1 Introduction

In Australia, asthma affects around 12% of the population, leading to nearly 40,000 hospitalisations (AIHW National Hospital Morbidity Dataset) and 314 deaths in 2003 (AIHW Mortality Database). Asthma was made a National Health Priority Area (NHPA) in Australia in 1999.

The purpose of this report is to provide a summary of two aspects of the economic impact of asthma in Australia: health system expenditure and the burden of disease. This information will help guide the formulation of health policy in relation to asthma.

A major portion of this report examines recent health care expenditure for asthma. The analyses presented illustrate the differentials in expenditure on asthma in various health sectors and population groups. Changes in expenditure between 1993–94 and 2000–01 are also assessed. 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 (hospital, out-of-hospital medical care, and pharmaceutical) to overall asthma-related expenditure, as well as changes over time, assists in planning interventions to optimise this expenditure.

Direct health expenditure for asthma care is only one component of the costs of asthma. The economic burden of asthma extends to personal expenses incurred, such as those arising from environmental modification or alterations in domestic arrangements due to asthma (Rand & Butz 2000; Warner & Warner 1991). 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. This impact may extend to the family and/or carer of the person with asthma (Jones 2000) as well as the person themselves.

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 (Mathers et al. 1999).

The Australian Burden of Disease Study adapted the Global Burden of Disease Study techniques for the Australian context (Mathers et al. 1999). Here, we summarise the findings from that study in relation to asthma. This information has value for providing an understanding of the burden of asthma in Australia, beyond health care expenditure.

A description of the methods for deriving the health care expenditure and burden of disease data presented in this report is provided in Chapter 2.

2 Methods and data sources

2.1 Health system expenditure data

Expenditure data used in this report were obtained from the Australian Institute of Health and Welfare's National Health Expenditure Database. This report considers recurrent health expenditure that has been allocated by health sector and disease. The analyses presented do not include non-recurrent (capital) health expenditure or expenditure that is not allocated to a health sector or disease (unallocated). Therefore, in this report, references to health care expenditure always imply 'allocated recurrent' health care expenditure.

Expenditure within each age and sex group is described on a per capita basis. Per capita expenditure was calculated by dividing the total allocated recurrent expenditure on persons within an age–sex category, by the Australian resident population in that age–sex group in 2000–01. All expenditure data are in 2000–01 dollars.

The methodology used for obtaining the data contained in the National Health Expenditure Database is described in *Health System Expenditure on Disease and Injury in Australia 2000–01* (AIHW 2004). A brief summary of the methods used to derive these data for the health sectors described in this report is provided in the following sections.

2.1.1 Hospital care

Hospital care expenditure comprises expenditure for admitted and non-admitted patient care. It includes expenditure for the care administered from medical practitioners while in hospital and hospital-dispensed pharmaceuticals.

Expenditure estimates relating to admitted patients in public hospitals were obtained from those published in *Australian Hospital Statistics 2001–02* (AIHW 2003a). Expenditure relating to private hospitals was derived from the Australian Bureau of Statistics Private Health Establishments Survey.

Hospital encounters for asthma were identified as those where the principal diagnosis was asthma (International Classification of Diseases version 10 codes J45 or J46). The National Hospital Costs Data Collection was used to estimate the costs of individual episodes of acute hospitalisation for asthma based on Diagnostic Related Groups and length of stay, with adjustment for the type of hospital. Sub-acute and non-acute hospital costs were extrapolated from the sub- and non-acute patient (SNAP) study (Eagar et al. 1997) and adjusted to 2000–01 values (AIHW 2002). Health Insurance Commission data were used to estimate the cost of specialist medical services for private in-patients.

Non-admitted patients include those attending emergency departments and out-patient services. Expenditure for non-admitted patients was reported in *Australian Hospital Statistics 2001–02* (AIHW 2003a). Individual episodes were differentiated by disease based on the demographic pattern in the 1993–94 non-admitted patient disease expenditure (Mathers & Penm 1999).

2.1.2 Out-of-hospital medical care

This comprises expenditure for private medical services in the community including general practitioners (GPs) and specialists. The Bettering the Evaluation and Care of Health

(BEACH) survey data and earlier similar studies were used to allocate; expenditure on out-of-hospital medical services by disease using BEACH disease codes; expenditure for imaging and pathology; and expenditure for other medical services such as specialists based on referral patterns recorded in these data. Where there were multiple presenting problems in a GP encounter, allocation of expenditure was done on a pro rata basis. Care administered by doctors in hospitals was included in hospital care expenditure.

2.1.3 Pharmaceuticals

Expenditure on pharmaceuticals was estimated using data on prescribed as well as 'over-the-counter' (OTC) medications supplied by community pharmacies. Data on expenditure on prescription medications was obtained from the Pharmaceutical Benefits Scheme (PBS) and the Department of Veterans' Affairs Repatriation Pharmaceutical Benefits Scheme (RPBS). Data on expenditure for medications purchased on private (i.e. non-PBS/RPBS) prescriptions and for prescribed medications whose cost is below the co-payment threshold were obtained from the Pharmacy Guild Survey. The BEACH survey data were then used to allocate these expenditure data to diseases according to the GP prescribing patterns for problems managed. To estimate expenditure for specialist-written prescriptions, an assumption was made that specialist prescribing patterns were the same as GPs.

There are no data on expenditure on OTC pharmaceuticals. Total expenditure on OTC pharmaceuticals was calculated by deducting expenditure on under co-payment and private prescriptions from all non-benefit pharmaceutical expenditure, as reported in *Health Expenditure Australia 2001–02* (AIHW 2003b). Expenditure on OTC medications was allocated to specific diseases, including asthma, using information on medication use obtained in the 1989–90 ABS National Health Survey (Mathers & Penm 1999). The same data were used for allocation of OTC expenditure to disease in both the 1993–94 analysis and the 2000–01 analysis. For the latter analysis, the data were adjusted for demographic change over the interval between 1993–94 and 2000–01.

Hospital-dispensed pharmaceuticals were included in hospital care costs.

2.1.4 Other costs

Remaining expenditure for asthma were categorised as 'other costs'. This comprised expenditure for other medical services, such as allied health care provided outside of hospitals (e.g. physiotherapy) and research. Allied health expenditure was allocated to disease using the expenditure estimates from 1993–94, adjusted for demographic change. As such, these were approximations and should be interpreted with caution. Research expenditure was allocated using the Australian Bureau of Statistics research and experimental development surveys. This should also be interpreted with caution when reviewing expenditure in subgroups within the population.

2.2 Burden of disease data

Burden of disease data used in this report were obtained from the Australian Burden of Disease Study. This study reported disability-adjusted life years (DALYs) for 176 diseases, injuries and risk factors (Mathers et al. 1999).

The DALY is a summary measure of health that provides a common currency by which many different diseases, injuries and risk factors can be compared. A DALY represents a lost

year of healthy life. It is calculated by adding future years lived with disability (YLD) for incident cases of the health condition to years of life lost due to premature mortality (YLL).

DALY = YLD + YLL

In the Australian Burden of Disease Study, DALYs were then discounted using a 3% per annum time discount rate so that earlier gains in health are given a greater value than later gains (Mathers & Penm 1999). In the *Return on Investments in Public Health* report (Abelson et al. 2003) the value of a human life was estimated, on the basis of 'willingness to pay', as $1 million. This value was derived from studies in the United States, as there are currently no available Australian studies. From this it is calculated that, on average, the financial equivalent cost of one DALY is $60,000.

2.2.1 Years of life lost due to disability

For asthma, the largest component of the DALY is YLD. To calculate YLD for incident cases occurring in the study year, the incidence of the health condition in the study year must be ascertained. As incident cases of asthma are not routinely reported, incidence must be estimated using best available data. In the Australian Burden of Disease Study this was done using age-specific remission rates for asthma (Bronnimann & Burrows 1986), and observed death rates attributed to asthma, to extrapolate incident rates from published data on the prevalence of current asthma among school children and adults (Burrows et al. 1991; Gergen et al. 1988). Prevalent cases of current asthma were defined as those people with airway hyperresponsiveness who also reported wheeze in the preceding 12 months (Toelle et al. 1992). Incident YLD could then be calculated by multiplying the number of incident cases of disease by the duration of the disease (from year of incidence to year of remission or death) and a disability weight associated with that disease.

YLD = incident cases x duration of disease x disability weight

Incident YLDs are useful for estimating the potential value to be gained by preventing an incident case of a disease and, for this reason, incident YLDs were presented as the main findings of the Australian Burden of Disease Study (Mathers et al. 1999). However, prevalent YLDs can also be calculated using the prevalence of the disease in the study year multiplied by its disability weight. They reflect the burden of disability over the current year due to cases arising in preceding years (that is, prevalent cases). Prevalent YLDs are useful for indicating the burden of a disease at the time of the study. This is particularly relevant to asthma, as there are currently no effective interventions known for preventing incident cases of asthma. However, prevalent YLDs are not suitable for calculating DALY estimates, because they cannot be added to YLL. This is because YLL is inherently a component of future disease burden, while prevalent YLDs relate to current burden. For this reason, analyses of DALYs for asthma presented in this report are based on incident YLDs. However, the Australian Burden of Disease Study also calculated prevalent YLDs and the contrasting interpretation of prevalent and incident YLDs is described in Section 2.3.2.

There are a number of methods for developing disability weights that reflect the burden of asthma relative to other conditions, injuries and risk factors. Methods for doing this usually involve valuation exercises, in which participants make judgements about where a condition lies in a continuum between perfect health and death. In the Australian Burden of Disease Study, most weights for conditions that were common in developed countries were obtained from a valuation study carried out in the Netherlands (Stouthard et al. 1997). Further weights were obtained from the Global Burden of Disease Study (World Bank 1993). Some examples of the Dutch weights are included in Stouthard et al. (1997) (see Table 2.1). In the

Australian Burden of Disease Study, the weights for asthma from the Dutch study were adjusted based on the distribution of disability due to asthma in Australia as reported in the 1998 Survey of Disability, Ageing and Carers (ABS 1999). The final weights for asthma used in the Australian Burden of Disease Study were 0.03 for mild asthma and 0.23 for severe asthma.

