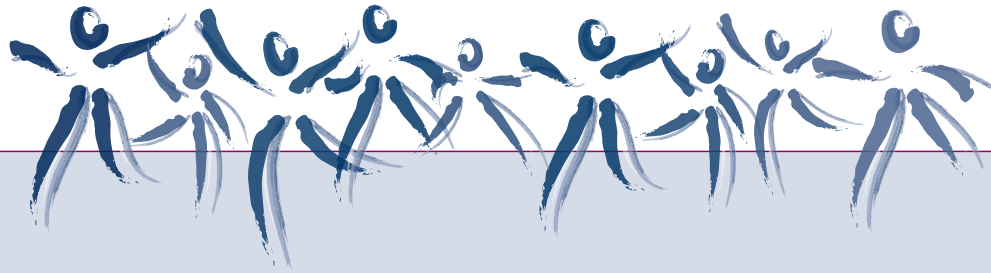
Appendix 1: Data sources, definitions and population groups



The purpose of this appendix is to provide information on the data sources from which we have collated information for the analyses presented in this report and also to provide details of the methods used when preparing data for this report. A more detailed description of statistical methods used by the Australian Centre for Asthma Monitoring (ACAM) can be found in the report *Statistical methods for monitoring asthma* (ACAM 2008).

A1.1 Analysis methods

A1.1.1 Rates

Rates are used to describe the incidence of an event or the prevalence of a condition in a population or a population subgroup. Incidence rates refer to the number of events occurring in a population over a specified time interval divided by the size of the population. Prevalence rates refer to the number of people with a specified condition within a population divided by the size of the population. For rare events, rates per 100,000 persons have been calculated. For less rare events or conditions, other bases (e.g. per 100 persons or percentage) have been used.

Population-based rates have been calculated using relevant Australian Bureau of Statistics (ABS) Estimated Resident Population data, which were provided by the Australian Institute of Health and Welfare (AIHW).

Population-based rates

Crude rates

Crude rates have been calculated by dividing the number of people with a condition in a population or the number of events that occurred in a population in a year by the size of that population at the middle of that year. The mid-year population is an estimate of the average population during the whole year.

$$n/\text{population} \times 100{,}000$$

where n = number of persons with a condition or number of events, and population is the mid-year population for the relevant year.

Age- and sex-specific rates

Where required, rates have been estimated separately for individual age groups and for males and females. In this case, the relevant cases or events (for the numerator) are those within the specific age–sex group and the relevant population (for the denominator) is the specified age–sex group within the whole population.

Age-standardised rates

Age-standardised rates are used in this report to adjust for differences in population age structures when comparing rates for different periods of time, geographical areas and population subgroups. For the purposes of this report we have age-standardised all age groups except the 0–4 year age group.

Direct age-standardisation

Direct age-standardisation has been used when the populations under study were large and the age-specific rates were considered to be reliable.

Age-standardised rates have been calculated using the following formula:

Age standardised rate (ASR) = $\Sigma(r_i P_i)/\Sigma P_i$

where

r_i is the sex- and age-group specific rate for sex and age group *i* in the population being studied

P_i is the population of age group *i* in the standard population

The Australian population as at 30 June 2001 was the standard population in all analyses.

For trend data that are presented in broad age groups (e.g. 5–14 years, 15–34 years, 35–64 years, 65 years and over) the rates for these broad groups are age-standardised to adjust for variation in age structure within them.

The standard error (se) for an age-standardised rate per 100,000 population was calculated as:

$$\text{se(ASR)} = \sqrt{\left(\sum\left[\left((r_i \times P_i^2)/n_i\right)\times 100000\right]/P^2\right)}$$

where r_i = age-specific rate per 100,000 for age group *i*

n_i = population for age group *i*

P_i = standard population for age group *i*

$P = \sum P_i$ = total standard population

The 95% confidence interval (CI) for an age-standardised rate was calculated as:

$$95\%\ \text{CI} = \text{ASR} \pm [1.96 \times \text{se(ASR)}]$$

When the number of cases was small, confidence intervals for direct age-standardised rates were estimated using a Poisson approximation (Anderson & Rosenberg 1998).

Indirect age-standardisation

In cases where the populations under study were small or where there was some uncertainty about the stability of age-specific rates—for example, when comparing mortality rates due to asthma between Indigenous and other Australians—we have used indirect age-standardisation. This method removes the influence of age structure, but does not provide a measure of prevalence in terms of a rate. Rather, the measure is a ratio of the number of observed cases to the number expected if the age-specific prevalence rates of the standard population are applied to the study population (Anderson & Rosenberg 1998). It is, therefore, interpreted as an age-adjusted rate ratio.

Asthma case-based rates

For some analyses, in which the event or condition is only relevant to people with asthma (for example, management or asthma-specific outcomes), rates are expressed as case-based rates in which the population with asthma is the denominator. These are based on the number of people with asthma as estimated from the most recent ABS NHS conducted in 2004–05.

For some analyses, both population-based rates and case-based rates are presented. This demonstrates the extent to which variation in population-based rates (for example, in hospitalisations for asthma) are attributable to variation in the prevalence of asthma.

It should be noted that, for reasons discussed in this report, the estimation of the prevalence of asthma entails inherent uncertainty. Hence, rates that include this estimate as a denominator are subject to this uncertainty.

A1.1.2 Confidence intervals

The rates and proportions contained within this report represent estimates derived from the available enumerated sample or aggregated data. These estimates contain inherent uncertainty, which is larger where the size of the sample or population from which it was estimated is smaller. Confidence intervals are used to demonstrate the extent of this uncertainty (that is, the precision of the estimates). The 95% confidence interval (CI) is an estimate of the range of values within which the 'true' population value is expected to lie, with 95% certainty (see Figure A1.1).

In the tables, 95% CIs are presented as ranges of values (in the form, xx to xx). In the figures, 95% CIs are depicted by vertical lines extending above and below each point or column.

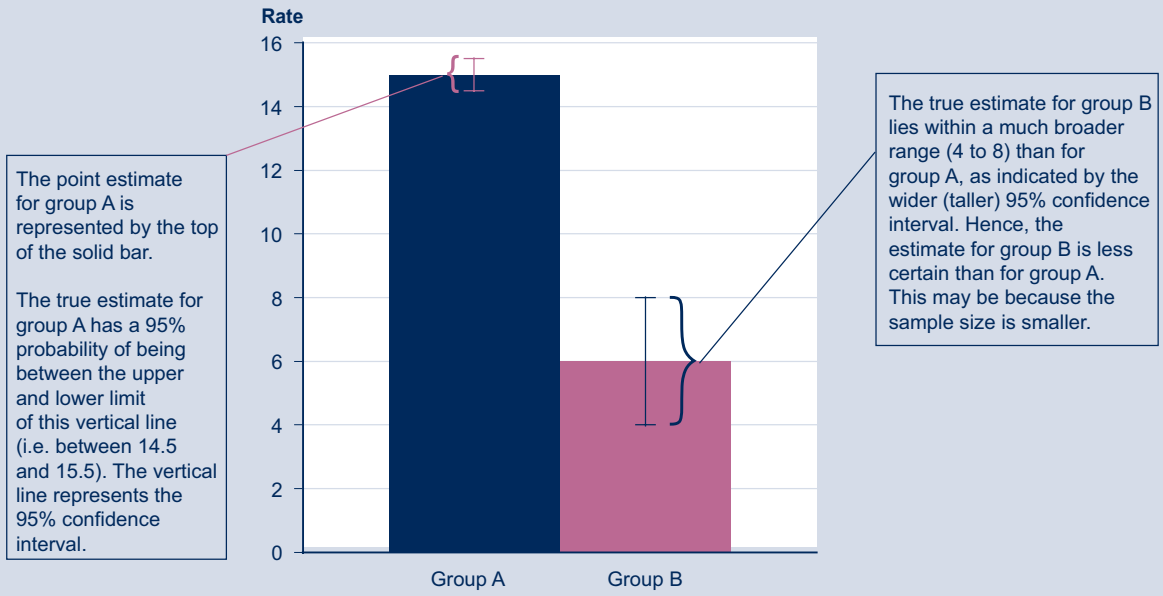


Figure A1.1: Point estimates and 95% confidence intervals

The quadratic method of Fleiss (1981) was used to calculate 95% CIs for crude, age- and sex-specific rates. This method gives an asymptotic CI that does not include logically impossible negative numbers. It differs from the more familiar normal approximation only for rates near zero.

