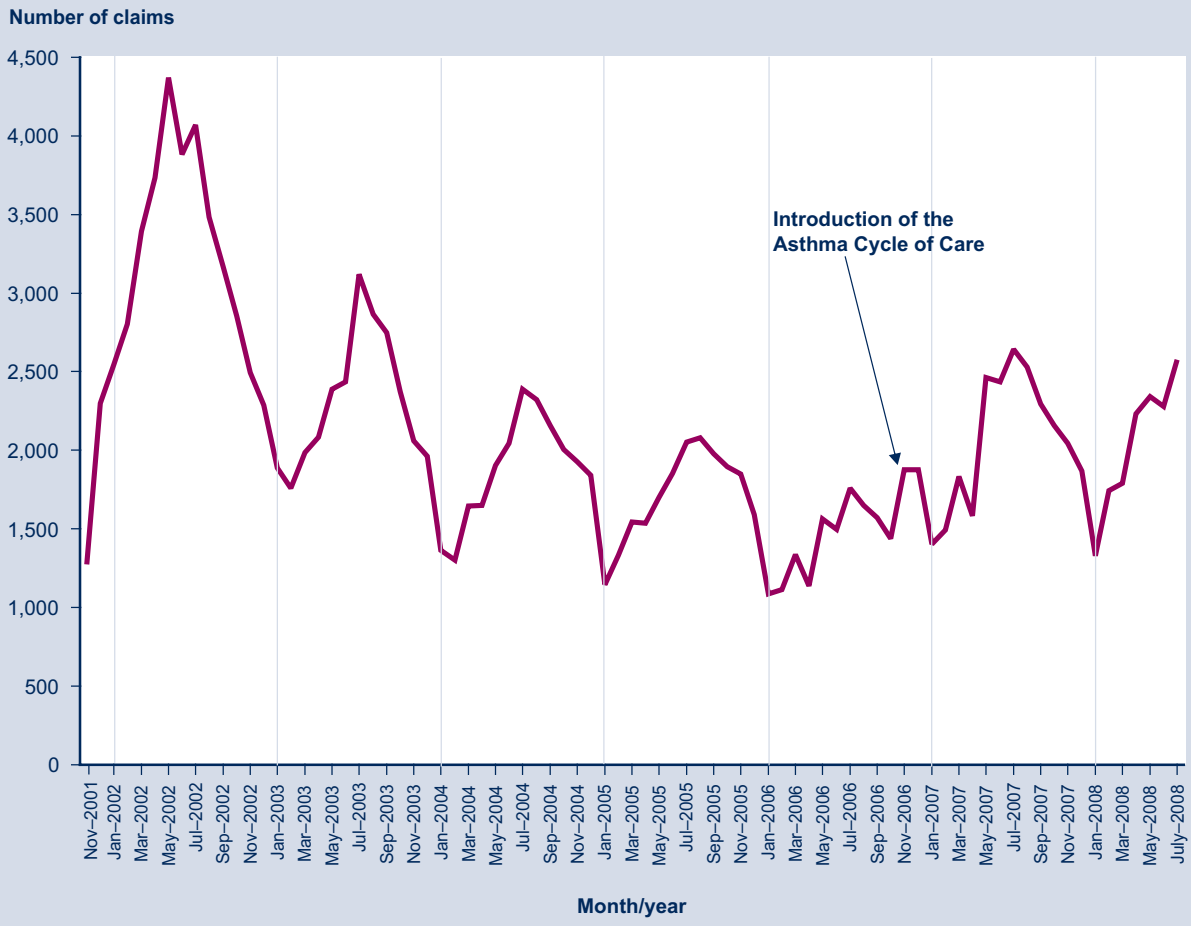
Zwar et al. (2005) interviewed 315 GPs in 5 Divisions of General Practice in metropolitan Sydney and found that 91.2% knew of the Asthma 3+ Visit Plan, but only 44.9% had used it. Major barriers to use of the Asthma 3+ Visit Plan included workload and administrative complexities, while patient attitude 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).



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.

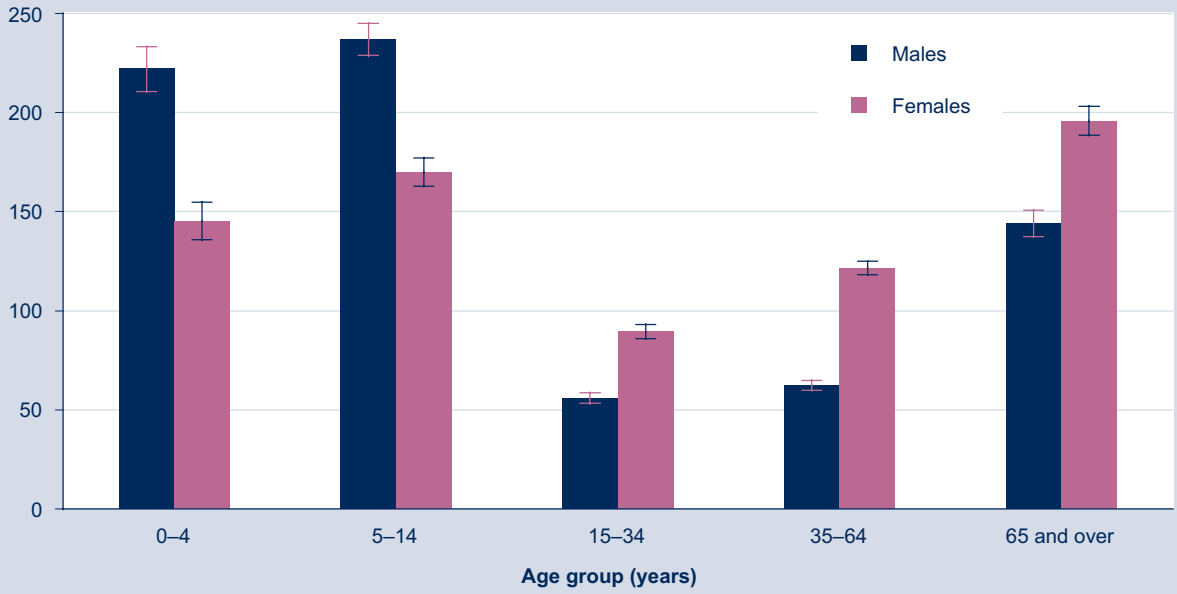
Figure 5.7: Number of claims for completed Practice Incentives Program Asthma 3+ Visit Plan /Asthma Cycle of Care, all ages, November 2001 to July 2008

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).

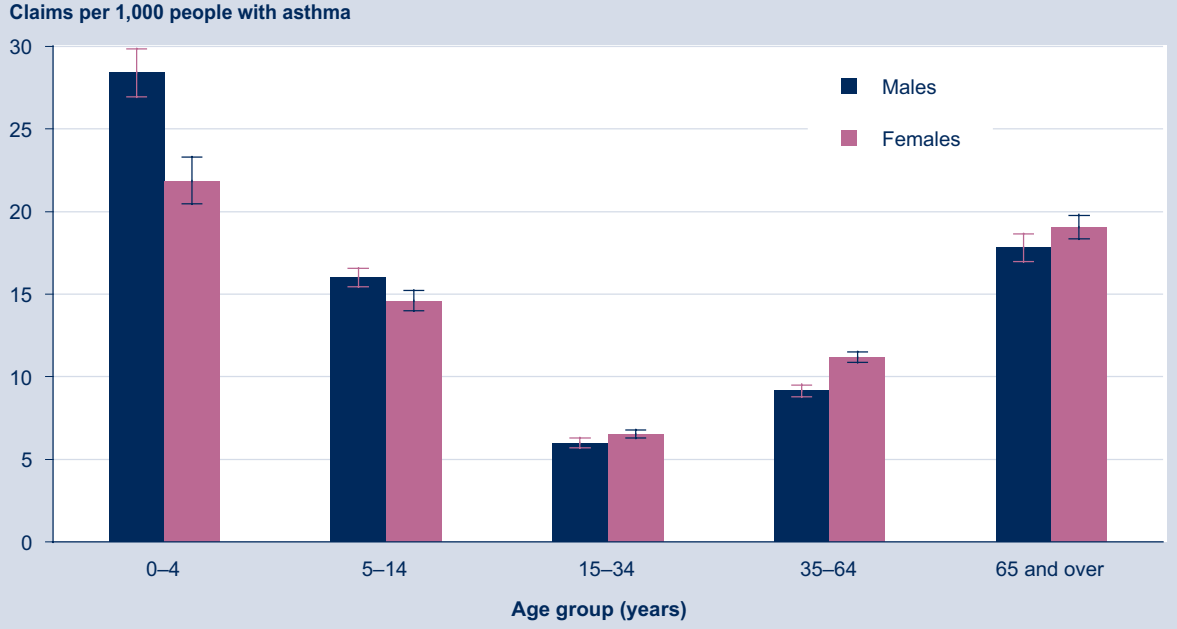
Among people with asthma, young adults aged 15–34 years were least likely to have utilised the Asthma Cycle of Care with 6.3 claims per 1,000 population (Figure 5.9). Children aged 0–4 years, especially males, and older Australians aged 65 years and over had the highest rates of claims.