Table 2.1: Some examples of disability weights from the Dutch study

Weight	Disease stage, severity level or sequela
0.00–0.01	Gingivitis, dental caries
0.01–0.05	**Mild asthma**, mild vision loss, mild hearing loss, basal skin cancer
0.05–0.10	Low back pain, uncomplicated diabetes case, mild stable angina (NHYHA 1–2)
0.10–0.15	Mild depression, osteoarthritis (radiological grade 2) of hip or knee, epilepsy
0.15–0.20	Mild/moderate panic disorder, spina bifida (sacral), HIV seropositive
0.20–0.30	Non-invasive breast cancer or tumour <2cm (diagnostic/treatment phase), anorexia, mild/moderate obsessive–compulsive disorder
0.30–0.40	Moderate depression, multiple sclerosis in relapsing–remitting phase, **severe asthma**, chronic hepatitis B infection with active viral replication, deafness
0.40–0.50	Severe vision loss, medium-level spina bifida (L3–L5), osteoarthritis (Grade 3–4) operable small cell lung cancer, moderate intellectual disability (IQ 35–49)
0.50–0.65	Paraplegia, AIDS (first stage), severe chronic bronchitis or emphysema
0.65–0.80	Disseminated breast cancer, severe depression, moderately severe brain injury resulting in permanent impairments, extreme intellectual disability (IQ<20)
0.80–1.00	Severe schizophrenia, disseminated colorectal cancer, severe dementia, alcoholic psychosis, quadriplegia, stroke with multiple permanent impairments, end-stage Parkinson's disease

Source: Reproduced from Mathers et al. 1999.

2.2.2 Years of life lost due to premature mortality

The smaller component of the DALYs for asthma is the YLL. This is calculated as the difference between age of death and a defined 'normative survivorship goal', defined in the Australian Burden of Disease Study as the 1996 cohort life expectancy. Cohort life expectancy is based on a calculation that takes into account future trends in mortality. For example, in 1996 the remaining cohort life expectancy from a woman aged 50 was 34.7 years and thus YLL for a death in a 50-year-old-woman in 1996 is 34.7.

2.3 Limitations of current methods

2.3.1 Health system expenditure data

Expenditure estimates for disease are based on the attribution of allocated recurrent health expenditure using the available information about the mix of diseases and health sector utilisation. The accuracy of the expenditure estimates is limited by the accuracy of the source data on health care utilisation. In relation to asthma there are substantial problems with diagnostic misclassification (Baker et al. 2004). These problems will particularly influence the estimates of expenditure on asthma in the elderly. The substantially higher cost-weight for chronic obstructive pulmonary disease compared with asthma (National Centre for

Classification in Health 2004) is an incentive for health care providers to assign admissions to chronic obstructive pulmonary disease, rather than asthma. Often there is no certain clinical basis for distinguishing the two entities. This may lead to underestimation of hospital bed utilisation, and hence, expenditure for asthma in the elderly. There is less incentive for misclassification in the BEACH survey data but diagnostic uncertainty remains an issue.

Furthermore, in some instances, data were not available regarding how costs should be attributed. For example, there are no data relating to the patterns of prescriptions by specialists, therefore it was assumed these would be the same as for general practitioners. The validity of this assumption is untested, and hence, these data should be interpreted with some caution. Also, the data on expenditure for OTC medications for asthma was derived from a survey conducted in 1989–90. These survey data may not reflect current patterns of use of OTC medications.

2.3.2 Burden of disease data

Although the Global Burden of Disease measures have been widely accepted and taken up for monitoring health by various organisations such as the World Health Organization, there are important limitations to the method, both at a strategic level and at an implementation level (Williams 1999). The main limitation of the approach is that it includes no information on the potential effectiveness of specific interventions. Without this information the use of Burden of Disease estimates for prioritising action will be misleading. Hence, on its own it has limited value for health policy formulation.

It is important to be aware that the estimation of incident YLD, which forms the major component of DALYs for asthma, is based on expected future disability in incident cases of asthma arising during the study year. As stated above, this measure was used because it is a conceptually consistent measure of future disease burden that can be added to YLL to estimate DALYs in the given study year. Incident YLDs are relevant to assessing the potential impact of preventive interventions that would reduce the number of incident cases. They will be favourably influenced by future interventions that increase rates of remission of asthma, thereby shortening the duration of the disease. However, as we are using the incident YLD measure, the current burden of disease attributable to prevalent (that is, pre-existing) cases of asthma is not quantified in the DALY estimates presented here. Furthermore, knowledge about asthma incidence in Australia is limited because incident cases are not routinely reported. The Australian Burden of Disease Study relied on prevalence and remission data from the United States and it is uncertain whether these are reliable for estimating asthma incidence in Australia.

Prevalence-based YLDs have been calculated for all diseases and injuries, and for various categories of disease (Mathers et al. 1999). Comparison of prevalent and incident YLDs shows that the two estimates are broadly similar but prevalent YLDs are lower than incident YLDs in the youngest age group and higher than incident YLDs in the older age groups (Mathers et al. 1999). This reflects that children are generally more likely to have incident conditions while a larger proportion of the elderly population have prevalent conditions. A comparison of incident and prevalent YLDs for asthma is presented in Section 4.2.2, Figure 4.4.

There are many other uncertainties in the estimation of DALYs attributable to asthma. The calculation of incident YLD is based on estimation of both the incidence and the duration of asthma. Both of these are derived from primary data on the prevalence, age-specific mortality and remission rates. There is no universally agreed definition of prevalence of

asthma and estimates vary substantially depending on the definition that is applied (ACAM 2003; Baker et al. 2004). This matters most for young children and the elderly. The Australian Burden of Disease Study applied an epidemiological definition which has been shown to identify a population with 'asthma that matters', that is, asthma that is more likely to be persistent, to require treatment and to be associated with impact on quality of life and need for health care (Toelle et al. 1992; Toelle et al. 1997). However, some people who are labelled as having asthma, have symptoms of asthma and take treatment for asthma are not included within this definition (ACAM 2003).

3 Health expenditure

Health expenditure is a term used to describe the actual amount spent on health care services. Here, data from the Health Expenditure Database at AIHW are used to describe health expenditure for asthma in Australia. All health expenditure data reported here represent allocated, recurrent health expenditure. In 2000–01, total allocated recurrent health expenditure (government and non-government) in Australia was $49.2 billion. In the same year, health expenditure attributable to asthma was $693 million (1.4% of the total) (AIHW 2004).

In this report, the term 'total health expenditure' will be used to refer to the sum of health expenditure for all health conditions while 'asthma expenditure' is the component of total health expenditure that is attributed to health care for asthma.

In the following sections, asthma is compared to total health expenditure in terms of:

(1) the rate of expenditure per capita (i.e. per person in the population);

(2) the proportion of expenditure spent by age group or sex;

(3) the distribution of expenditure by health sector; and

(4) changes in expenditure between 1993–94 and 2000–01.

3.1 Overall asthma expenditure

The highest average per capita rate of asthma expenditure in the Australian population was among children (Figure 3.1). For every child aged 0–4 years, annual asthma-related expenditure was $76 per boy and $66 per girl. The expenditure rate was lowest among those aged 25–34 years but rose again in older people, although not as high as for children. Among adults, expenditure on asthma was generally higher for females than males. This is consistent with the higher prevalence of asthma among adult women than men (ACAM 2003).

Overall, 1.4% of allocated recurrent health expenditure was attributed to asthma. This proportion was higher among children, particularly boys aged 5–14 years, where 5.5% of health care expenditure on this age group was attributable to asthma. On the other hand, among the elderly, asthma represented a substantially lower proportion of health expenditure (0.5%) (Figure 3.2). Therefore, while per capita expenditure for asthma in the elderly is nearly as high as for children, overall, asthma represents a much smaller component of health care expenditure among the older people. This is because there are many other causes of health expenditure in the elderly.

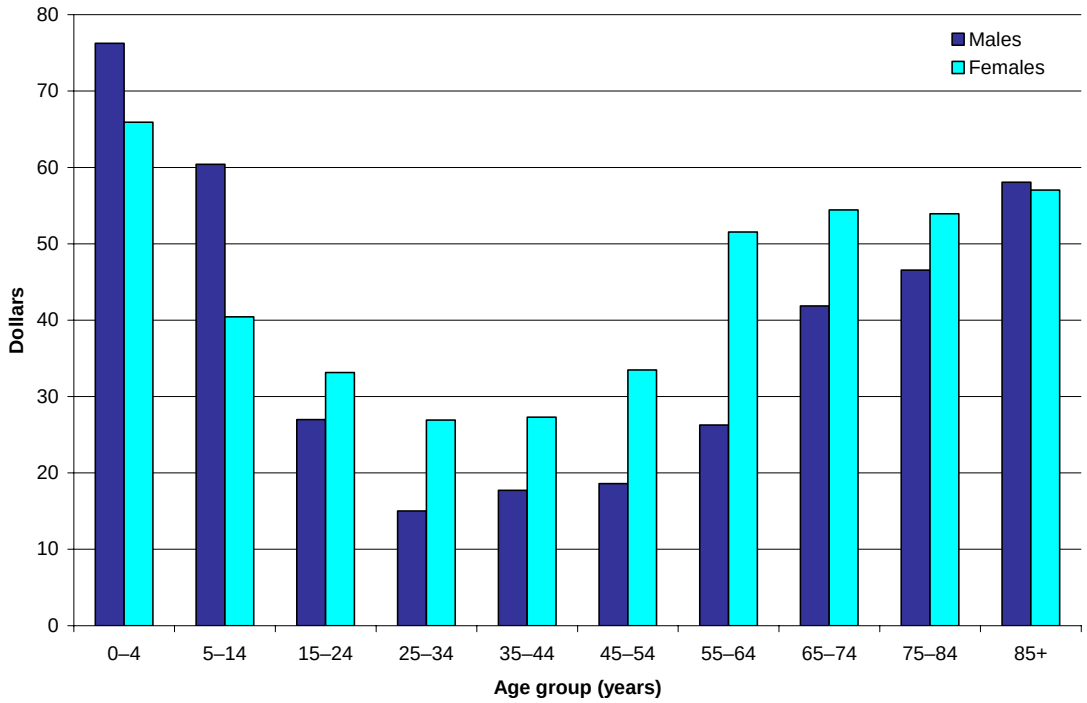


Figure 3.1: Asthma expenditure per capita by age group and sex, Australia, 2000–01