A1.1.3 Tests of statistical significance and association

Linear trends in rates have been tested using the chi-square test for trend. Differences in rates among groups have been tested by the chi-square test.

Multivariate regression methods are used to assess the independent effects of age, gender, socioeconomic disadvantage (SEIFA quintile), remoteness (Australian Standard Geographical Classification; ASGC) and Indigenous status on mortality, hospitalisation rates and smoking status. Logistic models have been constructed in which the independent effects of these characteristics on event rates are estimated. Interactions between factors have been tested and, where these were found to be significant, subgroup analyses have been presented. Results are expressed as adjusted (independent) odds ratios, with 95% CIs and/or as *p* values for the relevant chi-square test.

A1.2 Asthma definitions used for measuring prevalence

A number of definitions for asthma have been applied in the various surveys cited in this report. These have been used where the estimation of the prevalence of asthma is the primary purpose or where the purpose is to measure the prevalence of outcomes or treatments in people with asthma. In the latter case, the definition of asthma is used to identify a denominator population. Table A1.1 lists the definitions of 'ever asthma' and 'current asthma' that have been used in the surveys most commonly cited within this report.

Table A1.1: Asthma definitions used in the National Health Survey and state surveys

Ever asthma	Current asthma	Survey(s)
Have you ever been told by a doctor or a nurse that you have asthma?	Do you still get asthma?	Australian Bureau of Statistics (ABS) National Health Survey (2001 and 2004–05)
	In the last 12 months, have you had symptoms of asthma?	Western Australia Health and Wellbeing Surveillance System
	In the last 12 months, have you taken treatment for asthma?	
Have you ever had asthma? Was your asthma confirmed by a doctor?	Do you still have asthma?	South Australian Omnibus Survey
		WANTS Health and Wellbeing Survey
	In the last 12 months, have you taken asthma medication that was prescribed or given to you by a doctor?	South Australian Monitoring and Surveillance System
	In the last 12 months have you had whistling or wheezing in the chest at any time?	
Have you ever been told by a doctor that you have asthma?	In the last 12 months, have you had asthma symptoms of asthma (coughing, wheezing, shortness of breath and chest tightness when you don't have a cold or respiratory infection) or taken medications for asthma?	Victorian Child Health and Wellbeing Survey
Have you ever been told by a doctor or at a hospital that you have asthma?	Have you had symptoms of asthma or taken treatment for asthma in the last 12 months?	New South Wales Health Survey (child and adult)
		Queensland Omnibus Survey

Notes: State surveys used computer-assisted telephone interviews (CATIs); WANTS = Western Australia, Northern Territory and South Australia.

A1.3 BEACH (Bettering the Evaluation and Care of Health) and SAND (Supplementary Analysis of Nominated Data)

The BEACH data are collected through a continuous survey of general practice activity in Australia, which began in April 1998. BEACH is an activity of the Australian General Practice Statistics and Classification Centre (formerly the General Practice Classification and Statistics Unit), a Collaborating Unit of the Family Research Centre of the University of Sydney and the AIHW. A rolling random sample of general practitioners (GPs) is selected from the Medicare Australia database (AIHW: Britt et al. 2007). To be eligible to participate, GPs must have claimed at least 375 general practice Medicare items in the previous 3 months. Approximately 1,000 GPs participate annually, with about 20 GPs recording each week. Data are collected for 50 weeks each year. Each GP collects information on 100 consecutive encounters using a recording pack containing 100 forms. Each form is divided into two main sections. The first and larger section collects information on the current encounter for the BEACH data (see Section A1.3.1) and the data items/questions do not vary. The bottom section collects data for the SAND collection (see Section A1.3.2).

A1.3.1 BEACH data

The BEACH collection includes information about the following:

the encounter

- date and type of consultation
- up to four diagnoses or problems managed
- Medicare/Veterans' Affairs item number

the patient

- age and sex
- postcode of residence
- health-care card status/Veterans' Affairs card status
- non-English-speaking background status
- whether the patient identifies as Aboriginal and/or Torres Strait Islander
- up to three reasons for the encounter

the management of each problem

- medications prescribed, supplied or advised including brand, form, strength, dosage and drug status ('new' or 'continuing')
- non-pharmacological management including counselling, referrals, procedures, pathology and imaging ordered

the GP characteristics

- age and sex
- years working in general practice
- number of sessions worked per week
- postcode of main practice, etc. (AIHW: Britt et al. 2007).

For further information on BEACH, see <www.fmrc.org.au/beach.htm>.

International Classification of Primary Care

Information on diagnosis and problem managed during GP encounters, obtained from the BEACH data set, has been classified according to the International Classification of Primary Care, 2nd edition (ICPC-2) (AIHW: Britt et al. 2001). An extended vocabulary of terms called ICPC-2 PLUS is available from <http://www.aihw.gov.au/publications/index.cfm/subject/19>.

To classify 'asthma' from BEACH data, we have selected ICPC-2 rubric R96 and excluded code R96006 'extrinsic allergic alveolitis'. The following ICPC-2 PLUS codes were included:

R96001—asthma

R96002—bronchitis; asthmatic

R96003—bronchitis; allergic

R96005—status asthmaticus

R96007—bronchitis; wheezy

R96008—hyperactive airways

Analysis of BEACH data

Estimating the rate of general practice encounters for asthma

The number of general practice encounters where asthma was managed (i.e. general practice encounters for asthma) per 100 encounters was estimated from the BEACH data using a method which adjusts for the cluster (practice-based) sampling used in BEACH and also incorporates post-stratification weights to account for differences in age between the GP sample and the GP population. The data were also weighted for each participant's Medicare activity level, in order to better reflect total GP–patient encounters for Australia. This was implemented using the SURVEYMEANS® procedure in SAS software version 9 (SAS Institute 2005).

The estimated number of general practice encounters for asthma per 100 population was then estimated using the following information and formula:

$$\text{The estimated number of general practice encounters for asthma per 100 population} = \frac{\text{ARGPEs per 100 general practice encounters} \times \text{estimated total number of all general practice visits}}{\text{population}}$$

where

ARGPEs = number of general practice encounters for asthma based on analysis of BEACH data

population = the mid-year population for the relevant year.

The estimated total number of general practice visits was based on Medicare data for Medicare Benefits Schedule (MBS) Category 1 service items. This category includes all unreferred (i.e. primary care) attendances.

Derived variables for analysis of asthma-related BEACH data

Asthma medication

Asthma medication groupings were defined using BEACH in-house classification, the Coding Atlas for Pharmaceutical Substances (CAPS), which is mapped to the Anatomical Therapeutic Chemical (ATC) Classification System, the Australian standard for classifying medications at the generic level (Table A1.2).

Table A1.2: Variables for asthma medication groupings by name, ATC code and generic code

Variable	Medications included	ATC code	Generic code (CAPS)
Inhaled corticosteroids	Beclomethasone	R03BA01	R501
	Becloforte		
	Becotide		
	Qvar		
	Respocort		
	Budesonide	R03BA02	R502
	Pulmicort		
	Fluticasone propionate	R03BA05	R506
	Flixotide		
	Ciclesonide	R03BA05	R510
	Alvesco		
Long-acting beta-agonists combined with inhaled corticosteroids	Fluticasone/salmeterol	R03AK06	R508
	Seretide		
	Budesonide/eformoterol	R03AK07	R509
	Symbicort		
Oral corticosteroids	Prednisolone	H02AB06	H203
	Solone		
	Panafcortelone		
	Predsolone		
	Prednisone	H02AB07	H202
	Sone		
	Panafcort		
	Predsone		
	Prednisolone sodium phos. oral	H02AB06	H212
Leukotriene receptor antagonists	Montelukast	R03DC03	R410
	Singulair		
	Zafirlukast	R03DC01	R410
	Accolate		
Cromones	Nedocromil	R03BC03	R505
	Tilade		
	Sodium cromoglycate	R03BC	R503
	Intal		
	Cromese sterinebs		

Note: CAPS = Coding Atlas for Pharmaceutical Substances; ATC = Anatomical Therapeutic Chemical Classification System.