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



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

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.

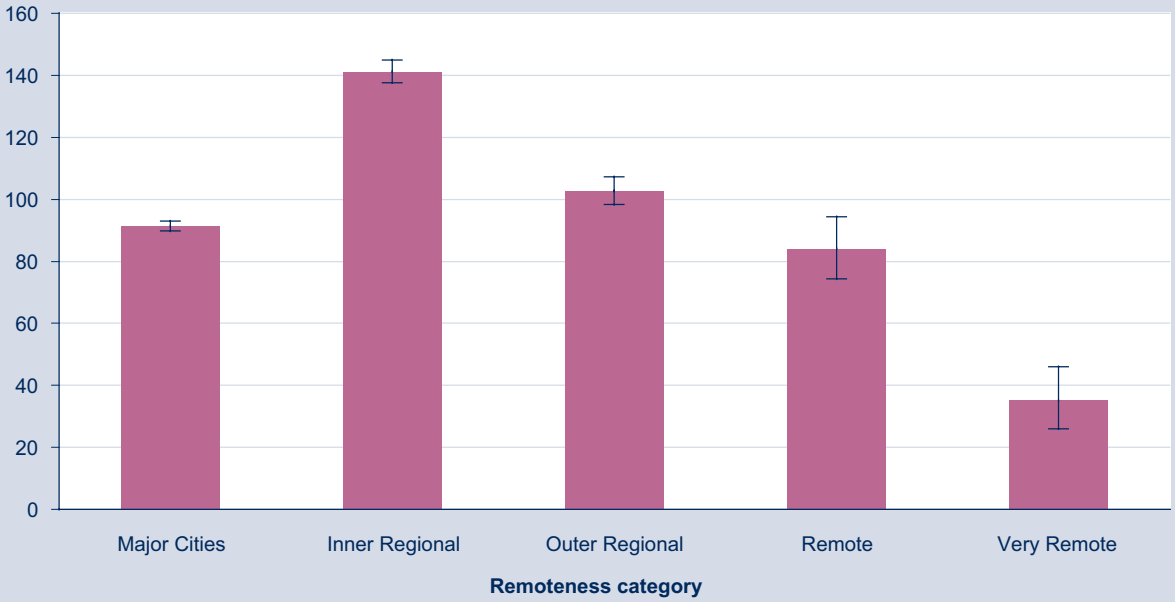
Notes: Claims are for asthma review visit classified codes 2546, 2547, 2552, 2553, 2558, 2559, 2664, 2666, 2668, 2673, 2675 and 2677. Age-standardised to the Australian population as at June 2001. PIP = Practice Incentives Program.

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.



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 ($p < 0.0001$).

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

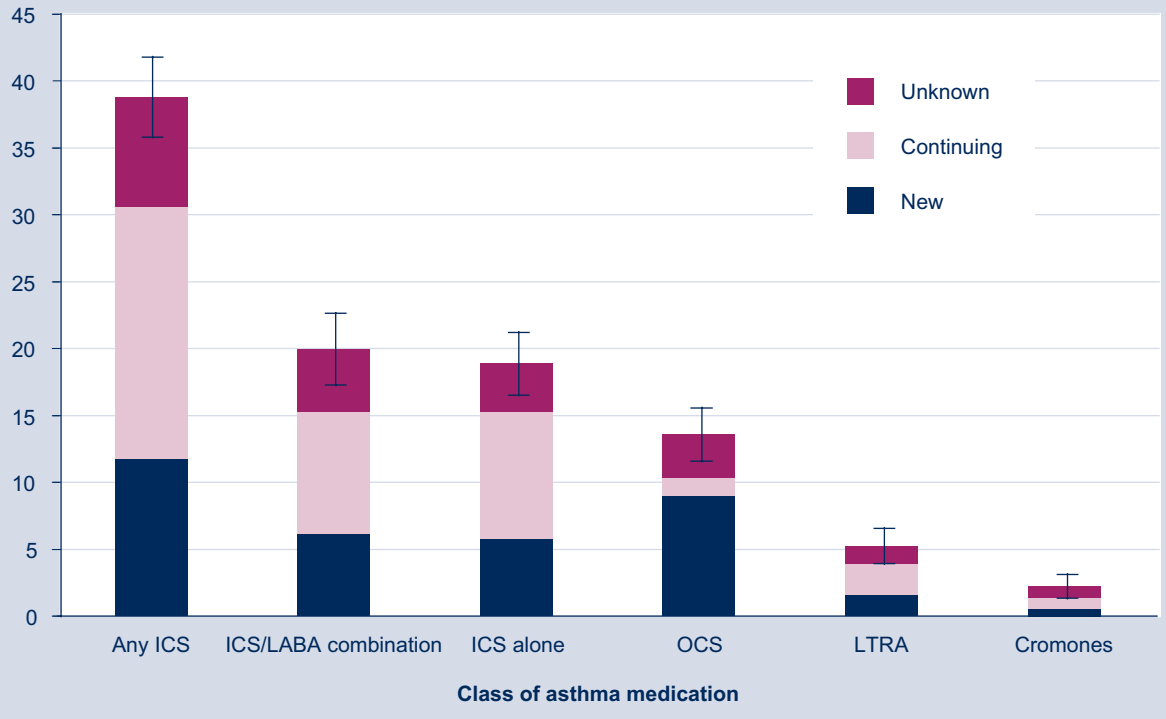
The most frequently prescribed medication during asthma-related GP encounters between April 2004 and March 2007 was inhaled corticosteroids (either alone or in combination with long-acting beta-agonists). During this time, inhaled corticosteroids were prescribed for the management of asthma at 51.9% (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.



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.

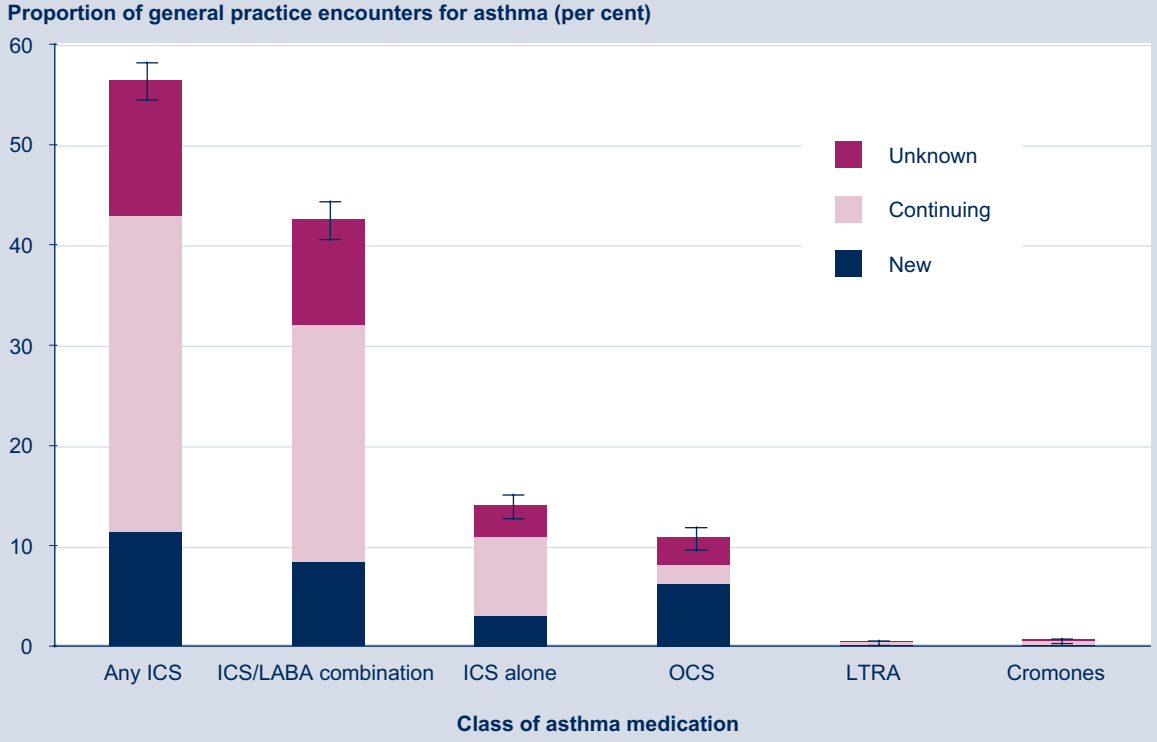
Source: Bettering the Evaluation and Care of Health (BEACH) program.