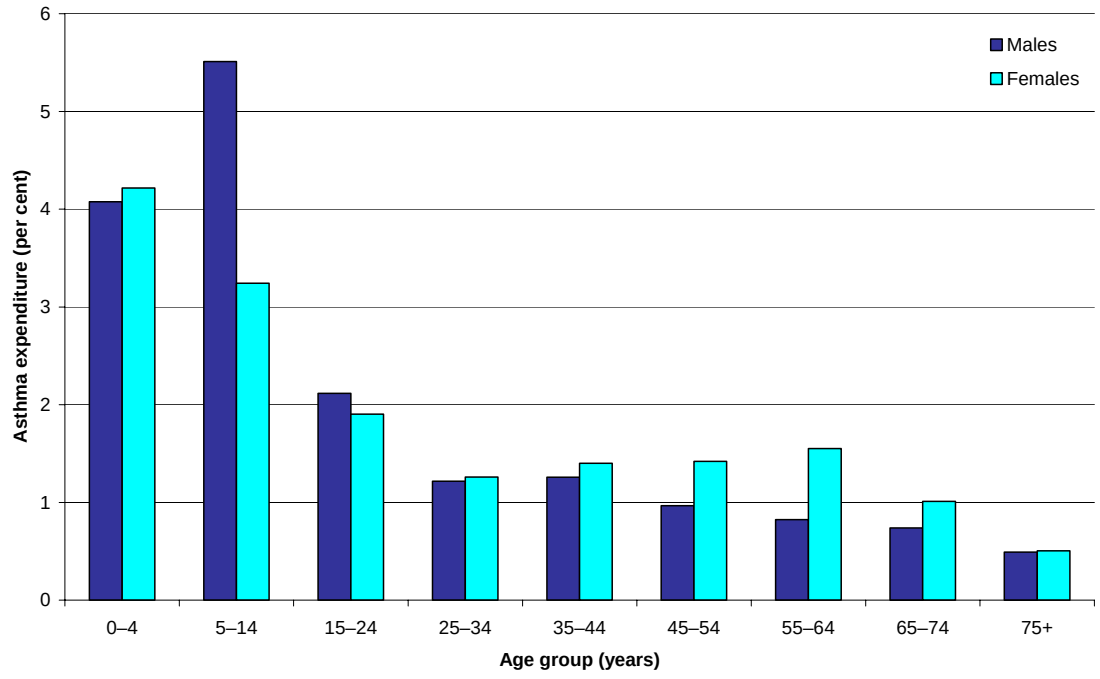


Figure 3.2: Proportion of allocated recurrent health expenditure attributed to asthma, by age group and sex, Australia, 2000–01

After adjustment for inflation, there was a 21% increase in expenditure on asthma over the period 1993–94 to 2000–01 (17% for males and 27% for females) (Table 3.1). However, among children aged 0–14 years, this increase was substantially smaller and among boys aged 0–4 years, the group with highest per capita expenditure on asthma, there was actually an 11% decrease over the period, reflecting the reduction in hospitalisations for asthma among children over this period.

Table 3.1: Asthma expenditure per capita, 1993–94 ($2000–01) and 2000–01, Australia

Sex/age group (years)	1993–94 expenditure ($) (adjusted to $2000–01)	2000–01 expenditure ($)	Per cent change
Males			
0–4	85.38	76.24	–11
5–14	57.78	60.42	5
15–24	18.58	26.98	45
25–34	10.83	15.02	39
35–44	12.16	17.73	46
45–54	14.01	18.61	33
55–64	20.51	26.27	28
65–74	34.28	41.86	22
75+	35.56	48.70	37
All males	**27.87**	**32.73**	**17**
Females			
0–4	63.03	65.91	5
5–14	40.10	40.44	1
15–24	24.46	33.15	36
25–34	18.26	26.92	47
35–44	19.85	27.28	37
45–54	23.79	33.49	41
55–64	38.28	51.54	35
65–74	39.60	54.45	38
75+	41.38	54.77	22
All females	**30.87**	**39.12**	**27**
Persons			
0–4	74.49	71.21	–4
5–14	49.17	50.68	3
15–24	21.46	30.01	40
25–34	14.54	21.00	44
35–44	16.00	22.53	41
45–54	18.80	26.05	39
55–64	29.35	38.75	32
65–74	37.10	48.36	30
75+	39.19	52.40	34
All persons	**29.66**	**35.95**	**21**

3.2 Asthma expenditure by health sector

Health expenditure is presented here in four broad sectors:

1) **hospitals,** which includes inpatient, emergency and outpatient care (both public and private);
2) **out-of-hospital medical,** which is primarily care in the community from general practitioners as well as specialists, imaging and pathology services;
3) **pharmaceuticals,** including prescribed and over-the-counter medications; and
4) **other expenditure** which comprises aged care services, community allied health services and research.

Methods for allocating expenditure to these sectors are provided in more detail in Section 2.1.

Over half (54%) of all asthma expenditure is attributable to pharmaceuticals. This is substantially higher than the proportion of total health expenditure that is attributable to pharmaceuticals (16%) (Figure 3.3). On the other hand, a substantially lower proportion of asthma expenditure is attributable to hospital care compared with total health expenditure.

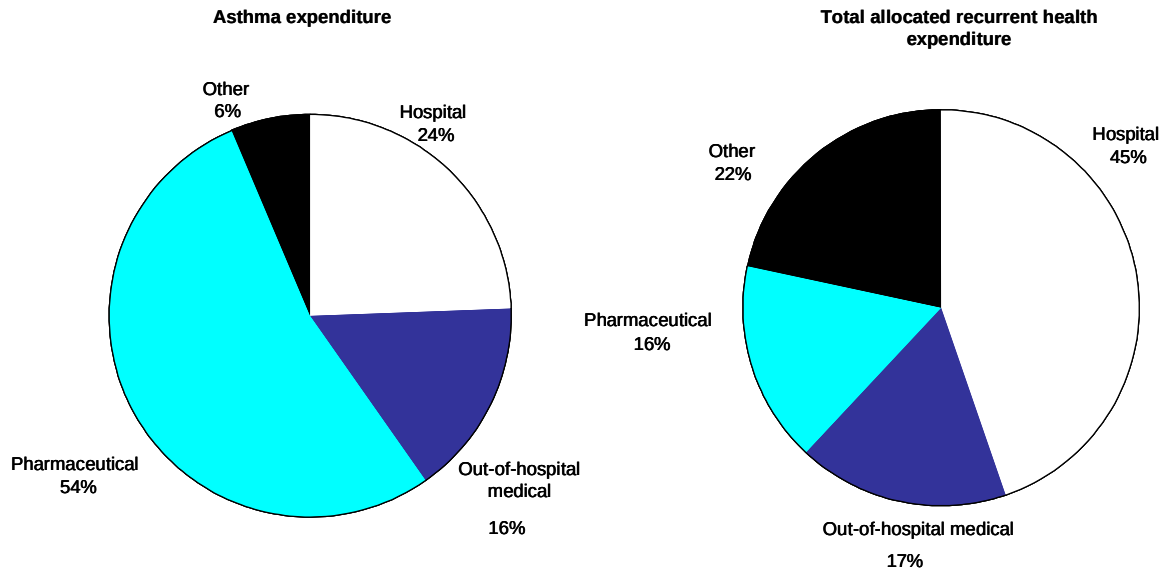


Figure 3.3: Distribution of asthma and total allocated recurrent health expenditure among health sectors, Australia, 2000–01

In all age groups, the highest proportion of asthma expenditure is that attributed to pharmaceuticals (Figure 3.4). Pharmaceutical expenditure comprises a greater proportion of asthma expenditure in adult age groups than for children, particularly young children, whereas children aged 0–14 years have a greater proportion of asthma expenditure in hospital care than other age groups.

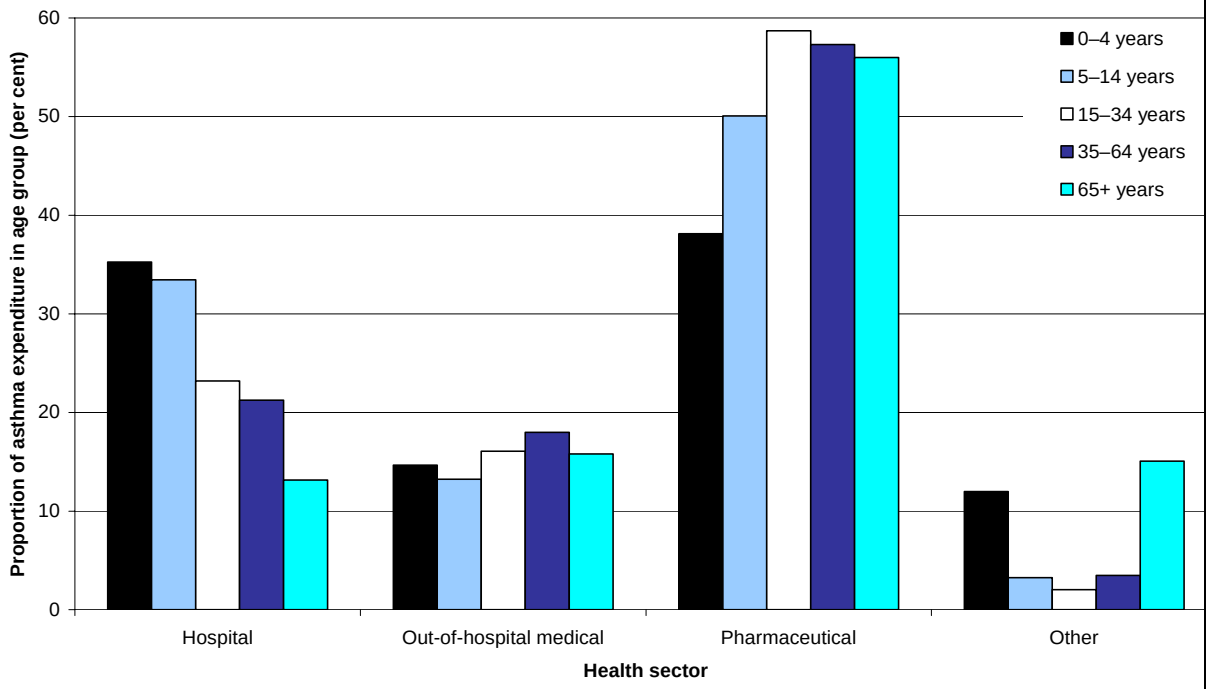


Figure 3.4: Proportions of asthma expenditure in each age group, by health sector, Australia, 2000–01

Between 1993–94 and 2000–01, per capita asthma expenditure on pharmaceuticals increased in all age groups, with increases of more than $10 per capita in the 65 years and over age group (Figures 3.5 and 3.6).