A medication variable was created and for each asthma-related encounter, defined as 'yes' or 'no' depending on whether or not at least one of the prescriptions provided at that encounter belonged to the designated medication class. For example, the inhaled corticosteroids (ICS) variable was assigned a value of '1' (i.e. 'yes') if asthma was managed during the encounter and at least one of the prescriptions

prescribed during that encounter had a generic code of R501, R502, R506 or R510. Otherwise, ICS was assigned a value of '0' (i.e. 'no') if asthma was managed or remained blank (not defined) for non-asthma encounters.

Procedures and referrals for asthma

Variables for procedures and referrals for the purposes of asthma management were defined using the ICPC-2 PLUS classification as described in Table A1.3.

Table A1.3: Variables for asthma-related procedures and referrals

Variable	BEACH data element	ICPC item included	ICPC code/rubric
Advice/consultation; smoking	Procedures, other treatments and counselling for asthma	Advice/consultation; smoking	P45004 P58008
Lung function test	Procedures, other treatments and counselling for asthma	Test; peak flow Test; pulmonary function Test; spirometry Test; lung function Test; physical function; respiratory Test; FEV1 Test; respiratory function	R39
Asthma plan	Procedures, other treatments and counselling for asthma	Asthma plan	R49002
Hospital	Referrals for asthma	Referral; hospital Admission; hospital	A67010 A67022, A62010
Emergency department	Referrals for asthma	Referral; A&E	A67011
Specialist	Referrals for asthma	Referral; specialist Referral; physician Referral; paediatrician Referral; allergist Referral; immunologist Referral; respiratory physician	A67001 A67001 A67004 A67005 B67003 R67002
Lung function test	Referrals for asthma	Test; peak flow Test; pulmonary function Test; spirometry Test; lung function Test; physical function; respiratory Test; FEV1 Test; respiratory function	R39
Unspecified referral	Referrals for asthma	Referral	A68011

Note: BEACH = Bettering the Evaluation and Care of Health; ICPC = International Classification of Primary Care; FEV1 = forced expiratory volume in 1 second; A&E = accident and emergency (emergency department).

A procedure/referral variable was created and for each encounter, the variable was defined as 'yes' or 'no' if asthma was managed during that encounter and at least one of the procedures/referrals belonged to the designated procedure/referral group. For example, Specialist variable was assigned a value of 1 ('yes') if asthma was managed during the encounter and at least one of the referrals belonged to the following ICPC-2 list: A67001, A67001, A67004, A67005, B67003 or R67002.

Limitations of BEACH data

The response rate by GPs to the BEACH survey was 31.1% in 2005–06, 28.1% in 2004–05, 23.7% in 2003–04, 28.9% in 2002–03 and 32.3% in 2001–02 (AIHW: Britt et al. 2004, 2007). The proportion of BEACH GPs practicing in remote areas is only 1.3%, hence the sample from remote areas is relatively small (n = 13 in 2005–06) (AIHW: Britt et al. 2004). To improve the representativeness of the sample, BEACH data are weighted for differences between the GP sample and the GP population and for participants' Medicare activity level.

The BEACH Project has a quality assurance program to ensure the reliability of data entry. This includes computer-aided error checks during data entry, the validating of samples of data entered against original recording forms, and further logical data checks during the data cleaning and analysis using specific SAS programming (AIHW: Britt et al. 2002).

Britt and coworkers (AIHW: Britt et al. 1998) compared the recording of morbidity data by GPs for the BEACH Project, with two trained observers independently viewing a videotape of the encounters. They found good agreement (87%) between the GPs observed and the observers (who were also GPs) at the broad disease level (ICPC chapter), but agreement at the condition-specific level (ICPC rubric) was lower (67%). Thus, the labelling of certain conditions varies between GPs. The Australian General Practice Statistics and Classification Centre uses features of the ICPC classification structure to ensure synonymous terms are classified to the correct rubric but this cannot deal with variation among GPs in the way they use the labels 'asthma', 'chronic obstructive pulmonary disease (COPD)' or other respiratory disease labels.

A1.3.2 SAND data

The SAND data are collected as a supplementary data set of the BEACH Project (AIHW: Britt et al. 2001). Organisations sponsoring blocks of SAND data collection ask questions on topics of their choice and have access to the detailed reports. General practitioners participating in SAND ask and record responses to specific questions in targeted patient groups. SAND modules relevant to asthma have been conducted in 1999, 2000–01, 2002–03, 2004–05 and 2006–07 (AIHW: Britt & Miller 2007).

A1.4 Emergency department data

Data on emergency department (ED) visits for asthma have been derived from the New South Wales Emergency Department Data Collection (NSW EDDC). An ED attendance 'index' was calculated for the five age groups in the population as the number of attendances per year per 100,000 population with asthma in that age group.

ED visits for asthma are identified using the 'principal diagnosis' for the visit and are classified using the International Statistical Classification of Diseases and Related Health Problems, 9th Revision (ICD-9) or 10th Revision (ICD-10). Data from the NSW EDDC for the period 1999–2007 were accessed using the Health Outcomes Information Statistical Toolkit (HOIST) system.

A1.4.1 Limitations of emergency department data

In New South Wales, the ED data set includes data from 81 of the 150 EDs in that state. Approximately 75% of ED visits in New South Wales are captured in the data set. Emergency departments in metropolitan Sydney and larger rural hospitals are more likely to be included. Furthermore, the nature of the missing data means that the ED data tend to under-represent people visiting EDs in rural and remote areas.

A1.5 Expenditure data

Expenditure data used in this report were obtained from the Australian Institute of Health and Welfare's Disease expenditure database. This report considers recurrent health expenditure that has been allocated by health sector and disease.

It is not possible to allocate all expenditure on health goods and services by disease. Expenditure on most community and public health programs, for instance, support the treatment and prevention of many conditions and cannot be allocated to one specific disease or injury. This is also true of capital expenditure on health facilities and equipment, which has the added problem of being characterised by large outlays that fluctuate greatly from year to year. The method used to derive the estimates in this report, however, ensures that the estimates add across disease, age and sex groups to the total amount of health expenditure that was able to be allocated by disease in 2004–05—around two-thirds (70%) of total recurrent health expenditure ($52.7 billion) (AIHW 2008d).

The expenditure that was not able to be allocated by disease includes capital expenditure, non-admitted patient hospital services, over-the-counter drugs, all other health practitioner services excluding optometry, community health expenditure (except community mental health), expenditure on public health programs (except cancer screening programs), health administration and health aids and appliances. Therefore, in this report, references to health-care expenditure always imply 'allocated recurrent' health-care expenditure. All expenditure data are in 2004–05 dollars.

A1.5.1 Expenditure for admitted patients

Expenditure for admitted patients comprises admitted-patient public and private hospital services expenditure (same-day as well as overnight admissions). The proportions of total public acute hospital expenditure which relate to admitted patients are estimated using the admitted patient fractions for hospitals in each state and territory and are published in *Australian hospital statistics 2005–06* (AIHW 2007a). Private hospital expenditure data are derived from the Australian Bureau of Statistics Private Health Establishments Survey.

The hospital morbidity expenditure method estimates acute hospital admitted-patient costs by apportioning the total admitted-patient expenditure to individual episodes of hospitalisation with an adjustment for the resource intensity of treatment for the specific episode (using the diagnostic related groups, or DRGs) and the length of stay. The length of stay adjustment is made in such a way as to reflect the fact that some costs are proportional to length of stay (e.g. ward costs and meals), whereas others are independent of length of stay (e.g. theatre costs). The subdivision of episode costs into these cost 'buckets' was made using National Hospital Costs Data Collection data.