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

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.



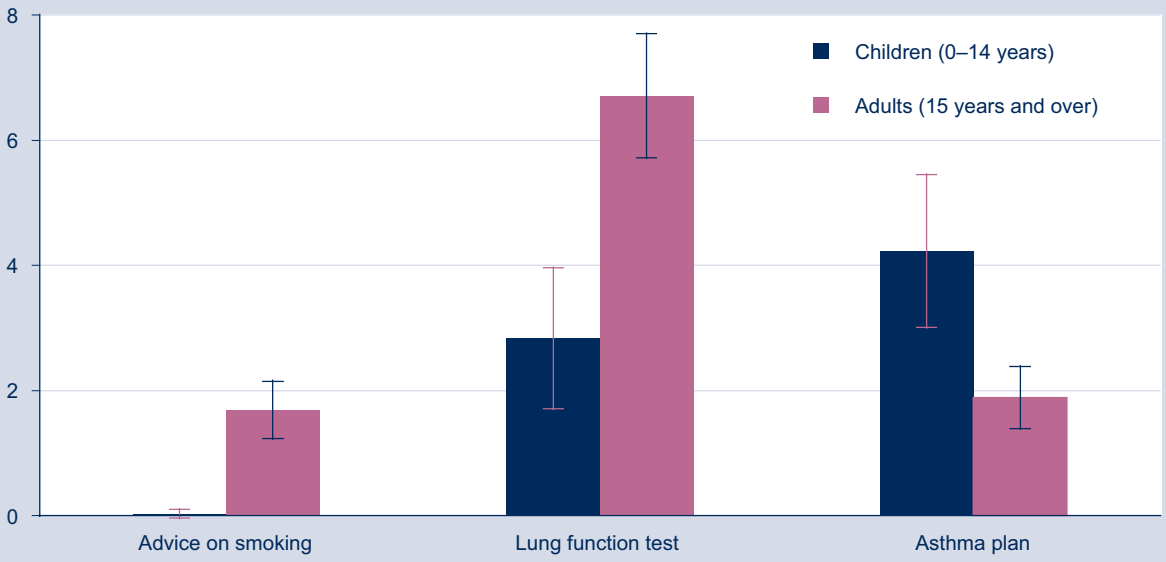
Notes: Asthma classified according to International Classification of Primary Care, 2nd edition (ICPC-2) code R96. ICS = inhaled corticosteroids, LABA = long-acting beta-agonists, OCS = oral corticosteroids, LTRA = leukotriene receptor antagonists.

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.



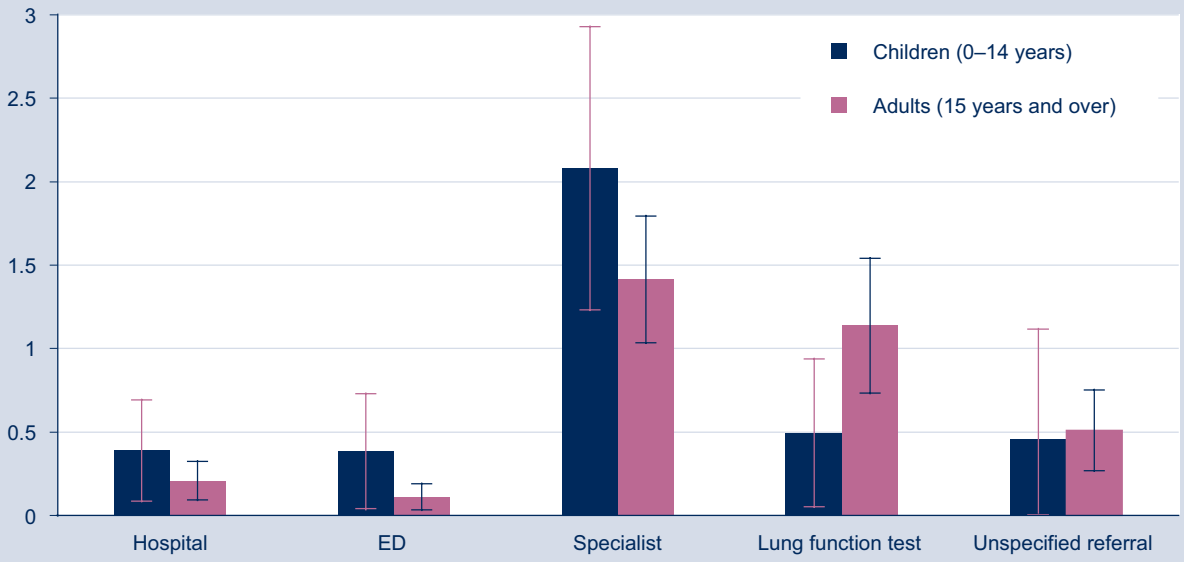
Note: Asthma classified according to International Classification of Primary Care, 2nd edition (ICPC-2) code R96. Lung function test includes all procedures listed under rubric R39—that is, peak flow, pulmonary function, spirometry, lung function, physical function; respiratory, forced expiratory volume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

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

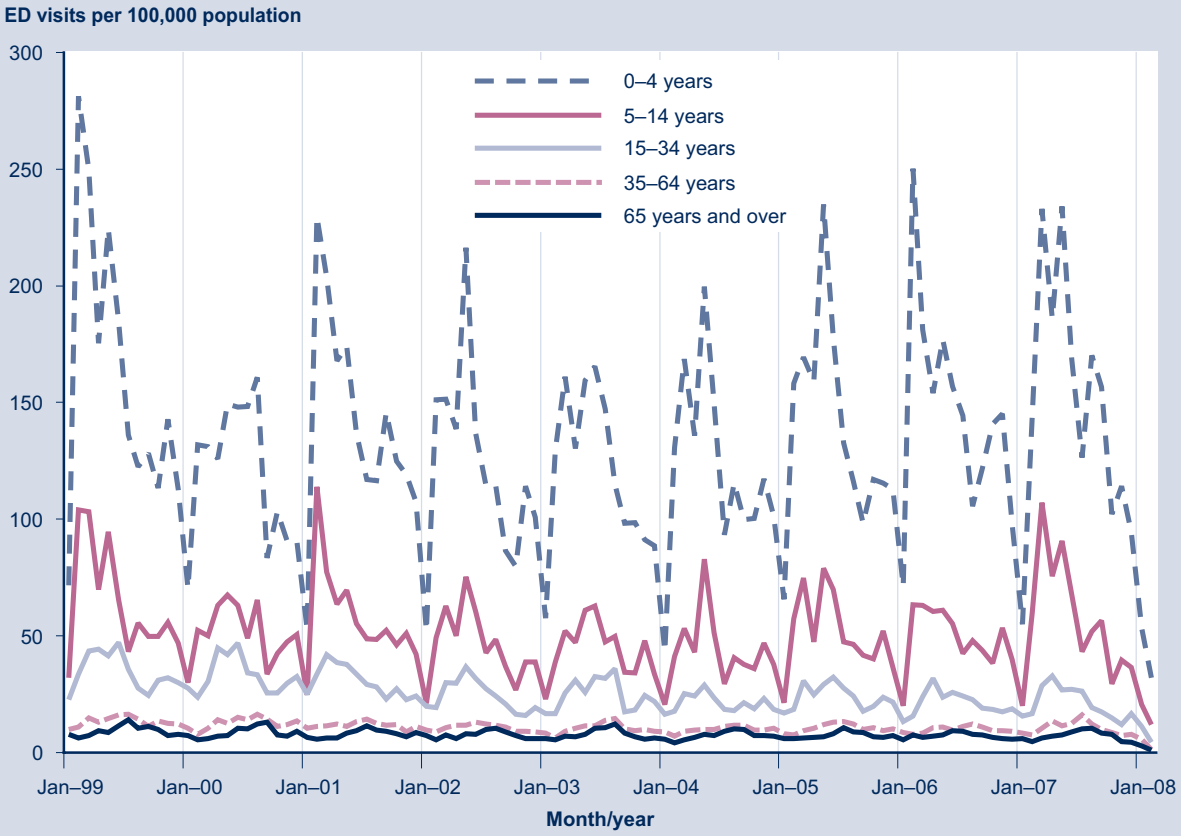
People with asthma may visit an emergency department (ED) when they experience an exacerbation or worsening of their disease. Since exacerbations may be a feature of severe or poorly controlled asthma, rates of ED visits for asthma are often considered to reflect the prevalence of severe or poorly controlled 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%).