Asthma expenditure for out-of-hospital medical care (GPs and specialists) decreased in most age groups apart from a small increase among people aged 15–34 years. There was also a large proportional rise in 'other' expenditure on asthma recorded in the 65 years and over age group (Figure 3.5). However, as Figure 3.6 shows, this represented only a small absolute rise in the expenditure ($3.72 per capita). This increase was almost entirely attributable to expenditure on asthma in the aged care sector.

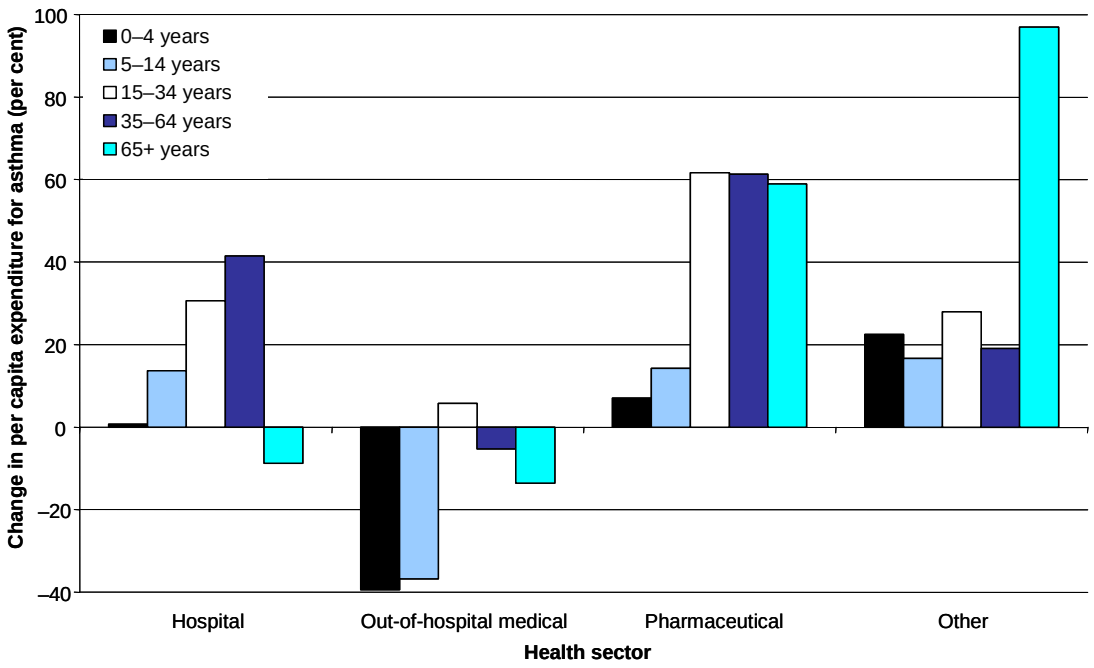


Figure 3.5: Per cent change in per capita expenditure on asthma, by age group and sector, 1993–94 to 2000–01, Australia (adjusted to 2000–01 dollars)

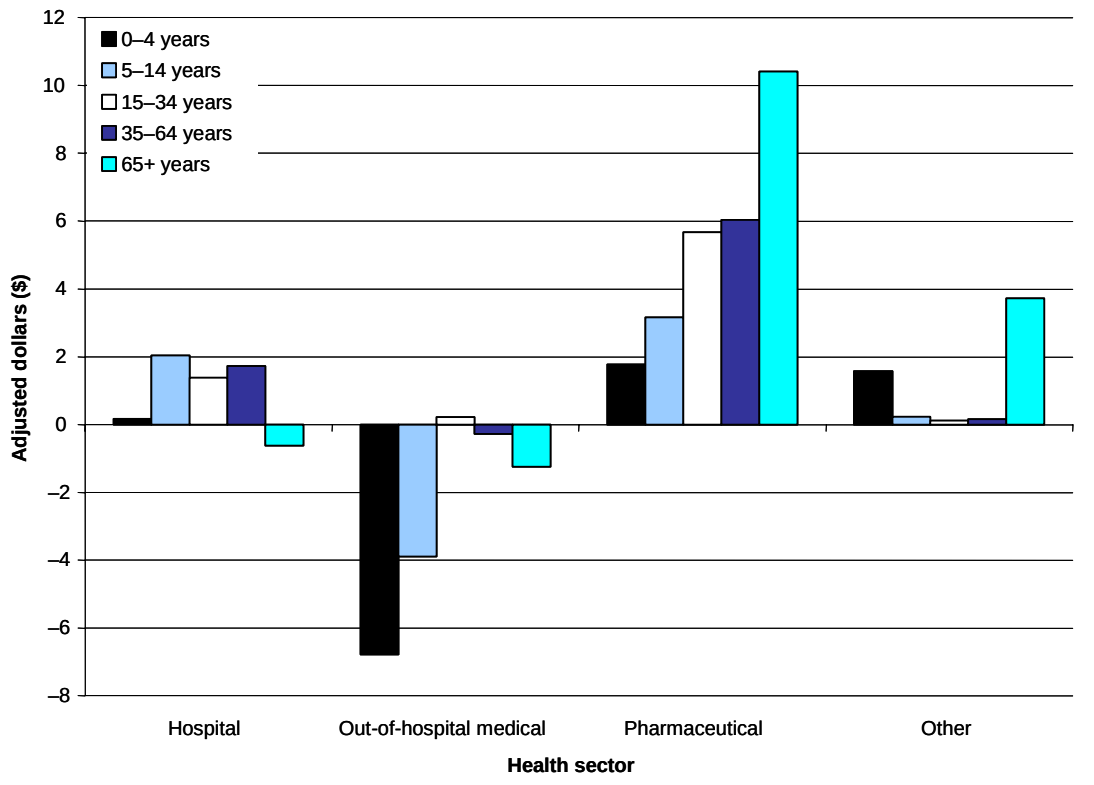


Figure 3.6: Change in per capita expenditure on asthma, by age group and sector, 1993–94 to 2000–01, Australia (adjusted to 2000–01 dollars)

After adjusting for inflation, per capita asthma expenditure increased in all sectors combined by 21% during the period 1993–94 to 2000–01, which was slightly less than the 26% increase in total health expenditure (Figure 3.7). The greatest difference was in the out-of-hospital medical sector, where asthma expenditure decreased by 18% while total health expenditure increased by 16%. Although the largest increase in asthma expenditure was for pharmaceuticals, the increase in pharmaceutical expenditure for asthma was less than the increase in total health expenditure on pharmaceuticals.

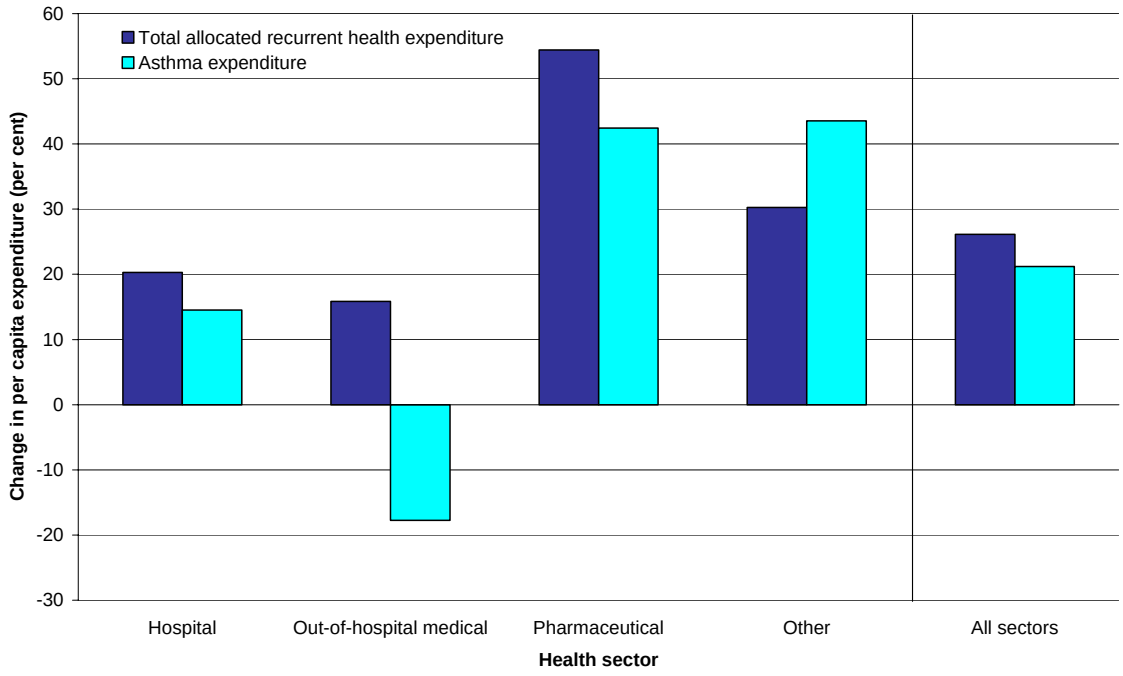


Figure 3.7: Change in per capita health expenditure, total and for asthma, by sector, 1993–94 to 2000–01 (2000–01 prices)

In each sector, over 25% of asthma expenditure was for children aged 0–14 years (Figure 3.8). In particular, nearly half (46%) of all hospital expenditure for asthma was for this age group. In the out-of-hospital medical sector, children aged 0–14 years accounted for 28% of asthma expenditure while 55% was for adults aged 15–64 years. Asthma expenditure on young children (aged 0–4 years) was least in the pharmaceutical sector, in contrast to hospital care.