An adjustment is also made for the actual hospital where the treatment is provided. The standard DRG method for estimating costs uses state DRG weights, and so assumes that the hospital has the same average costliness as the average for the state. The Public Hospitals Establishments Database contains the actual cost of treating admitted patients at each hospital, so these data are used to scale up or down the estimate that comes from using state DRG weights.

For subacute and non-acute patients, where there are no DRG weights, the most recent data on costs come from the July to December 1996 subacute and non-acute patient (SNAP) study (Eagar et al. 1997). Per diem costs were applied and inflated to 2004–05 estimates using the implicit price deflator for final government consumption expenditure on hospital care (AIHW 2006).

Estimates of expenditure on medical services for private patients in hospitals are included in admitted patient hospital costs. Expenditure for private medical services in 2004–05 was $2,746 million (AIHW 2008d). These estimates come from Medicare data.

Hospital encounters for asthma were identified as those where the principal diagnosis was asthma (ICD-10 codes J45, J46 or J82).

A1.5.2 Out-of-hospital medical services expenditure

'Out-of-hospital medical' is primarily care in the community from GPs as well as specialists, imaging and pathology services. Specifically it includes MBS unreferred attendances, imaging, pathology, specialist, other medical MBS and any other medical services expenditure for 2004–05 reported in *Health expenditure Australia 2005–06* (AIHW 2007c) that has not been counted elsewhere.

Data from the GPs survey, Bettering the Evaluation and Care of Health (BEACH), was used to allocate private medical services provided by both GPs and specialists. The ICPC-2 codes used in BEACH were mapped to the disease costing groups to enable medical services expenditure to be allocated by disease.

Three years of the BEACH database, 2003–04, 2004–05 and 2005–06, were used in the analysis, which gave 297,000 encounters overall. The proportions of problems by disease were used to allocate medical expenditures. The total medical expenditures came from Medicare and the AIHW health expenditure database.

Expenditures for 'unreferred attendances', 'imaging' and 'pathology' were allocated to disease on the basis of GP encounters, while expenditure for 'other medical services' (mostly specialist services) was allocated to disease on the basis of the referral pattern in BEACH. Allocation of GP costs where there are multiple presenting conditions in the GP encounter was done on a pro-rata basis.

In-hospital medical expenditure for private patients was not included under medical services, but was allocated as part of admitted patient expenditure.

A1.5.3 Prescription pharmaceuticals expenditure

This includes benefit paid pharmaceuticals, under-copayment prescriptions and private prescriptions.

The Australian Government Department of Health and Ageing (DoHA) provided detailed costing data for pharmaceuticals issued under the Pharmaceutical Benefits Scheme (PBS) and the Department of Veterans' Affairs Repatriation Pharmaceutical Benefits Scheme (RPBS). It also provided volume data for private prescriptions and under-copayment drugs. These data originally came from a Pharmacy Guild survey and were adjusted by the DoHA to represent volume figures for all of Australia. Costing figures were applied to these prescription drugs to obtain a total expenditure figure for each drug. Prescription drugs were coded by the 5th edition of the Anatomical Therapeutic Chemical Classification System developed by the World Health Organization for classifying therapeutic drugs (WHO Collaborating Centre for Drug Statistics Methodology 2003). The codes were mapped to codes for prescription drugs used in the BEACH survey. As a result, data from BEACH were used to allocate expenditure on prescription drugs to each disease group, based on the medical problem in the GP encounter that related to the prescribing of the particular drug. An assumption was made that the pattern of diseases relating to each type of prescription drug is the same when prescribed by a GP and by a specialist.

This assumption was applied because there are no data that permit allocation of specialist-written prescriptions to diseases.

Pharmaceuticals that are dispensed in hospitals are included in the estimates of hospital costs.

A1.5.4 Other costs

'Other' expenditure comprises expenditure on optometrical services, dental services, community mental health, public health cancer screening and research. For asthma expenditure, the category 'other' only comprises expenditure on research, since the other components were not applicable. Therefore, for the purposes of this report, we have only included research funding in the category 'other' for total recurrent health expenditure to ensure comparable growth rates for the category 'other' for asthma and all other diseases.

Total expenditure on 'research' was obtained from *Health expenditure Australia, 2005–06* (AIHW 2007c) and was allocated to disease using data from the latest Australian Bureau of Statistics research and experimental development surveys. Most of the research data are classified at a fairly high level, but it does give a fairly good picture of the distribution of research expenditure at the burden of disease chapter level. Asthma research expenditure was a derived subcomponent of research expenditure on respiratory diseases.

A1.5.5 Limitations of expenditure data

It is important that the interpretation and limitations of these estimates be clearly understood. Expenditure estimates for disease are based on the attribution of allocated recurrent health expenditure using the available information about the mix of diseases by age and gender and health sector utilisation. The accuracy of the expenditure estimates is limited by the accuracy of the source data on health-care utilisation. For further details on the interpretation and limitations of these estimates, refer to the technical notes in AIHW 2008d. In relation to asthma, there are substantial problems with diagnostic misclassification (AIHW: Baker et al. 2004). These problems will particularly influence the estimates of expenditure on asthma in the elderly. Often in this age group, there is no certain clinical basis for distinguishing asthma from chronic obstructive pulmonary disease (COPD). However, the substantially higher cost-weight for COPD compared with asthma (National Centre for Classification in Health 2004) is an incentive for health-care providers to assign admissions to COPD rather than asthma. This may lead to underestimation of hospital bed utilisation and, hence, expenditure for asthma in the elderly. There is less incentive for misclassification in the BEACH survey data but diagnostic uncertainty remains an issue.

Furthermore, in some instances, data were not available regarding how costs should be attributed. For example, there are no data relating to the patterns of prescriptions by specialists, therefore it was assumed these would be the same as for GPs. The validity of this assumption is untested and, hence, these data should be interpreted with some caution.

The Medicare broad type service category 'allied health', which includes outpatient physiotherapy services, has been excluded from these analyses since it was not possible to obtain disease expenditure splits for allied health.

A1.6 Health survey data

A1.6.1 National Health Survey

The NHS, conducted by the ABS periodically since 1977, is designed to collect information on the health status, use of health services and facilities, and health and lifestyle characteristics of residents across Australia. It aims to get national information on a range of health issues, provide information on health indicators for National Health Priority Areas and for important population subgroups and, where possible, enable trends to be monitored over time.

Households from all states and territories are sampled randomly using a stratified multi-stage area sample to ensure that all eligible members of the population within a given state and territory have an equal chance of selection. Residents from hospitals, nursing and convalescent homes, boarding schools, prisons, single quarters of military establishments and persons living in Australia but not usually considered part of the Australian population are excluded. Non-private dwellings such as hostels, boarding houses, hotels and motels are also excluded.

In 2004–05, the NHS sampled approximately 19,500 households from non-sparsely settled areas of all states and territories of Australia between August 2004 and July 2005 (ABS 2006a). One adult, aged 18 years or over and, where applicable, one child, were included from each selected dwelling, providing a total sample of approximately 25,900 respondents. Parents or guardians were interviewed on behalf of children or, where possible, children aged 15–17 years were interviewed in person, with parental consent. The average survey time was 40 minutes per household.

In this report, data from the 2004–05 and 2001 surveys were used. The estimate of the prevalence of current asthma was derived from two questions asked in the survey (see Table A1.4). The proportion of the sample that had 'current' asthma (that is, 'still get asthma') has been estimated. This subgroup of the population was asked additional questions from the asthma module of the survey, also described in Table A1.4. In order to make comparisons of various outcomes in people with and without asthma, the authors also analysed data from the NHSs that are designed for the general population (Table A1.5).

The 2004–05 and 2001 ABS NHS data presented in this report have been accessed through the ABS Remote Access Data Laboratory (RADL). This facility is available to authorised users to access confidentialised unit record files (CURFs), which are de-identified record-level data. Grouping variables are incorporated in these data (for example, region of birth, age group) to ensure that information from these records cannot be used to identify an individual.

The 2004–05 NHS CURF contains eight separate files: household, (all) persons in household, (selected) person, alcohol, conditions, medications, injury damage and body part injured. There are two formats of the NHS CURF data—the expanded and the basic. The expanded CURF contains some information that is more detailed than that available in the basic CURF.