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).

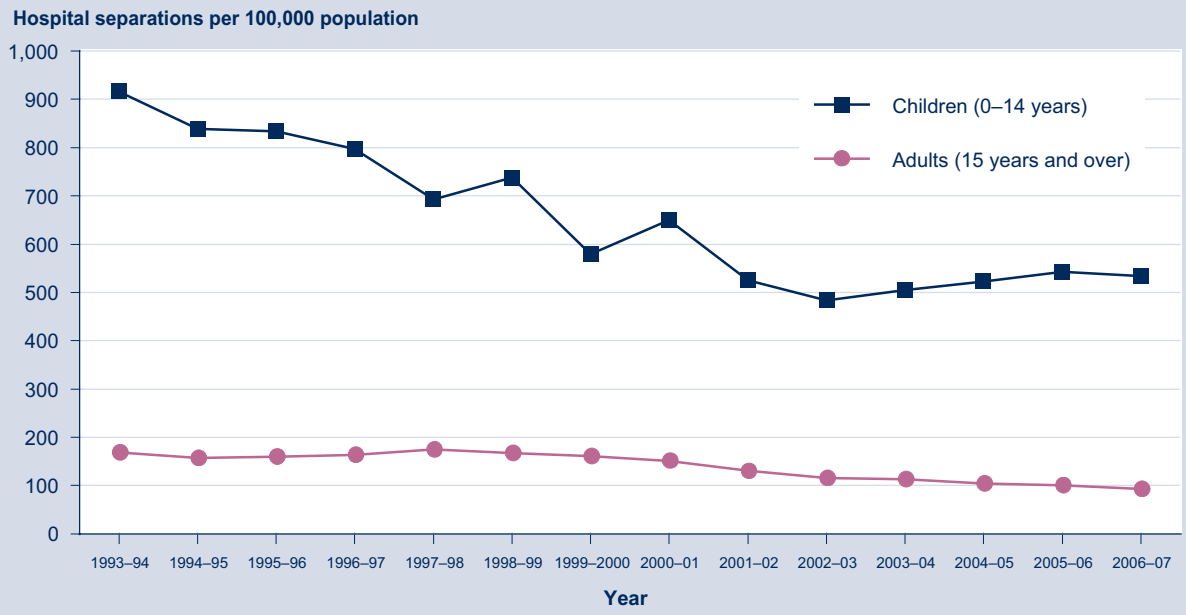
The data for this section are derived from the National Hospital Morbidity Database. In these data, the term 'hospital separation' refers to the formal process by which a hospital records the completion of treatment or care for an admitted patient. This includes completion due to discharge, death, transfer 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

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.

Notes

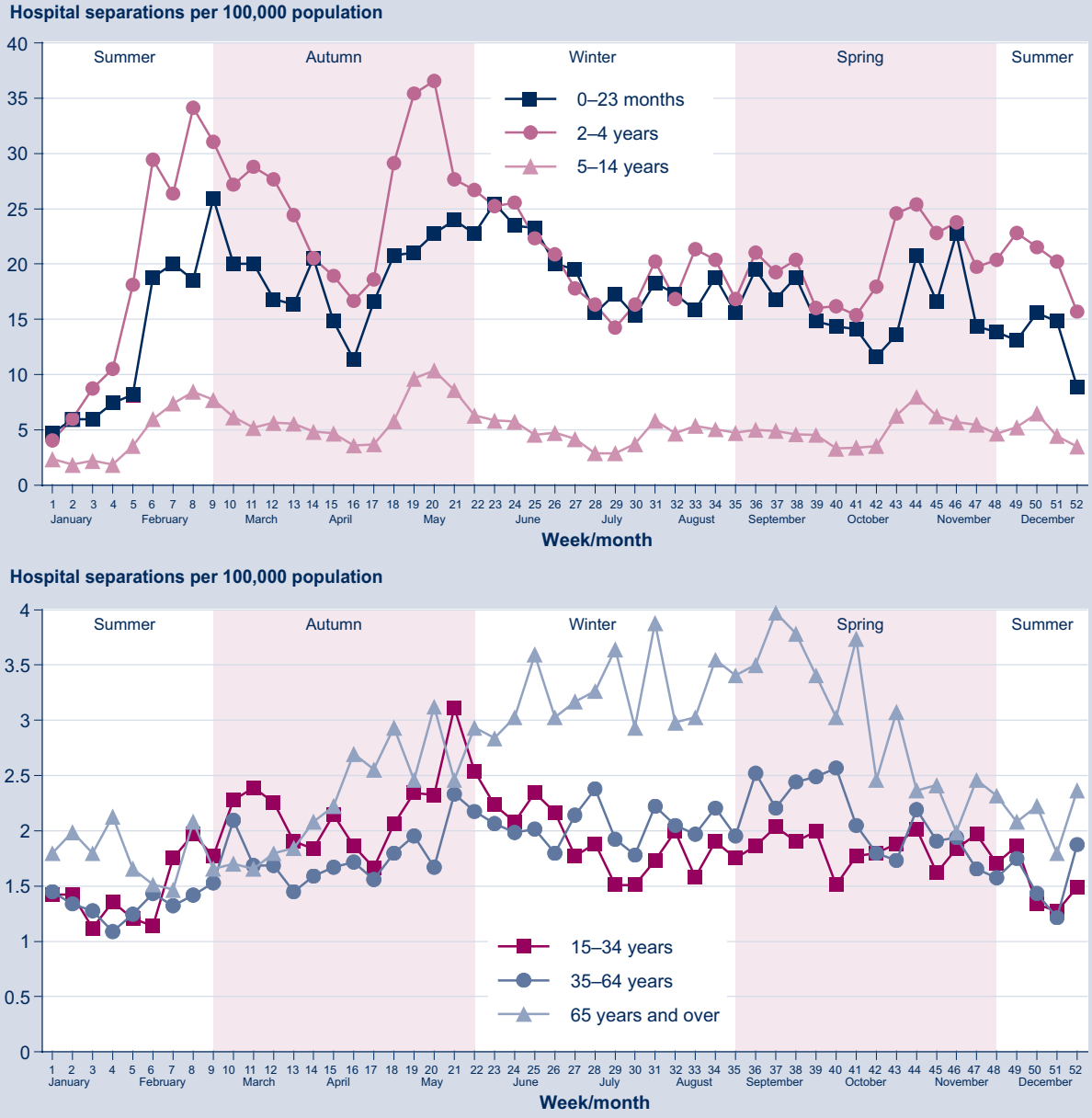
1. Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded.
2. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th 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

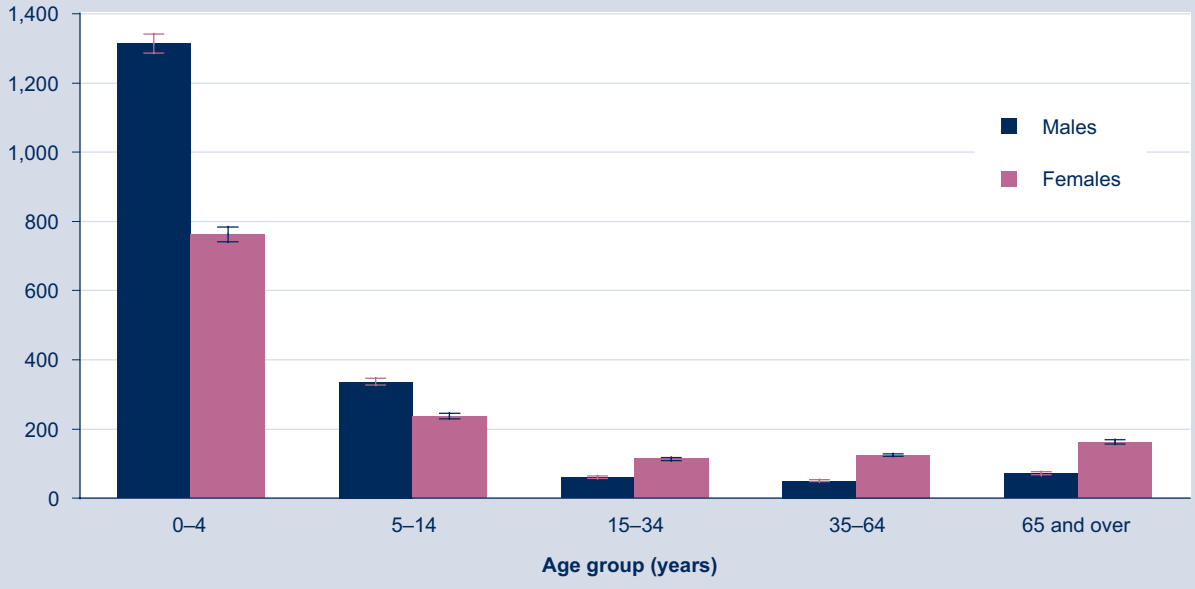
Large seasonal peaks in hospital admission rates for children have been observed in both the Northern and Southern Hemispheres in late summer. In New South Wales, it has been noted that these peaks coincide with the return to school after the holidays (Lincoln et al. 2006). It has been reported that 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).