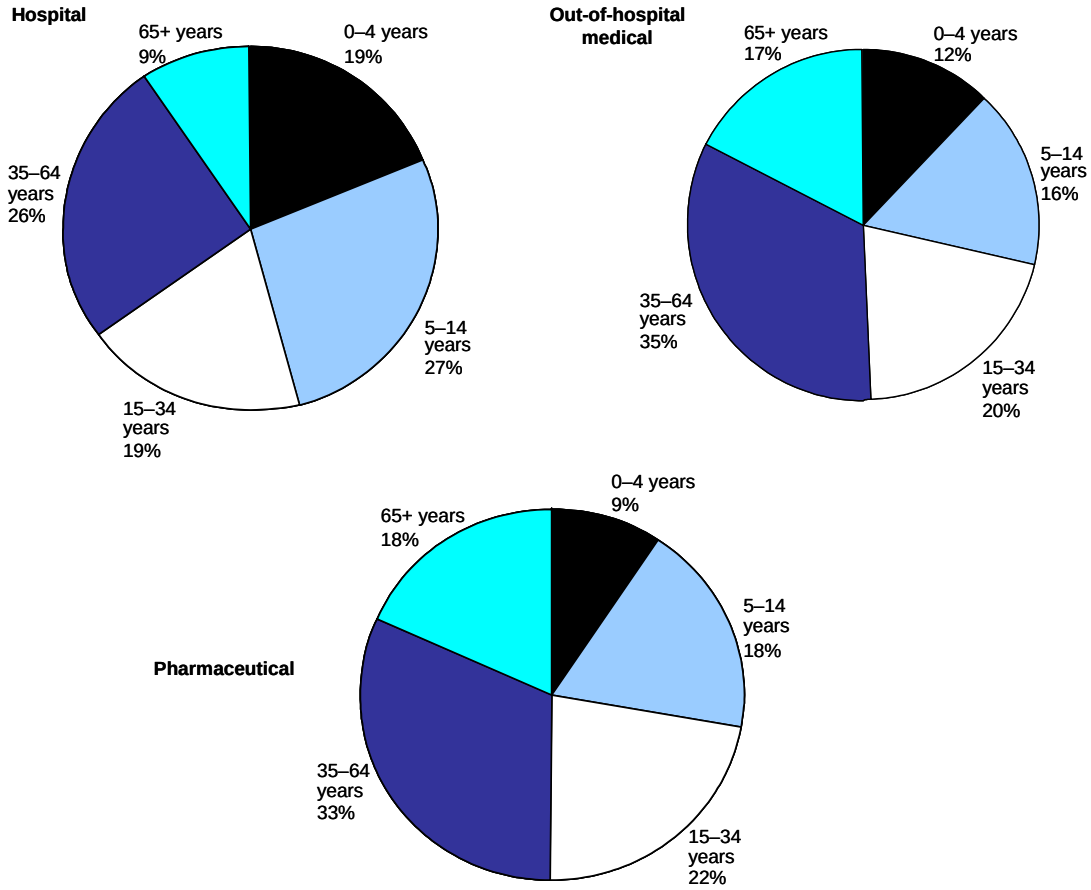


Figure 3.8: Asthma expenditure by health sector and age group, Australia, 2000–01

Average per capita asthma expenditure for hospital care was highest for children aged 0–14 years, particularly boys. However among adults, per capita expenditure was higher in women (Figure 3.9).

As noted previously, hospital care includes both admitted and non-admitted care. For asthma, the majority of non-admitted care occurs in hospital emergency departments. Among children, asthma expenditure for those aged 0–4 years was predominantly for admitted care, while among those aged 5–14 years, a greater proportion of hospital expenditure for asthma was for non-admitted care (i.e. emergency departments) (Figure 3.10). Among people aged 65 years and over, virtually all hospital care expenditure for asthma was attributed to admitted care.

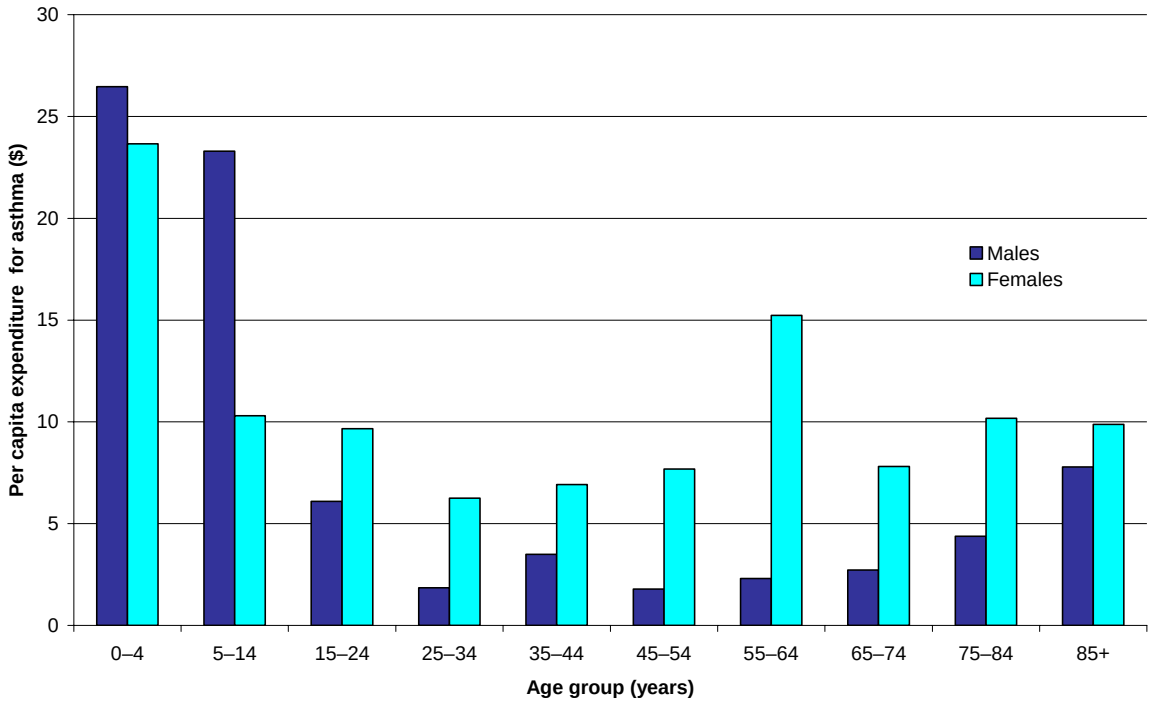


Figure 3.9: Per capita expenditure for admitted and non-admitted hospital care for patients with asthma, by age group and sex, Australia, 2000–01

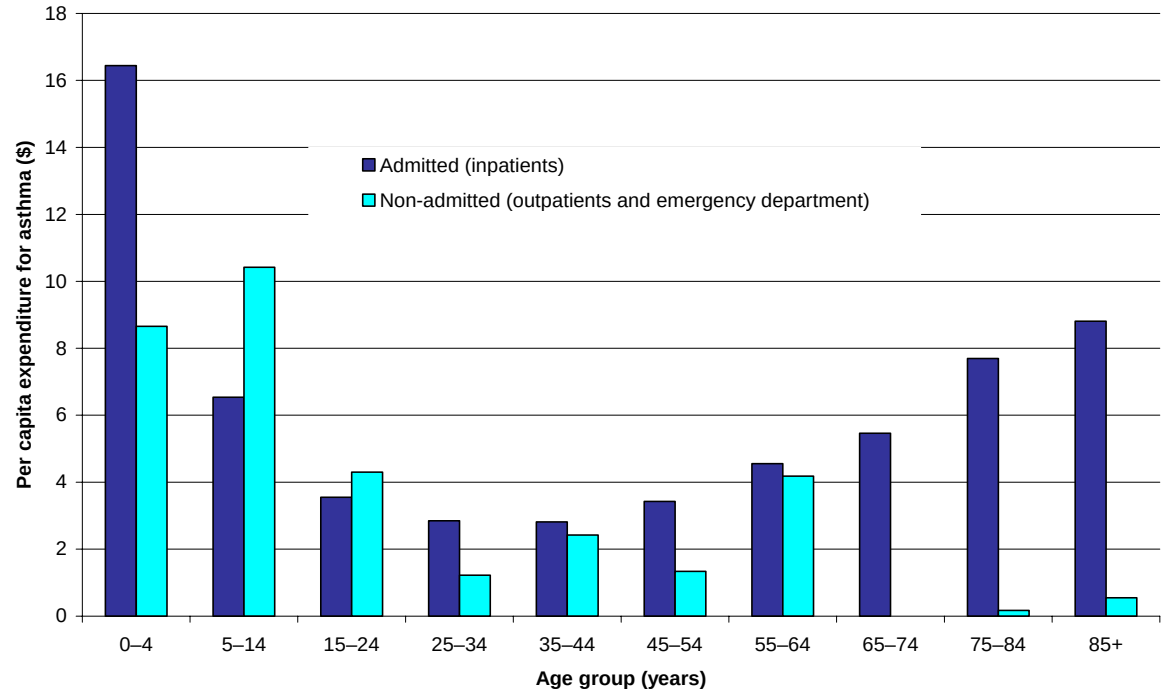


Figure 3.10: Per capita expenditure for hospital care for patients with asthma, by age group and admission status, Australia, 2000–01

Average per capita asthma expenditure for out-of-hospital medical care, as for other sectors, was highest in young children. However, in this sector, expenditure on asthma in the elderly, particularly women, was also substantial (Figure 3.11). Comparison with data on the prevalence of asthma (ACAM 2003), which was highest in children but not particularly high in older people, suggests that there was a relatively high use of out-of-hospital medical care among older people with asthma.