The expanded CURF can only be accessed through the RADL, while the basic CURF can be accessed either through the RADL or via CD-ROM (ABS 2006b). For the purposes of this report, the expanded CURF was used, unless stated otherwise.

Table A1.4: Asthma-specific questions from the Australian Bureau of Statistics (ABS) National Health Survey relevant to this report

Question(s)	Section of this report where data presented
Have you ever been told by a doctor or a nurse that you have asthma?	Sections 2.1 and 3.1 (prevalence of ever having asthma)
If yes, do you still get asthma?	Sections 2.1 and 3.2 (prevalence of current asthma)
Do you have a written asthma action plan?	Sections 2.4 and 6.1 (written asthma action plans)
Did you get the asthma action plan from a doctor?	
Did you get the asthma action plan from a nurse?	
Did you get the asthma action plan from a chemist?	
Is your action plan similar to this?	
Have you taken any medication for asthma in the last 2 weeks?	Section 6.2 (use of asthma medications)
What are the names or brands of all the asthma medication you have used in the last 2 weeks?	
During the last 2 weeks, have you used a nebuliser to administer this/any of these medication(s) for your asthma?	
Have you taken any of these actions for your asthma in the last 2 weeks?	Section 8.2 (health-related actions taken for asthma)
Which ones?	Section 8.2 (days of reduced activity)
10. Admitted to hospital as an inpatient	
11. Visited outpatient clinic	
12. Visited emergency/casualty	
13. Visited day clinic	
14. Consulted a doctor (GP or specialist)	
15. Consulted other health professional	
16. Had days away from study/work	
17. Had other days of reduced activities	
18. Taken vitamin or mineral supplements	
19. Used natural/herbal medicines	
Did you consult a general practitioner or a specialist?	

Table A1.5: General questions from the Australian Bureau of Statistics (ABS) National Health Survey relevant to this report

Question(s)	Section of this report where data presented
In general, would you say that your health is excellent, very good, good, fair or poor?	Sections 2.6 and 8.1 (self-assessed health status)
Do you currently smoke? Do you smoke regularly, that is, at least once a day? Have you ever smoked regularly (that is, at least once a day)?	Sections 2.5 and 7.1 (people with asthma who smoke)
Does anyone (else) in this household smoke regularly that is at least once a day? How many (other) people in this household smoke regularly? Do you or does anyone else usually smoke inside the house?	Sections 2.5 and 7.2 (passive smoke exposure in children with asthma)
In the past 4 weeks: About how often did you feel tired out for no good reason? About how often did you feel nervous? About how often did you feel so nervous that nothing could calm you down? About how often did you feel without hope/hopeless? About how often did you feel restless or jumpy/fidgety? About how often did you feel so restless that you could not sit still? About how often did you feel depressed? About how often did you feel that everything was an effort? About how often did you feel so sad that nothing could cheer you up? About how often did you feel worthless? Responses: 1. All of the time / 2. Most of the time / 3. Some of the time / 4. A little of the time / 5. None of the time	Used to calculate Kessler-10 score in Section 8.2 (psychological distress)
In the last 2 weeks have you stayed away from your work for more than half the day because of any illness or injury you had? On how many days in the last 2 weeks have you stayed away from your work?	Section 8.2 (days of reduced activity) Used to calculate differences between people with and without current asthma

A1.6.2 National Aboriginal and Torres Strait Islander Health Survey

The NHS included questions about whether the respondent came from an Aboriginal or Torres Strait Islander background. This sample was included in the main analyses. In addition, the NHS has over-sampled in Indigenous Australian populations to enable more reliable estimates of health status in Indigenous Australians since 1995. This component of the NHS is referred to as the NATSIHS. A total sample of 10,439 Aboriginal and Torres Strait Islander Australians was included in the NATSIHS (ABS 2006d). This component of the survey carried out further sampling of 4,904 Aboriginal and Torres Strait Islander Australians in remote Indigenous communities. The response rates for the NATSIHS non-remote and remote samples were 83.4% and 85.5%, respectively. The majority of questions used were the same as those administered in the 2004–05 NHS. However, some asthma-specific questions were not included in the 2004–05 NATSIHS, namely those about respiratory symptoms, type of medication used, nebuliser use or actions taken for asthma (Table A1.6). Furthermore, information about asthma action plans was only collected in non-remote areas.

The 2004–05 and 2001 ABS NATSIHS data presented in this report have also been accessed through the ABS Remote Access Data Laboratory, using the expanded CURF, which is the only format available for the NATSIHS.

Table A1.6: Asthma-specific and other relevant questions included in the National Aboriginal and Torres Strait Islander Survey 2004–05

Data item	Non-remote	Remote
Ever diagnosed asthma	✓	✓
Current asthma	✓	✓
Whether has written asthma action plan	✓	×
Source of written asthma action plan	✓	×
Whether has standard asthma action plan	✓	×
Whether used pharmaceutical medications for asthma in the last 2 weeks	✓	✓
Type of medication used	×	×
Use of nebuliser	×	×
Action taken for asthma	×	×

A1.6.3 State/territory surveys

Most Australian states and territories now regularly conduct general health surveys within their jurisdictions. These are usually carried out using computer-assisted telephone interview (CATI) surveys that sample the population using random digit dialling. In this report, CATI survey data have been provided by New South Wales Department of Health, Queensland Health, South Australian Department of Human Services, Victorian Department of Human Services and Western Australian Health Department. The questions used to define 'ever asthma' and 'current asthma' in these surveys is shown in Table A1.1.

A1.7 Medicare Benefits Schedule (MBS) statistics

Medicare Australia provides statistics on the claims submitted to and paid by the MBS. These include items claimed by general practitioners, doctors and specialists in the community.

A1.7.1 Practive Incentives Program Asthma Cycle of Care (formerly the Asthma 3+ Visit Plan)

Data from Medicare Australia were obtained for the Practice Incentives Program (PIP) Asthma Cycle of Care /Asthma 3+ Visit Plan. Online interactive data reports were accessed at: <http://www.medicareaustralia.gov.au/statistics/mbs_item.shtml> and collated by time period. On 1 November 2006, the PIP Asthma Cycle of Care was introduced to replace the Asthma 3+ Visit Plan, which had been in operation since November 2001. The initiatives, both funded by the Australian Government, were introduced to recognise the key role general practice plays in the monitoring and management of asthma and encourage a structured approach to diagnosis, assessment and management of patients with moderate or severe asthma in general practice (DoHA 2001). The PIP item numbers that were analysed for this report were 2546–2559 and 2664–2677. These items can only be claimed when the requirements of the Asthma Cycle of Care have been met for an individual patient. In other words, the items can only be claimed when two visits have been completed within one year.

More detailed data on the Asthma Cycle of Care were obtained directly from the MBS Policy Development Branch/Medical Benefits Division, DoHA. In particular, this allowed the analysis of claims by socioeconomic status and remoteness of residence.

A1.8 Medication data

A1.8.1 IMS Health pharmaceutical data

Data on sales of pharmaceutical products into the Australian market are collected and provided by IMS Health Australia. The value of these data is that they reflect supply (and, hence, purchases) of specific medications. As many of these medications are sold without prescription or are below the PBS subsidy threshold, equivalent data are not available through the PBS.

We have calculated the annual aggregate number of packs (sale units) distributed each year for each product relevant to the treatment of asthma for the period January 1996 to December 2006. Parenteral forms were excluded. Data reflect sales from major manufacturers and wholesalers operating in Australia. Usage, measured in units of defined daily doses (DDDs) per 1,000 persons per day, was calculated according to methods presented in Section A1.8.3.

Limitations of IMS data

The nature of the IMS data is that they contain no information on the characteristics of the purchasers or consumers. As most of the drugs used by people with asthma are also commonly used by people with COPD, it is not possible to directly ascribe the trends and differentials observed in these data to the population with asthma. Furthermore, socioeconomic and geographical trends and differentials in the utilisations of drugs cannot be assessed using these data.