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.

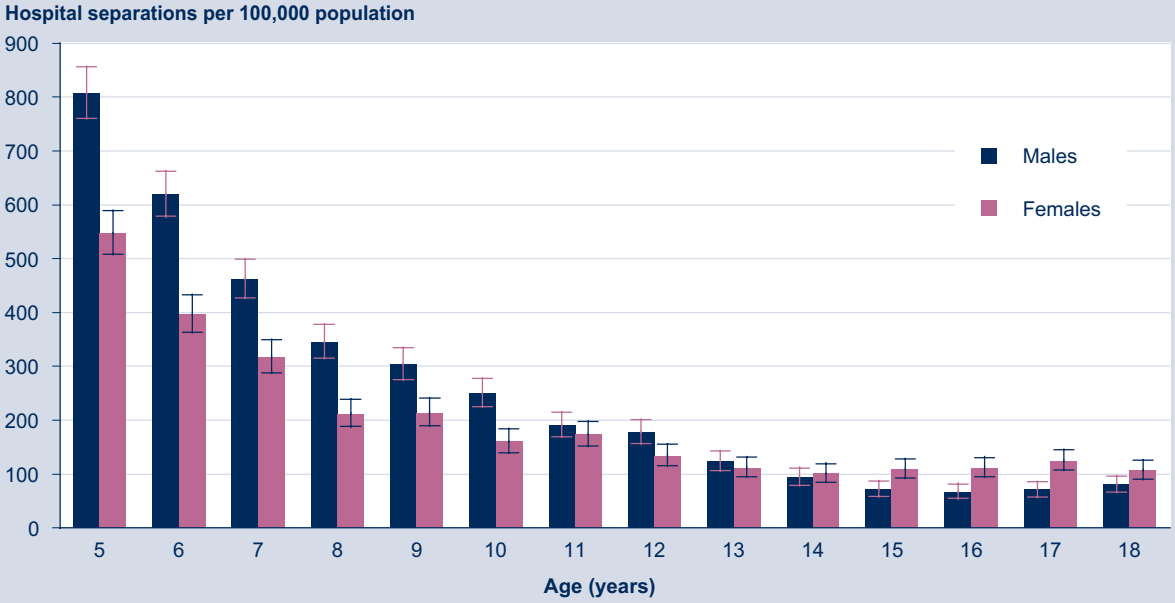
Sources: AIHW National Hospital Morbidity Database; Australian Bureau of Statistics.

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.

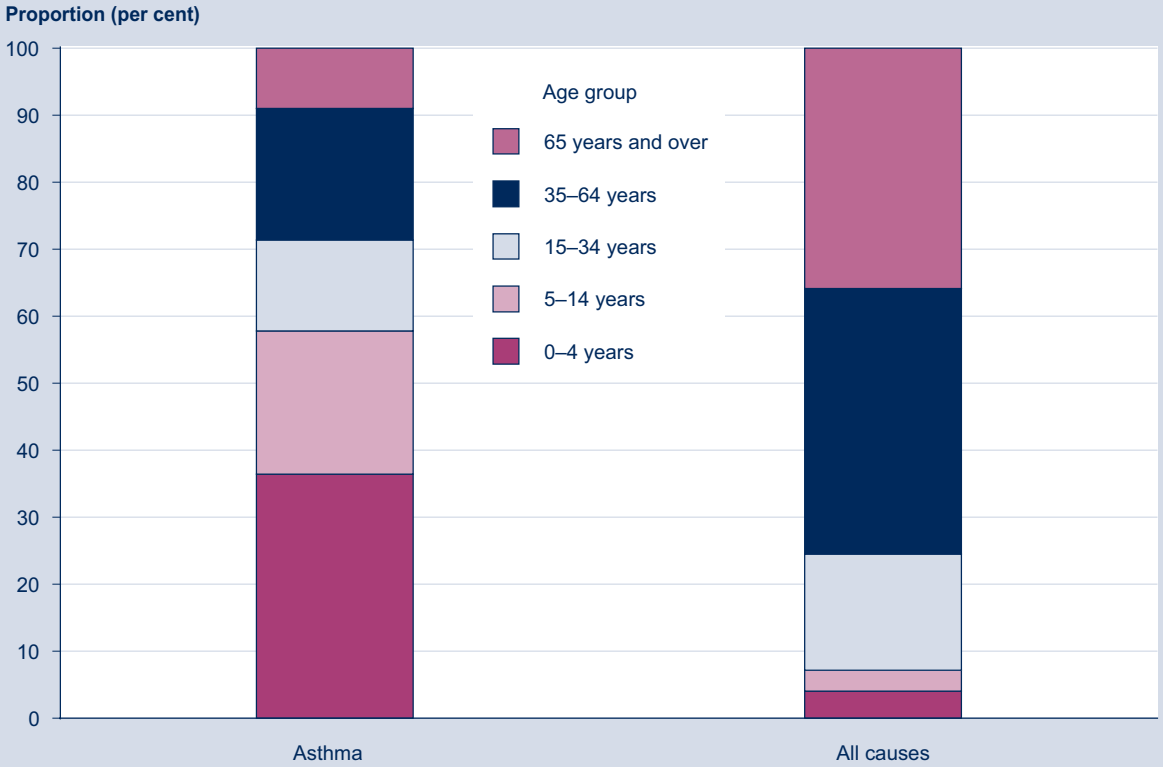


Notes: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th 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

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).

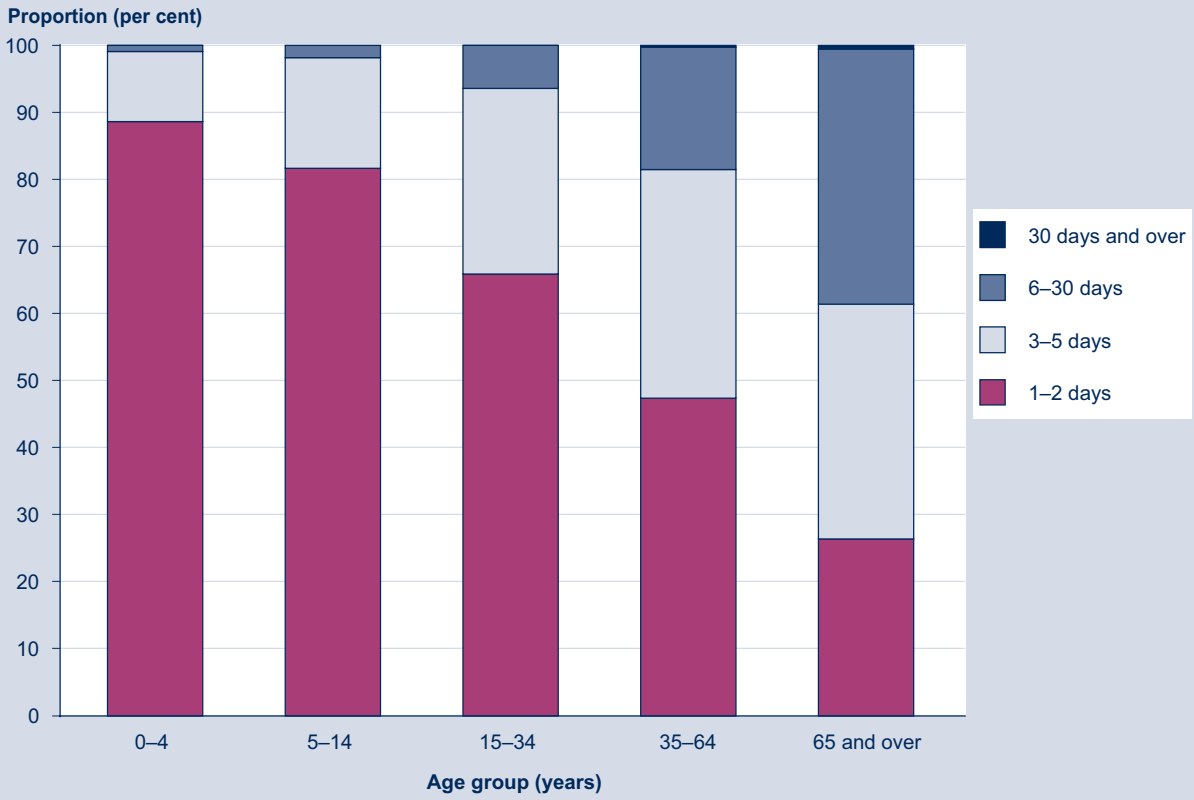


Notes: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th 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.