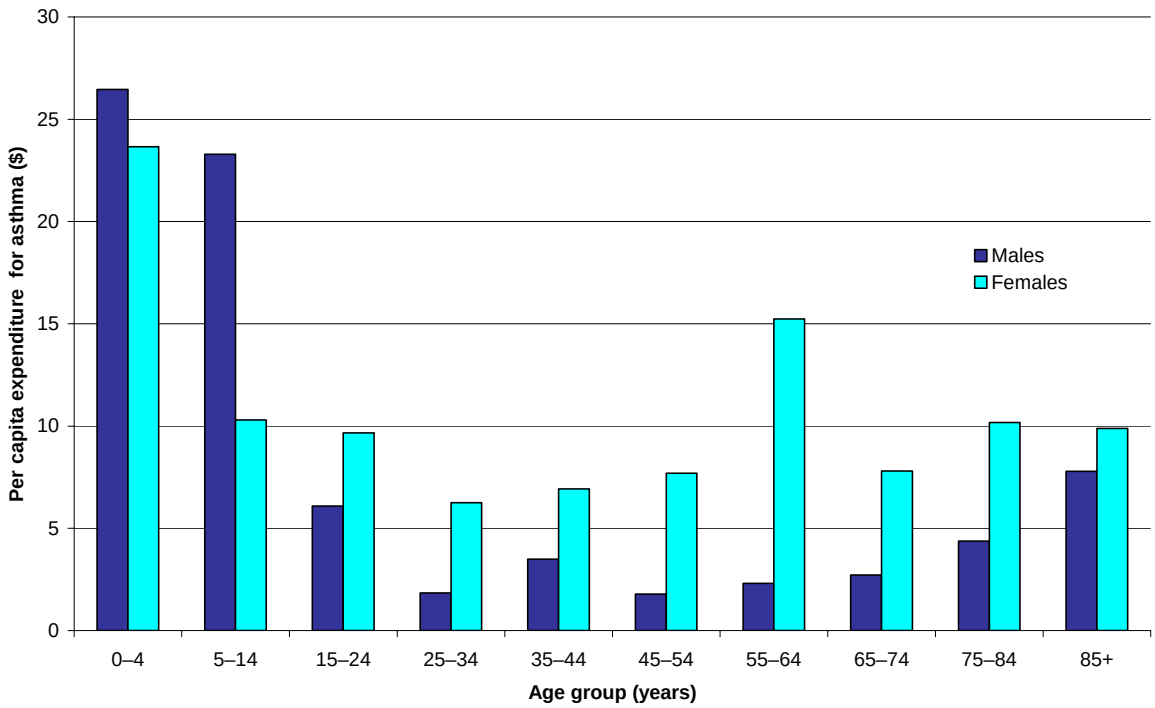


Figure 3.11: Per capita expenditure on out-of-hospital medical care for asthma, by age group and sex, Australia, 2000–01

Out-of-hospital medical care comprises specialist services and unreferred attendances in general practice. Among children, the highest per capita asthma expenditure was for care by general practitioners (Figure 3.12), while more per capita asthma expenditure for specialist care was attributed to people aged 55 years and over.

Asthma expenditure, per capita, on pharmaceuticals was highest in children (particularly boys) and older people (particularly women aged 55 to 84 years and men aged 65 to 84 years) (Figure 3.13). The observed high rates of pharmaceutical use in children presumably reflects the high prevalence of asthma in this age group (ACAM 2003). However, high rates of expenditure on pharmaceuticals for asthma in older people were not proportional to the observed prevalence of asthma in this age group and, therefore, might reflect relatively greater use of pharmaceuticals in older people with asthma.

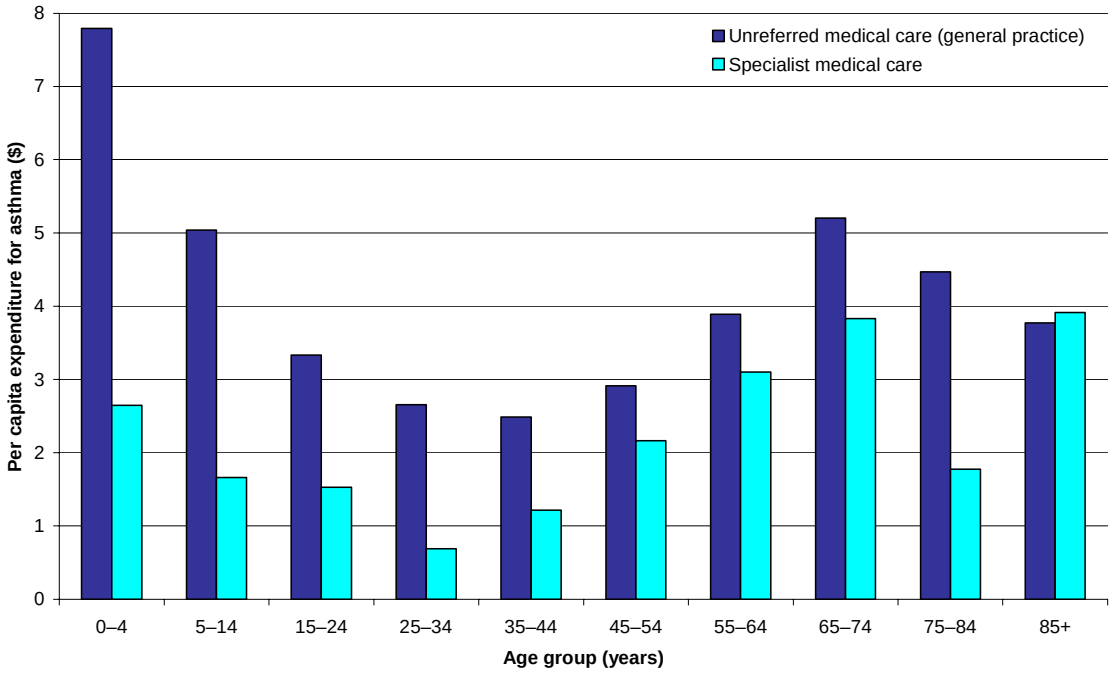


Figure 3.12: Per capita expenditure on out-of-hospital medical care for asthma, by age group and type of medical care, Australia, 2000–01

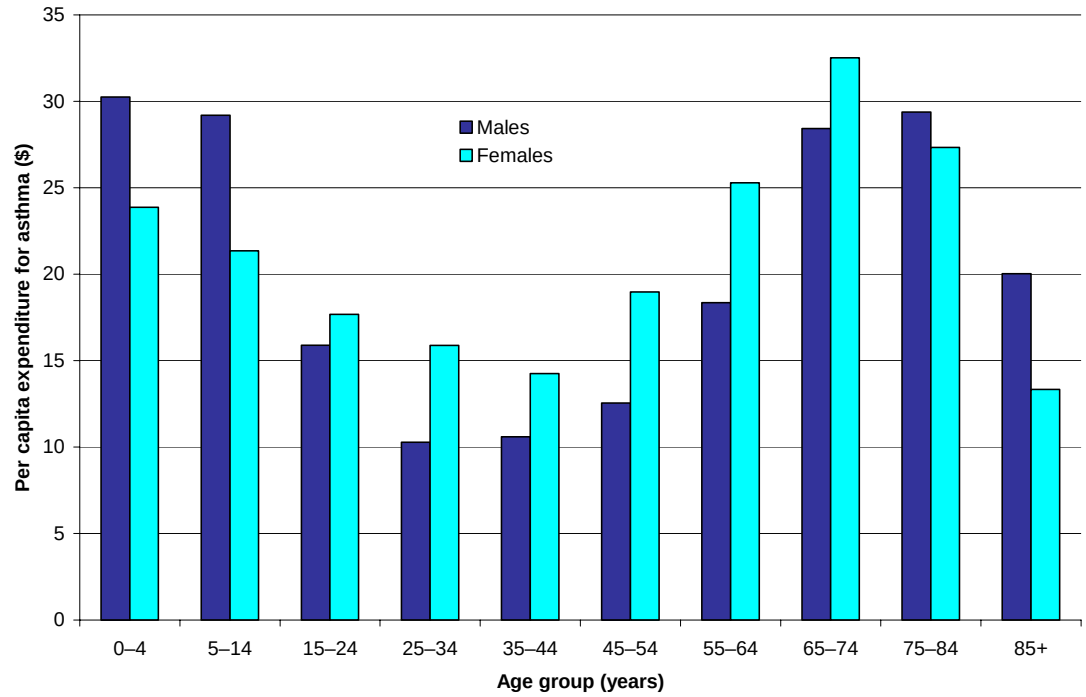


Figure 3.13: Per capita expenditure on pharmaceuticals for asthma, by age group and sex, Australia, 2000–01

Per capita expenditure attributed to prescription pharmaceuticals for asthma was highest for people aged 65 years and older, whereas expenditure on OTC pharmaceuticals for asthma was highest in 5–14-year-old children (Figure 3.14).