A1.8.2 Pharmaceutical Benefits Scheme and Repatriation Pharmaceutical Benefits Scheme data

Since early 2002, prescriptions recorded in the Pharmaceutical Benefit Scheme (PBS) database have included the patients' Medicare numbers. Use of the Medicare number has created the ability to anonymously identify prescriptions for the same individuals within the PBS data and also to link information on age, sex and home postcode. This is done using an encrypted Medicare patient identification number (PIN) so that patient confidentiality is protected.

The ACAM has obtained these data from the DoHA for people who were prescribed asthma medications during the period July 2002 to May 2007. In this report, the ACAM has used these newly available PBS data to investigate the patterns of use of asthma medication by Australians.

These data were then used to calculate the defined daily doses (DDDs) per 1,000 persons per day for each PBS item using the methods described in Section A1.8.3.

Limitations of PBS and RPBS data

Most respiratory medications are subsidised under the PBS and the RPBS. However, some 'reliever' medications are frequently purchased without prescription (over-the-counter) and, when purchased on prescription, cost less than the minimum subsidy for general patients. These drugs do attract a subsidy when purchased on prescription by health-care card holders or pensioners. Leukotriene receptor antagonists only attract a PBS/RPBS subsidy when prescribed for children. Hence, for some medications the PBS/RPBS data only record purchase by a section of the Australian population and substantially underestimate total usage.

The PBS does not collect any information on the underlying disease or the reasons for prescribing. Thus, there is no way of identifying whether a patient using these medications has asthma, COPD or an acute respiratory infection.

The patient copayment increases yearly. Prescriptions that were dispensed for some medications that are below the threshold do not get recorded in the PBS database. The following table (Table A1.7) shows the yearly status (from 2002–2006) of some inhaled corticosteroids and long-acting beta-agonists medications, that is, if they were above or below the copayment threshold, and whether or not they were included in the PBS schedule in a particular year.

Table A1.7: Inhaled corticosteroids and long-acting beta-agonists items in the PBS (2003–2006)

Medication (ATC code)	PBS item code	Proprietary name	2003	2004	2005	2006
Inhaled corticosteroids						
Beclomethasone dipropionate (R03BA01)	8406K	Qvar 50 pMDI	<	<	<	<
	8407L	Qvar 100 pMDI	✓	✓	✓	✓
	8408M	Qvar 50 Autohaler	✓	✓	<	<
	8409N	Qvar 100 Autohaler	✓	✓	✓	✓
Budesonide (R03BA02)	2065Q	Pulmicort 0.5 Respules	✓	✓	✓	✓
	2066R	Pulmicort 1.0 Respules	✓	✓	✓	✓
	2070Y	Pulmicort 100 Turbuhaler	<	<	<	<
	2071B	Pulmicort 200 Turbuhaler	✓	✓	✓	✓
	2072C	Pulmicort 400 Turbuhaler	✓	✓	✓	✓
Fluticasone (R03BA05)	8147T	Flixotide jnr 100 Accuhaler	<	<	<	<
	8148W	Flixotide 250 Accuhaler	✓	✓	✓	<
	8149X	Flixotide 500 Accuhaler	✓	✓	✓	✓
	8345F	Flixotide 125 pMDI	✓	✓	✓	<
	8346G	Flixotide 250 pMDI	✓	✓	✓	✓
	8516F	Flixotide jnr 50 pMDI	<	<	<	<
Ciclesonide (R03BA08)	8853Y	Alvesco 80 pMDI	–	–	<	<
	8854B	Alvesco 160 pMDI	–	–	✓	✓
Long-acting beta-agonists						
Salmeterol (R03AC12)	3027H	Serevent 25 Accuhaler	✓	✓	✓	✓
	8141L	Serevent 50 Accuhaler	✓	✓	✓	✓
Eformoterol (R03AC13)	8136F	Foradile 12 Handyhaler	✓	✓	✓	✓
	8239P	Oxis 6 Turbuhaler	✓	✓	<	<
	8240Q	Oxis 12 Turbuhaler	✓	✓	✓	✓
Patient copayment for the year		**No concession**	**$23.10**	**$23.70**	**$28.60**	**$29.50**
		Concession card	**$3.70**	**$3.80**	**$4.60**	**$4.70**

– not included in the PBS schedule

< dispensed price is less than the co-payment for those without a concession card. Therefore, only prescriptions purchased with a concession card are captured in the database.

✓ dispensed price is greater than or equal to the co-payment for those without a concession card. Therefore all prescriptions, regardless of concession card possession, are captured in the database.

Note: PBS = Pharmaceutical Benefits Scheme; ATC = Anatomical Therapeutic Chemical Classification System; pMDI = pressurised metered dose inhaler.

Source: DoHA 2006.

A1.8.3 Calculation of defined daily dose per 1,000 population per day

Medication usage, measured as defined daily doses (DDDs) per 1,000 people per day (DDD/1,000/day) is used in this report to compare respiratory drug sales and reimbursed prescriptions dispensed over time and across drug groups where information about actual drug consumption is not available. The information in this report is based on unpublished data prepared and supplied by IMS Health Australia and published data from the PBS and RPBS item reports calculated at the Medicare Australia website.

For each medication, the relevant DDD was obtained from the website of the World Health Organization Collaborating Centre for Drug Statistics Methodology (<http://www.whocc.no/atcddd>) (see Table A1.8). The DDD is defined as 'the assumed average maintenance dose per day for a drug used for its main indication in adults'. The DDD is used internationally as a unit of measurement for drug utilisation studies. Each medication pack or sale unit (for IMS Health data) or maximum quantity dispensed (for PBS or RPBS items) is converted to a number of DDDs per unit or item.

For each of these items, the DDD per 1,000 persons per day (DoHA 2004) is then calculated using the following formula:

$$\text{DDD/1,000 persons/day} = \frac{N \times M \times Q \times 1{,}000}{\text{DDD} \times P \times D}$$

where

- N = total number of subsidised prescriptions dispensed per year (Medicare Australia data) or total number of items sold per year (IMS Health data)
- M = mass of each dosage unit (e.g. mg per tablet or mcg per inhaler dose)
- Q = total number of dosage units dispensed per prescription or sold unit
- P = mid-year Australian population (ABS mid-year population estimates) for year of data collection
- D = number of days in the year

The DDD/1,000 persons/day for individual medications are then summed across the members of each class of medications to estimate the total number of DDD/1,000 persons/day for each class. Combined medications contribute DDDs to both classes of medications they contain.

Table A1.8: Classification of respiratory medications

Category	Medications included	DDDs / formulation
Short-acting beta-agonists	Fenoterol	0.6 mg Inhalation aerosol
		0.6 mg Inhalation powder
		4 mg Inhalation solution
	Orciprenaline	60 mg Oral
	Salbutamol	0.8 mg Inhalation aerosol
		0.8 mg Inhalation powder
		10 mg Inhalation solution
	Terbutaline	2 mg Inhalation aerosol
		2 mg Inhalation powder
		20 mg Inhalation solution
Long-acting beta-agonists	Salmeterol	0.1 mg Inhalation aerosol
		0.1 mg Inhalation powder
	(e)Formoterol	24 mcg Inhalation aerosol
		24 mcg Inhalation powder
Short-acting anti-cholinergics	Ipratropium	0.12 mg Inhalation aerosol
		0.12 mg Inhalation powder
		0.3 mg Inhalation solution
Long-acting anti-cholinergics	Tiotropium bromide	18 mcg Inhalation powder
Cromones	Cromoglycate	40 mg Inhalation aerosol
		80 mg Inhalation powder
		80 mg Inhalation solution
	Nedocromil	8 mg Inhalation aerosol
Inhaled corticosteroids	Beclomethasone	0.8 mg Inhalation aerosol
		0.8 mg Inhalation powder
		1.5 mg Inhalation solution
	Budesonide	0.8 mg Inhalation aerosol
		0.8 mg Inhalation powder
		1.5 mg Inhalation solution
	Fluticasone	0.6 mg Inhalation aerosol
		0.6 mg Inhalation powder
		1.5 mg Inhalation solution
Xanthines	Theophylline	0.4 g Oral
	Choline theophyllinate	0.6 g Oral
Leukotriene receptor antagonists	Montelukast	10 mg Oral
	Zafirlukast	40 mg Oral

Note: DDD = defined daily dose.
Source: WHO 2003.