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

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.

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.

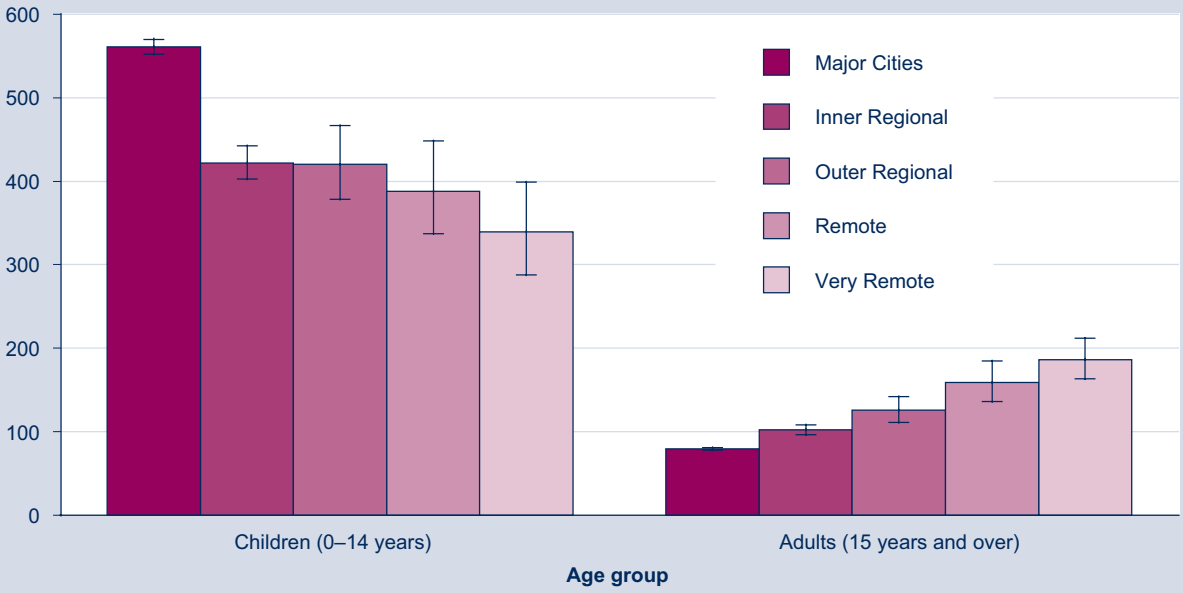
Figure 5.25: Hospital separations for asthma per 100,000 population among children and adults, by state and territory, 2006–07

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).



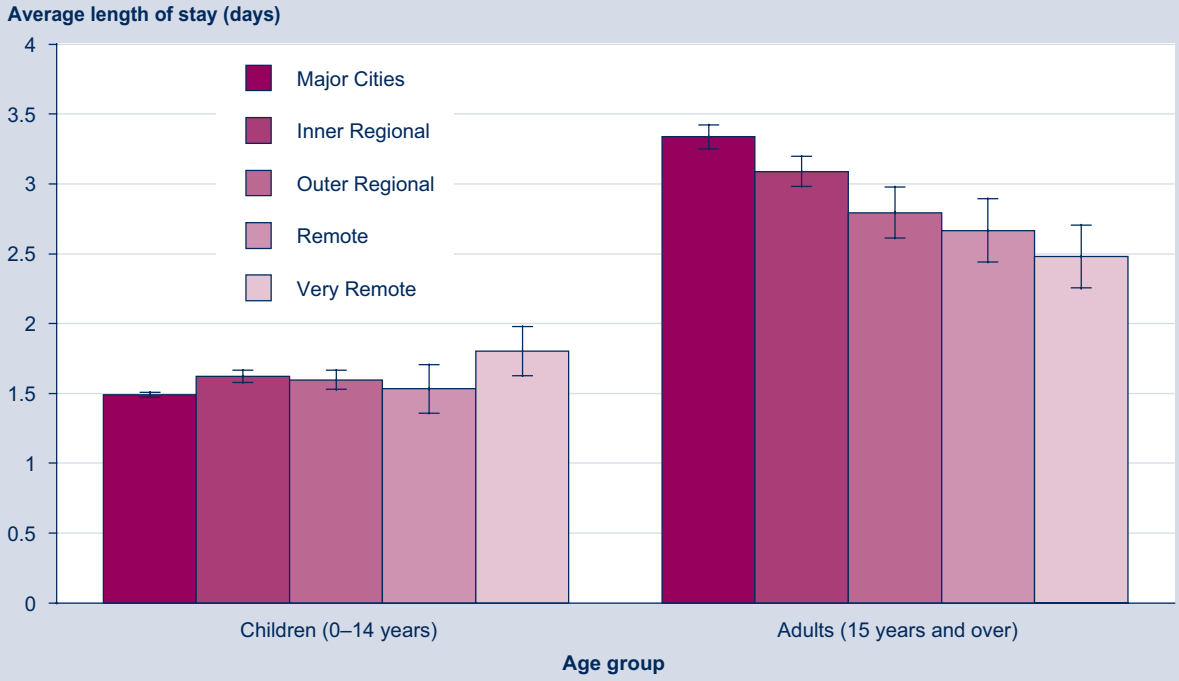
Notes: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th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



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.

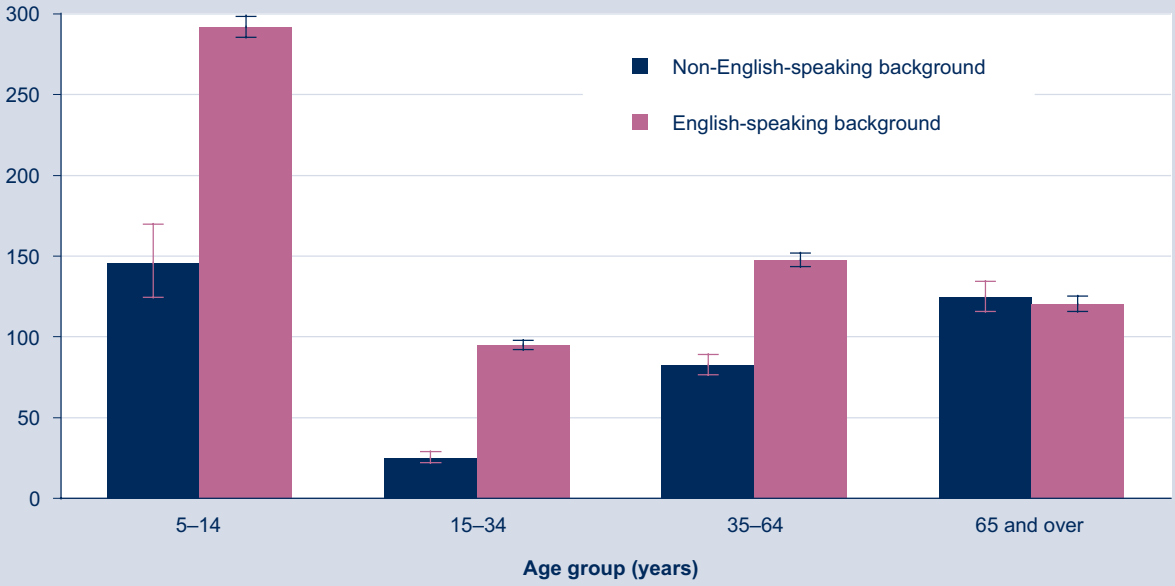
Source: AIHW National Hospital Morbidity Database.

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 ($p = 0.4093$).



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.