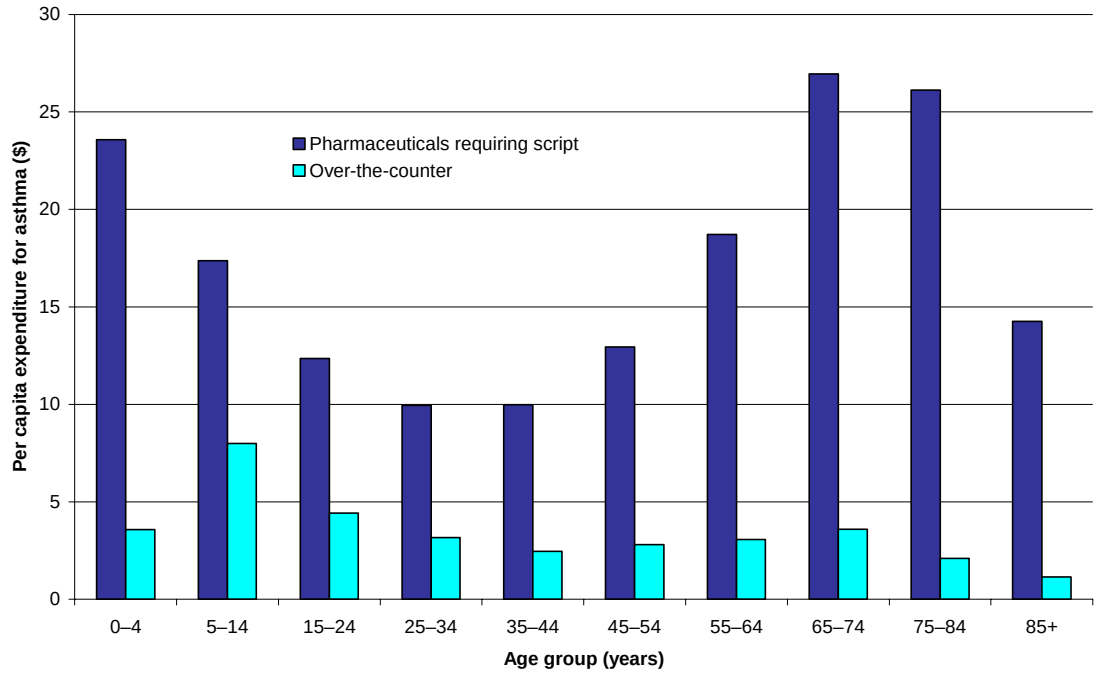


Figure 3.14: Per capita expenditure on pharmaceuticals for asthma, by age group and source, Australia, 2000–01

4 Disease burden

The Australian Burden of Disease Study quantified the impact of specified diseases in units of disability-adjusted life year or DALYs in 1996 (Mathers et al. 1999). One DALY represents one lost healthy year of life. The methods for deriving the components of DALYs have been described in Section 2.2. This section summarises the findings for asthma from that study.

4.1 Leading causes of disease burden in Australia

In Australia in 1996, there were over 2.5 million years of healthy life lost, or DALYs, due to new (incident) diseases and injuries and premature deaths occurring during that year. In the same year, there were 8,732 years of life lost (YLL) and 55,791 years of life disabled (YLD) due to asthma, which added together, total 64,523 DALYs for asthma. Asthma contributed 2.6% of all DALYs in Australia in that year and was the ninth leading contributor to the overall burden of disease. Among children aged 0–14 years, asthma contributed 18% of all DALYs, making it the leading cause of disease burden in that age group (Table 4.1).

Table 4.1: The ten leading causes of disease burden in Australia, 1996

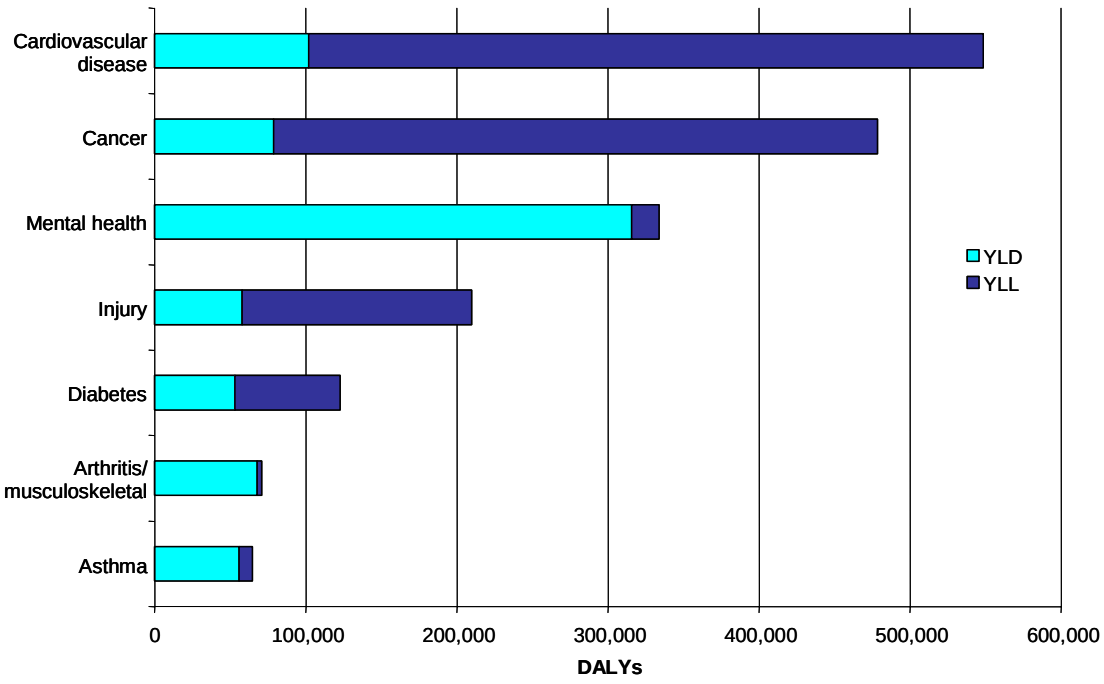
	All ages				Children aged 0–14 years		
	Total DALYs in 1996		**2,510,274**		**Total DALYs in 1996**		**213,369**
Rank	**Disease**	**DALYs**	**Per cent of total DALYs**	**Rank**	**Disease**	**DALYs**	**Per cent of total DALYs**
1	Ischaemic heart disease	311,330	12.4	**1**	Asthma	38,882	18.2
2	Stroke	136,578	5.4	**2**	Low birth weight	12,967	6.1
3	Chronic obstructive pulmonary disease	93,387	3.7	**3**	Attention deficit disorder	12,959	6.1
4	Depression	93,016	3.7	**4**	Birth trauma and asphyxia	8,113	3.8
5	Lung cancer	90,521	3.6	**5**	Other chromosomal abnormalities	7,516	3.5
6	Dementia	88,978	3.5	**6**	Congenital heart disease	7,174	3.4
7	Diabetes mellitus	74,931	3.0	**7**	Sudden infant death syndrome	6,550	3.1
8	Colorectal cancer	66,951	2.7	**8**	Depression	6,322	3,0
9	Asthma	64,523	2.6	**9**	Road traffic accidents	6,133	2.9
10	Osteoarthritis	56,305	2.2	**10**	Autism	5,897	2.8

Source: Mathers et al. 1999.

4.2 Disease burden due to asthma in Australia

4.2.1 Comparison with other National Health Priority Areas

Mortality due to asthma (YLL) is uncommon, and the major portion of DALYs due to asthma arises from disability (YLD). Years of life disabled (YLD) for asthma was similar to that in some other National Health Priority Area conditions such as diabetes and injury, cancer and arthritis/musculoskeletal conditions (Figure 4.1). Mental health disorders contributed a far greater number of YLD than any other NHPA conditions.



Note: Arthritis and musculoskeletal includes rheumatoid arthritis, osteoarthritis and osteoporosis.

Figure 4.1: Burden of disease, as years of life lost (YLL) and years of life disabled (YLD), attributable to each National Health Priority Area condition, Australia, 1996

4.2.2 Age and sex distribution of burden of asthma

The burden of disease attributed to new cases of asthma and deaths from asthma in 1996 was greatest among children, particularly boys (Figures 4.2 and 4.3). There were 38,882 DALYs attributed to asthma in children aged 0–14 years. However, among people aged more than 15 years, asthma burden was greater among females. These differentials reflect the higher incidence of asthma in these population groups.

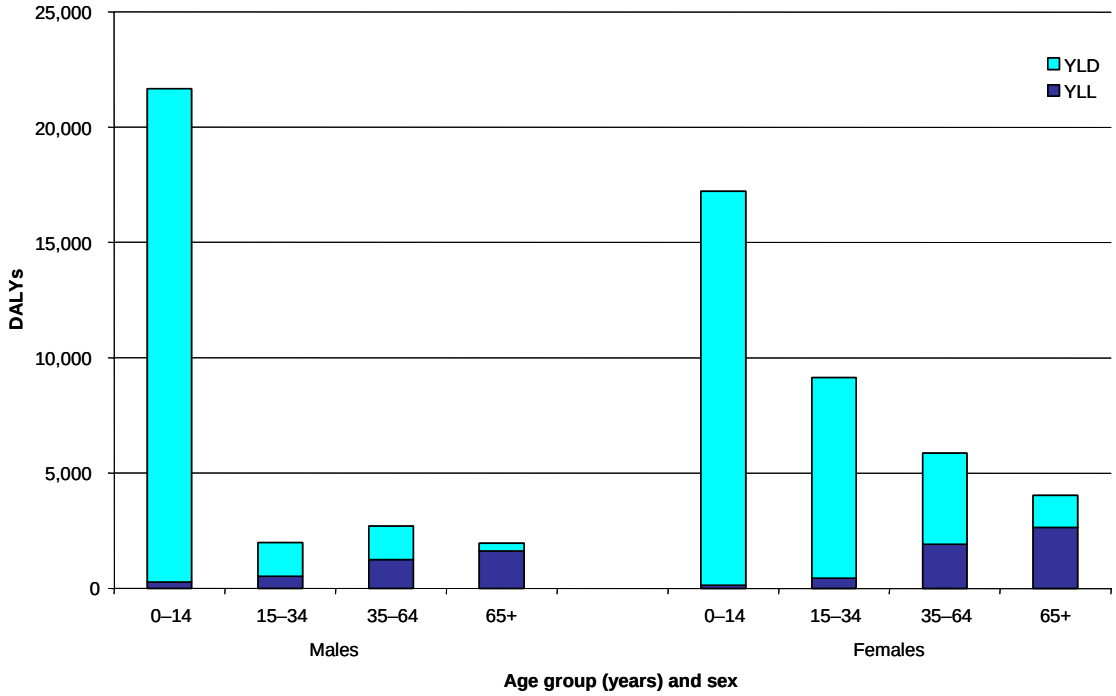


Figure 4.2: Burden of disease, measured as years of life lost (YLL) and years of life disabled (YLD), attributable to asthma, by age group and sex, Australia, 1996