A1.9 Hospital data

The National Hospital Morbidity Database (NHMD) contains data on episodes of care for patients admitted to hospital, including demographic, procedural and length of stay information. Each of the states and territories collect data for hospital separations and provide a specified subset of these data to AIHW for inclusion in the NHMD. The data are organised in financial year periods. Whilst the data set contains details of principal and additional diagnoses, in this report data relate to the principal diagnosis only, unless otherwise stated.

When analysing hospital data by state and territory, we have used the state of the institution (hospital) rather than the state of residence.

A1.9.1 Limitations of the National Hospital Morbidity Database

There are a number of issues affecting the reliability and validity of hospitalisations attributed to asthma. In particular, the reliability of coding of hospital separations will be influenced by variation in the propensity of attending medical practitioners to diagnose and label patients as having asthma. There has been no recent validation of the coding of diagnosis of asthma during hospital admissions in Australia. International evidence suggests that diagnostic coding of asthma is reasonably accurate in children and younger adults (Krueger et al. 2001; Osborne et al. 1992), but this accuracy decreases with age (Osborne et al. 1992).

A1.9.2 Hospital diagnosis codes

Hospital diagnosis is classified according to the principal diagnosis and was coded using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM), for hospital separations from 1993 to 1997, and the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM), for separations from 1998 onwards. A principal diagnosis is the diagnosis chiefly responsible for the episode of hospital care. Comparability factors were also applied to data on hospital separations before 1998, which were coded under ICD-9, to enable comparison with more recent data coded using ICD-10 (see Section A1.9.3).

A1.9.3 Comparability factors for hospitalisation data

Table A1.9 shows the age-group specific comparability factors calculated by the AIHW for converting ICD-9-CM to ICD-10-AM (AIHW, unpublished data).

Table A1.9: Comparability factors for hospital separations for asthma

Age group	Conversion factor
5–34 years	1.0326
35–64 years	0.7938
65 years and over	0.4813

Source: AIHW, unpublished data.

A1.9.4 Definitions of comorbid conditions

To examine comorbidities among people hospitalised with a principal diagnosis of asthma (ICD-10-AM codes J45 and J46), we applied the following definitions.

Respiratory comorbidities were classified as an additional diagnosis of:

- acute upper respiratory infections (J00–J06);
- influenza or pneumonia (J09–J18);
- other acute lower respiratory infections (J20–J22);
- non-infectious upper respiratory conditions (J30–J39); or
- COPD or bronchiectasis (J40–J44, J47).

Other comorbidities were classified as an additional diagnosis of:

- diabetes mellitus (E10–E14);
- heart, stroke or vascular disease (I20–I25, I50, I60–I69, I70–I79);
- arthritis or osteoporosis (M00–M25, M80–M82);
- mental or behavioural disorders (F30–F39, F40–F48, F90–F98);
- malignant neoplasms (i.e. cancer) (C00–C97); or
- any other additional diagnosis except excluded diagnoses (see below).

We excluded the following conditions as additional diagnoses:

- pregnancy, childbirth and the puerperium (O00–O99)
- certain conditions originating in the perinatal period (P00–P96)
- symptoms ,signs and abnormal clinical and laboratory findings, not elsewhere classified (R00–R99)
- injury, poisoning and certain other consequences of external causes (S00–T98)
- external causes of morbidity and mortality (V01–Y98)
- factors influencing health statistics and contact with health services (Z00–Z99)
- codes for special purposes (U00–U99).

A1.9.5 Mechanical ventilation

The National Hospital Morbidity Database includes information relating to specific aspects of care, such as the use of mechanical ventilation. Invasive mechanical ventilation is a medical intervention used in situations where patients become unable to breathe by themselves. It involves the use of a positive pressure ventilator to maintain respiration via an endotracheal tube. This intervention is generally administered in hospital intensive care units (ICUs). The National Hospital Morbidity Database has collected data on the use of invasive mechanical ventilation since 1993–94. However, due to a change in the coding standards for invasive mechanical ventilation in 2000–01, only data for the period 2000–01 onwards have been analysed in this report.

The data presented in this report do not include episodes of non-invasive ventilation. Available data on non-invasive ventilation are incomplete and not suitable for analysis.

The procedure codes that have been included in these analyses are:

- ICD-10-AM
  - 13882-00—Management of continuous ventilatory support ≤24 hours
  - 13882-01—Management of continuous ventilatory support >24 hours–<96 hours
  - 13882-02—Management of continuous ventilatory support ≥96 hours
  - 13857-00—Continuous ventilatory support, initiation outside of ICU
  - 13879-00—Continuous ventilatory support, initiation in ICU
- ICD-9-AM
  - 96.70—Management of continuous ventilatory support ≤24 hours
  - 96.71—Management of continuous ventilatory support >24 hours – <96 hours; Continuous ventilatory support, initiation outside of ICU; Continuous ventilatory support, initiation in ICU
  - 96.72—Management of continuous ventilatory support ≥96 hours.

It should be noted that the data analysed for this section of the report are based on episodes and not individuals and, hence, may include multiple episodes for the same person.

Same-day separations are included in these analyses. There were 138 same-day separations for invasive mechanical ventilation between 2002–03 and 2006–07.

A1.10 Mortality data

Registration of deaths is the responsibility of individual state and territory Registrars of Births, Deaths and Marriages. Information on the cause of death is provided to the registrar by a medical practitioner certifying a death, or by the coroner to whom a death is reported. This information is, in turn, supplied to the Australian Bureau of Statistics (ABS) for coding cause of death and compilation into aggregated statistics. Death data from all states and territories are supplied by the ABS to the AIHW for the National Mortality Database. As the registration of deaths is a legal requirement in Australia, this data set is considered nearly complete, although there has been no formal validation of completeness. The ABS advises that Aboriginal and Torres Strait Islander Australians are probably under-enumerated in some states and territories.

Although data on multiple causes of death are available, death data throughout this report relate only to the underlying cause of death reported on each certificate.

A1.10.1 Limitations in mortality data

There are a number of issues affecting the reliability and validity of certification of deaths. The reliability of death certification can be influenced by variation in the propensity of attending medical practitioners to diagnose and label patients as dying from asthma. Validation studies of asthma deaths coded on death certificates reveal that adult deaths from asthma can be under-enumerated (Guite & Burney 1996; Hunt et al. 1993; Smyth et al. 1996) or over-enumerated (Jones et al. 1999; Sears et al. 1986; Sidenius et al. 2000). It is generally considered that asthma diagnosis is fairly unambiguous in people aged less than 45 years and data are, therefore, more reliable in these ages. However, a recent study has also demonstrated under-enumeration in children and young adults (Jorgensen et al. 2000). Generally, in older people the attribution of death to asthma, or alternatively to one of a range of illnesses with overlapping clinical features, is problematic and, therefore, the death data for asthma are less reliable in older people (Jones et al. 1999; Sidenius et al. 2000; Smyth et al. 1996). Changes in the classification scheme, or code, have a quantifiable impact on time trends in death data. However, the extent to which changes, over time, in diagnostic fashion affect death data are less well studied.

A1.10.2 Cause of death codes

The classification of asthma as the underlying cause of death was based on the ICD-9 for deaths from 1979 to 1997, and on ICD-10 for deaths from 1998 onwards (Table A1.10). Comparability factors were applied to data classified under ICD-9 to make the data comparable to that coded using ICD-10 (see Section A1.10.3).

Table A1.10: Disease codes

Classification	Codes used	Description
ICD-9	493.0	Extrinsic asthma
Code 493	493.1	Intrinsic asthma
	493.2	Chronic obstructive asthma
	493.9	Asthma, unspecified
ICD-10	J45.0	Predominantly allergic asthma
Codes J45 & J46	J45.1	Non-allergic asthma
	J45.8	Mixed asthma
	J45.9	Asthma, unspecified
	J46.0	Status asthmaticus

Note: ICD-9 and ICD-10 = International Classification of Diseases, 9th Revision and 10th Revision, respectively.