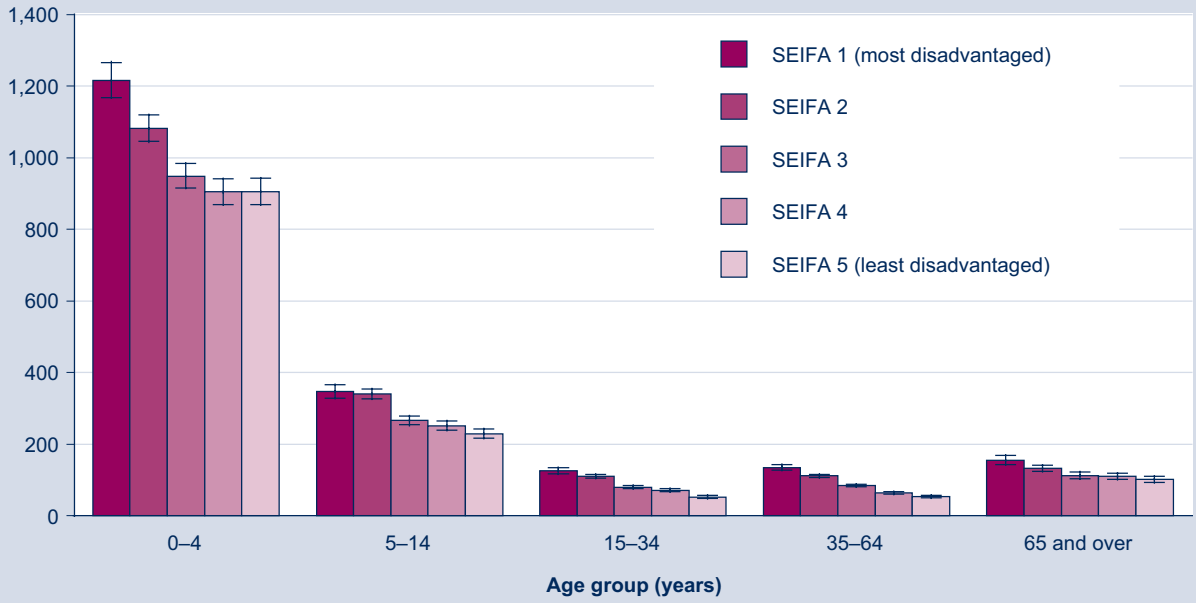
Figure 5.28: Hospital separations for asthma per 100,000 population, by broad age group and country of birth, people aged 5 years and over, 2006–07

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.

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.



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

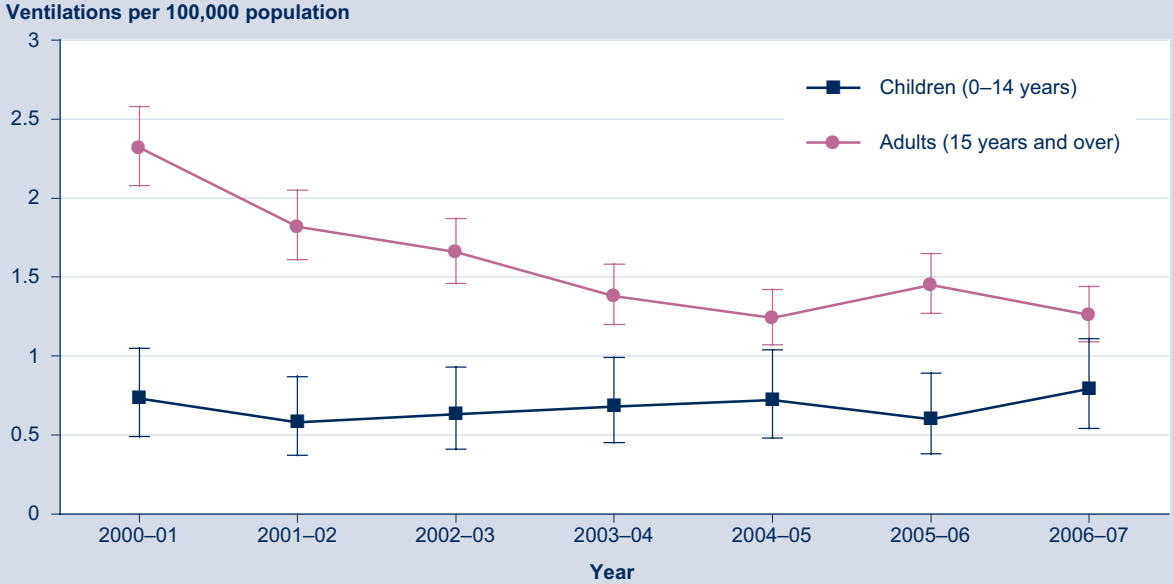
A small proportion of people with severe exacerbations of asthma either stop breathing altogether or decrease their breathing to such an extent that they are at risk of stopping breathing. This represents a severe, imminently life-threatening event and can only be averted by the introduction of artificial 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).

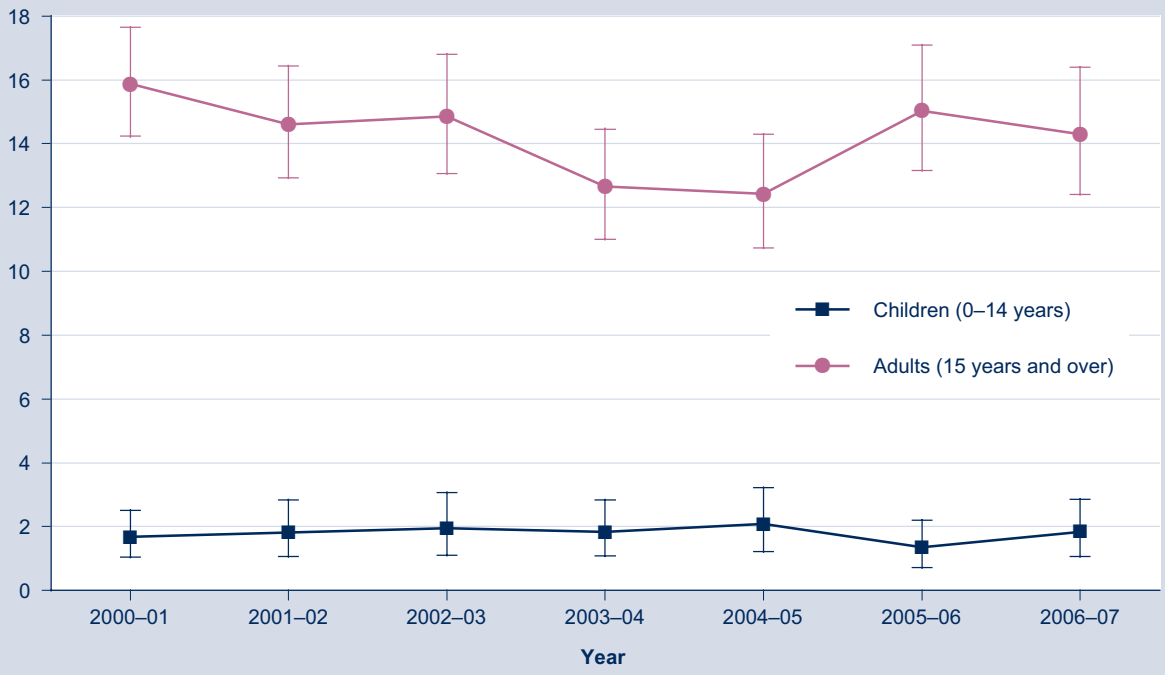


Notes: Age-standardised to the Australian population as at 30 June 2001. Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical 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.