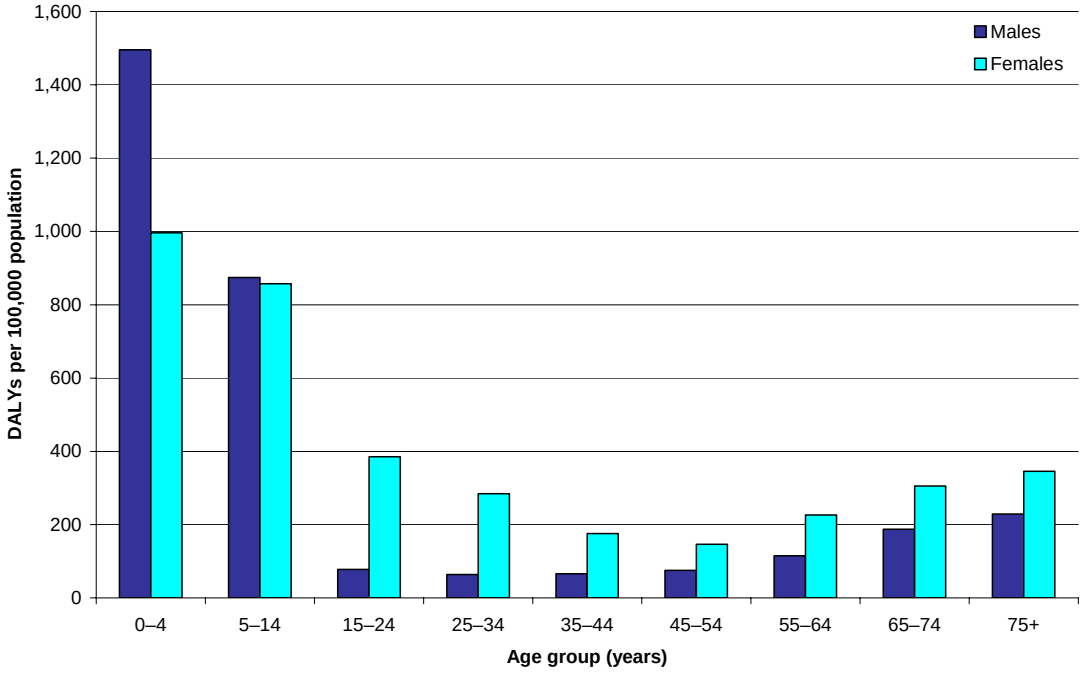


Figure 4.3: Burden of disease attributed to asthma, measured as disability-adjusted life years per 100,000 population, by age group and sex, Australia, 1996

As noted previously, incident YLDs indicate the future burden that would be avoided if a disease was prevented in the study year, while prevalent YLDs indicate the current burden due to existing diseases in the study year. Comparing these two measures, incident YLDs were higher in the young and lower in older age groups (Figure 4.4). This was particularly the case for males, for whom 87% of incident YLDs were attributed to persons aged less than 15 years. This reflects the substantially higher incidence of asthma in male children than in male adults.

Prevalent YLDs are useful for providing an indication of the burden of disability due to asthma in the study year because there are currently no known measures that are effective in preventing this condition. In 1996, asthma-related disability was greatest in young males aged 0–34 years, and in females the burden was greatest in those aged 15–64 years. Compared with incident YLD, a greater proportion of prevalent YLD was attributable to adults, especially females aged 15–64 years.

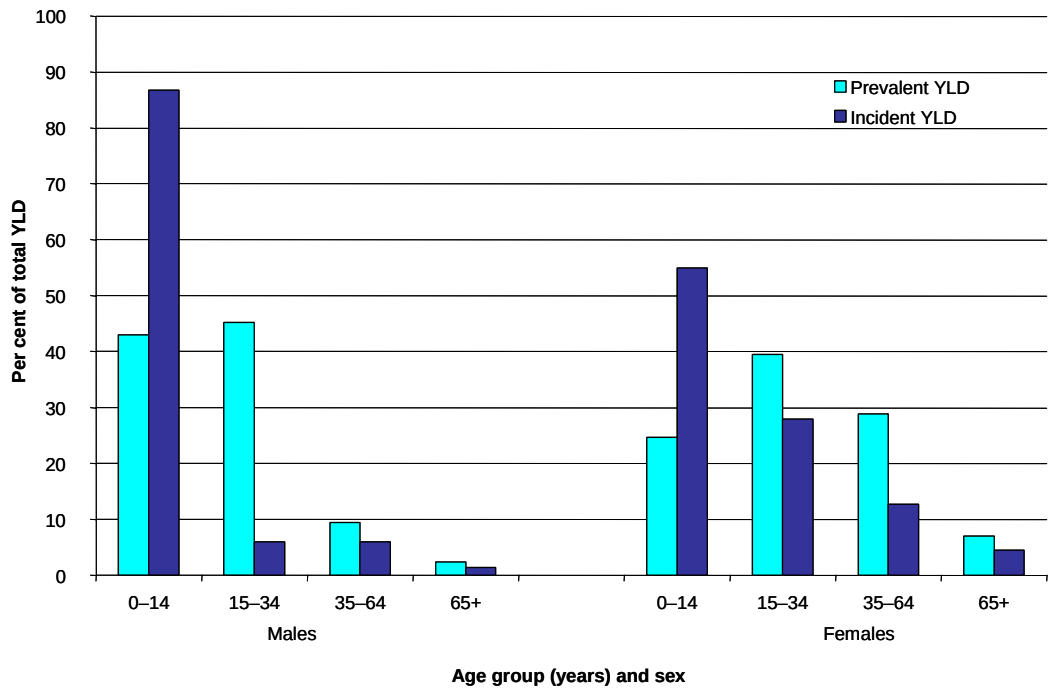


Figure 4.4: Comparison of years of life disabled (YLD) based on incident and prevalent asthma, by age group and sex, Australia, 1996

4.2.3 Allocating a price to the burden of asthma

The 'burden of disease' is a measure of the health burden specific diseases, conditions or risk factors place on society. It is informative to use this health burden estimate to calculate the economic burden of specific diseases. Techniques to ascertain the economic value that the community places on DALYs have estimated that one DALY in 1996 was worth $60,000 to Australians (Abelson et al. 2003). Using this estimate and adjusting for inflation, the 64,523 DALYs attributed to asthma in 1996, equates financially to $4.3 billion in 2000–01 dollars. This can be interpreted as burden, estimated in dollar units, attributable to projected disability arising from new cases of asthma and to premature mortality due to asthma, during 1996.

5 Discussion and conclusions

Overall, health care expenditure for asthma represented a rather small proportion of total allocated recurrent expenditure on health in Australia in 2000–01. Many features of the distribution of expenditure are predictable on the basis of the nature of the disease, its treatment and its known epidemiology. For example, hospitalisation rates were highest in children; hence the proportion of asthma expenditure attributable to hospital care in children was greater than in adults. The major therapeutic intervention for asthma is pharmaceutical, and this was reflected in the relatively high proportion of asthma expenditure in the pharmaceutical sector. Furthermore, the proportion of asthma expenditure attributable to pharmaceuticals was higher in adults than in children, in whom regular preventer therapy is less widely recommended and used. Finally, the observed sex differences in asthma expenditure profiles also reflect known differences in prevalence and health care utilisation: more asthma in boys than girls and more in adult women than men.

However, some aspects of the expenditure data deserve specific comment. In particular, there was a substantial inflation-adjusted rise in expenditure on asthma in all age groups except under-5 year olds and across most sectors except out-of-hospital medical care. The most noteworthy rise was in 'other' expenditure among people aged 65 years and over. However, although relatively large, it was small in absolute terms ($3.72 per capita). Almost all of this increase occurred in the aged care sector.

The other major increase in asthma expenditure was that attributed to pharmaceuticals, particularly in the adult age range. This 7-year period saw the introduction of a number of new medications, including new formulations of inhaled corticosteroids and a combined inhaled formulation of long-acting beta agonist and corticosteroid. However, this latter formulation first became available during 2000. Although it rapidly achieved substantial market penetration (ACAM 2003), it is unlikely to have substantially influenced the asthma expenditure data for 2000–01. Perhaps more importantly this period also saw the phasing out of generic CFC-containing inhaled medications and their replacement with newly formulated preparations that were also more expensive. Finally, substantial commercial and public sector campaigns aimed at increasing the use of inhaled corticosteroids ('preventers') by people with moderate to severe asthma were undertaken during this time.

There was a reduction in asthma expenditure on out-of-hospital medical care for children during the period 1993–94 to 2000–01. There is evidence that the prevalence of diagnosed asthma and asthma symptoms among children also decreased over this time interval (Robertson et al. 2004; Toelle et al. 2004). However, it remains uncertain whether this change represents a real reduction in the prevalence of the disease and its cost burden or, alternatively, it represents a relabelling of asthma-like symptoms as a different diagnosis, with expenditure therefore attributed to another disease entity. The lack of any reduction in expenditure on pharmaceuticals for asthma in this age group lends some support to the latter explanation.

The burden of disease attributable to asthma was dominated by disabled years, especially in the youngest age group. This is consistent with the natural history of asthma: a chronic disease with highest incidence in childhood and low rates of mortality and remission. However, it is important to emphasise that these estimates of life-long burden are sensitive to the data on incidence. As noted in Section 2.3, these data are not particularly robust in relation to asthma.

The burden of disease measured by this indicator only reflects that which is borne by the individual with the disease. A missing component that is an important aspect of the burden of asthma, particularly in children, but also in the elderly, is the influence it has on the lives of family and carers (Nocon & Booth 1991). This burden may include family financial costs of asthma care and carers' loss of time for productive activity.

Asthma has economic implications for the individual as well as society. This report has summarised two aspects of the economic burden of asthma from a societal perspective: health care expenditure on asthma and burden of disease attributable to asthma-related disability and premature mortality. It highlights the importance of pharmaceutical costs as a driver of health care expenditure on asthma and the relative importance of long-term disability expectations of children with asthma as a contributor to the burden 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.