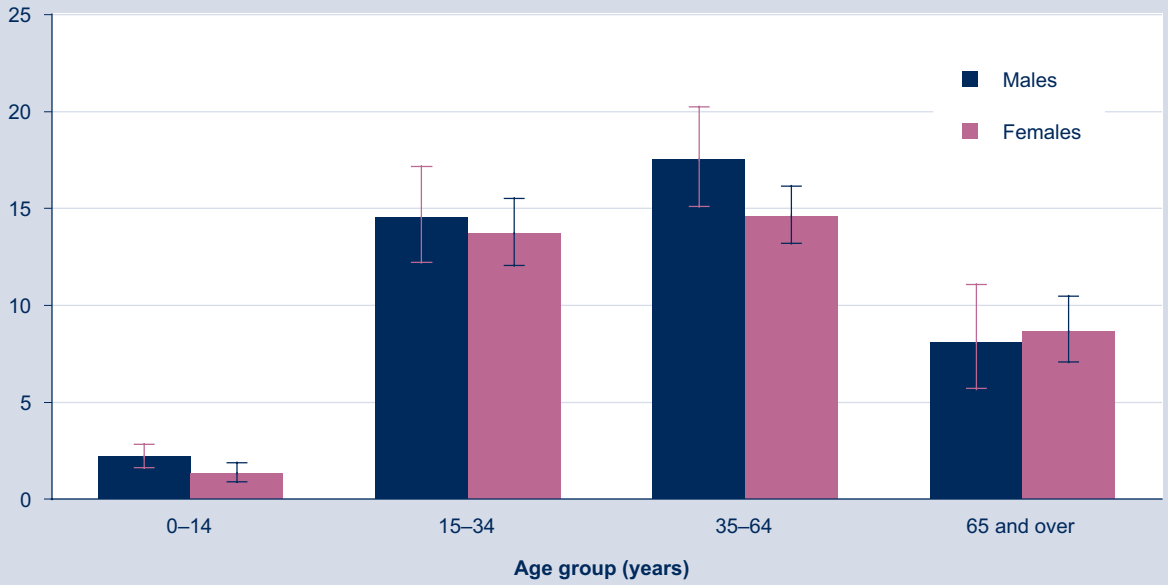
Figure 5.31: Proportion of hospital separations for asthma with invasive mechanical ventilation, by age group, 2000–01 to 2006–07

5.3.2 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.



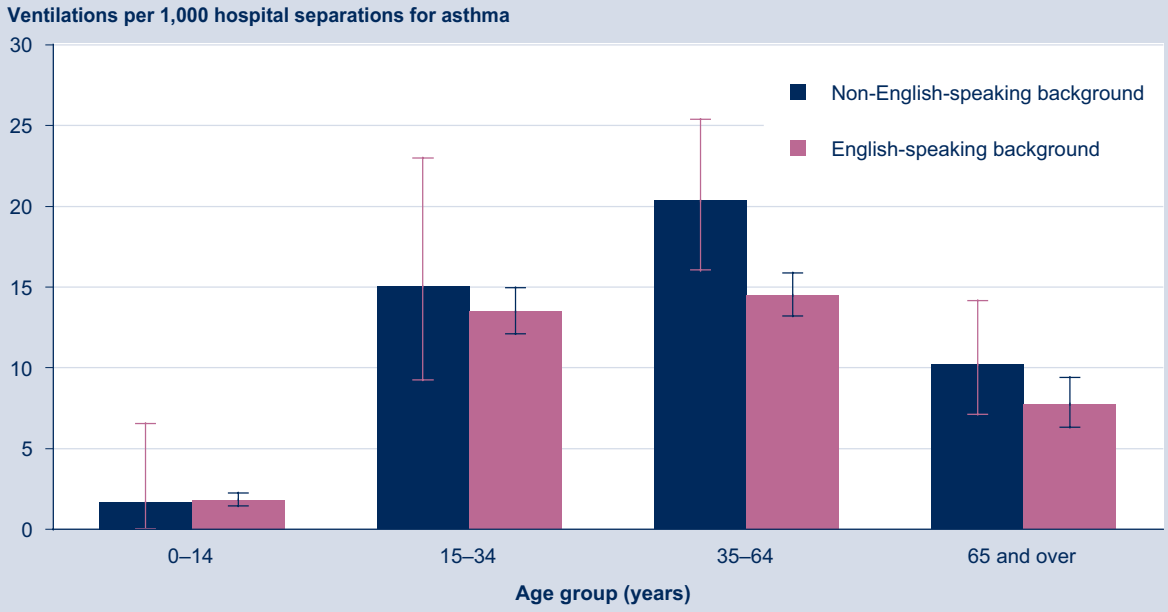
Notes: Separations for which the care type was reported as *Newborn* with no qualified days, and records for *Hospital boarders* and *Posthumous organ procurement* have been excluded. Asthma classified according to International Statistical Classification of Diseases and Related Health Problems, 10th 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

5.3.3 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.

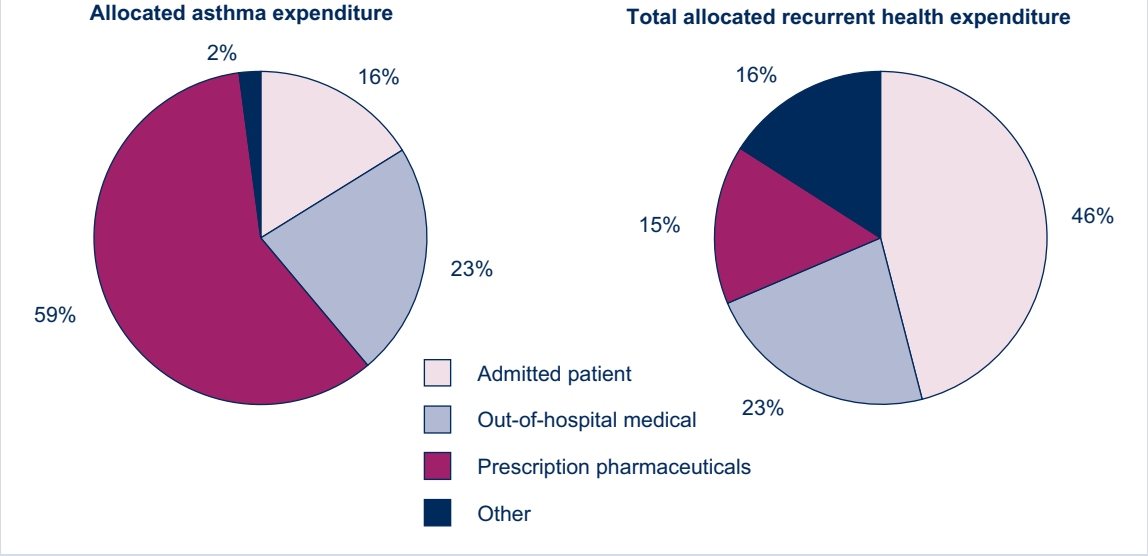
5.4.1 Expenditure by health sector

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.

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%).



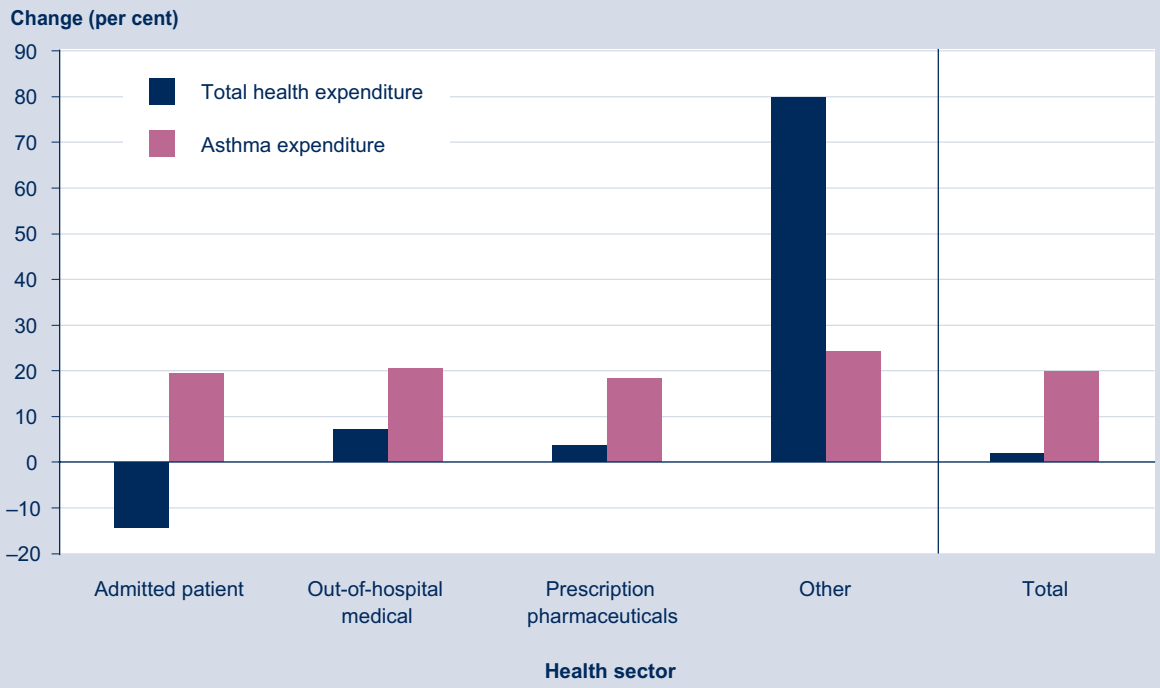
Source: AIHW disease expenditure database.

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.



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.

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.