A1.10.3 Comparability factors for mortality data

Table A1.11 shows the age-group specific comparability factors calculated for converting number of asthma deaths from ICD-9 to ICD-10. The method for calculating these comparability factors has been described previously (ACAM 2003, Section A1.3).

Table A1.11: Comparability factors for asthma mortality data

Age group	Conversion factor
Less than 35 years	1.0 (i.e. no conversion)
35–64 years	0.84
65 years and over	0.68

A1.10.4 Definitions of comorbid conditions

To examine comorbidities among people whose underlying cause of death was asthma (ICD-10 codes J45 and J46), we applied the following definitions.

Respiratory comorbidities were classified as an associated cause of death of:

- acute upper respiratory infections (J00–J06)
- influenza and pneumonia (J09–J18)
- other acute lower respiratory infections (J20–J22)
- non-infectious upper respiratory conditions (J30–J39)
- COPD and bronchiectasis (J40–J44, J47).

Other comorbidities were classified as an associated cause of death of:

- diabetes mellitus (E10–E14)
- heart, stroke and vascular disease (I20–I25, I50, I60–I69, I70–I79)
- arthritis and osteoporosis (M00–M25, M80–M82)
- mental and behavioural disorders (F30–F39, F40–F48, F90–F98)
- malignant neoplasms (i.e. cancer) (C00–C97).

In the section where we have investigated asthma as an associated cause of death when other conditions were listed as the underlying cause of death, the analyses undertaken for this report were confined to seven main causes of death—cancer (C00–C97); diabetes mellitus (E10–E14); mental and behavioural disorders (F30–F39, F40–F48, F90–F98); heart, stroke and vascular disease (I20–I25, I60–I69, I50, I70–I79); influenza, pneumonia and other acute respiratory tract infections (J00–J06, J09–J22); COPD and bronchiectasis (J40–J44, J47); and arthritis and osteoporosis (M00–M25, M80–M82).

A1.11 Population data

This report uses population data sourced from the AIHW, which, in turn, are sourced from the ABS Demography section and are updated as revised or new estimates become available. All population estimates currently produced by the ABS are referred to as estimated resident populations.

Estimated resident populations are based on the 5-yearly Census of Population and Housing, to which three significant adjustments are made:

- All respondents in the census are placed in their state or territory, statistical local area and postcode of usual residence. Overseas visitors counted in the census are excluded.
- An adjustment is made for persons missed in the census (approximately 2%).
- Australians temporarily overseas on census night (these are not counted in the census) are added to the usual residence census count adjusted for undercount.

Estimated resident populations are then updated each year from the census date using indicators of population change, such as births, deaths and net migration. More information is available from the ABS website, <www.abs.gov.au>.

A1.12 Population groups

A1.12.1 Aboriginal and Torres Strait Islander Australians

'Indigenous Australians' refers to people who identify themselves as being of Aboriginal or Torres Strait Islander origin. It is important to identify health disadvantages, with respect to asthma, among Aboriginal and Torres Strait Islander Australians so that those issues can be addressed. It is also important to ensure an acceptable level of reliability and validity of the data that are used for this purpose. Data for Indigenous Australians are currently available via several collections, including the 5-yearly Census, other surveys conducted by the ABS, AIHW, state health departments and other agencies, and administrative data sets such as hospital statistics and mortality collections. However, data quality issues around the identification and enumeration of Indigenous Australians exist across the majority of these collections.

There have been substantial increases in the Indigenous Australian population between census collections that cannot be fully explained by natural increase (Ross 1999). The ABS has introduced an experimental methodology which attempts to account for the changing levels of 'unexplained growth'

in estimating and projecting the Indigenous population. Using this methodology, the ABS has produced consistent series of estimates of the Indigenous population from 1991 to 2009. For further information refer to ABS (2004).

It should be noted that the Indigenous populations used to estimate the 2006 population are based on projections from data from the 2001 ABS Census of Population and Housing. The estimated resident population used underestimates the actual estimated resident population of Indigenous persons as at June 2006 derived from the 2006 ABS Census of Population and Housing. For example, overall the Queensland Indigenous population is underestimated by almost 4 per cent, however, this varies by age group. The cohorts aged under 10 years and 60 years and older are likely to be underestimated by around 10 per cent.

Indigenous identification and the quality of Indigenous data have been improving over time in a number of data sets through efforts at all levels. Despite this, deficiencies in health data for Indigenous Australians continue to exist in the National Mortality Collection and the National Hospital Morbidity Database (NHMD). In 2000–01, all states and territories adopted a standard definition for use in the NHMD. However, currently for mortality data, only Queensland, Northern Territory, Western Australia and South Australia have relatively complete identification of Indigenous deaths (ABS 2005). For hospital morbidity data, the information provided for Indigenous status from the Northern Territory, South Australia, Queensland and Western Australia is considered acceptable from 1998–99 onwards; while from 2004–05 onwards, data from New South Wales and Victoria are also considered acceptable. There are likely to be variations in admission practices between jurisdictions and within jurisdictions. The data are not necessarily representative of the jurisdictions excluded.

Since 1995, the NHS has over-sampled in Indigenous Australian populations to enable more reliable estimates of their health status. The validity and reliability of other general population surveys (including the state CATI surveys) are less certain. Finally, a voluntary Indigenous identifier has been included recently on Medicare forms. This should help improve data about access to health services by Indigenous Australians.

As there is not the same quantity or quality of information about Aboriginal and Torres Strait Islander health as there is for non-Indigenous Australians, it has not been possible in many cases to provide the same level of information on the prevalence of asthma in Australia's Indigenous population or how this is being managed. However, the information about people living in remote regions and people who are socioeconomically disadvantaged may also be applicable to a large number of Indigenous Australians.

In this report, it was possible to make comparisons between Indigenous and non-Indigenous Australians based on data from the ABS 2004–05 National Aboriginal and Torres Strait Islander Health Survey. However, for mortality and hospital morbidity data, it was only possible to make comparisons between Indigenous and 'other Australians', where 'other Australians' included both non-Indigenous persons and persons for whom Indigenous status was not stated, unknown or inadequately described.

A1.12.2 Country of birth

Factors associated with cultural background may have an impact on health status. People whose first language is not English have been identified as population groups who are likely to experience disadvantage when seeking access to health and related services (ABS 1999). As such, it is necessary to describe the health status of people from different backgrounds. The term 'non-English-speaking background' has been used throughout this publication to describe people who have settled in Australia but who come from countries where English is not the primary language spoken.

The Department of Immigration and Multicultural and Indigenous Affairs (DIMIA) has developed a classification from 2001 census data, which places every country into one of four groups based on the relative English proficiency of recent arrivals to Australia (DIMIA 2003).

English-speaking background is defined as those people born in Australia, New Zealand, the United Kingdom, Ireland, the United States of America, Canada, Zimbabwe or South Africa, which corresponds to the DIMIA English proficiency countries in group 1. These are the main countries from which Australia receives overseas settlers who are likely to speak English. Non-English-speaking background is defined as those people whose country of birth was somewhere other than one of these eight countries. This corresponds to the DIMIA English proficiency countries in the remaining groups 2 to 4.

For the purposes of this report we have classified English-speaking and non-English-speaking countries as defined by DIMIA in their 2003 report where possible. For the analysis of the ABS 2004–05 NHS, it was not possible to include Zimbabwe in the English-speaking-background category because of the structure of the country of birth information in the Remote Access Data Laboratory and in the CURFs. Therefore, for Chapter 3 (Prevalence), Zimbabwe is included with non-English-speaking nations. Also for Figure 4.9, where we have analysed the number of deaths due to asthma per 100,000 people with asthma, Zimbabwe was included with non-English-speaking nations since the denominator population was derived from the 2004–05 NHS.

A1.12.3 Socioeconomic disadvantage

Findings from all over the globe continue to provide evidence that people living in socioeconomically disadvantaged localities experience poorer health outcomes than people living in relatively advantaged localities. The relationship is consistent for a range of chronic diseases, the list of which includes asthma. Socioeconomic status encompasses a range of contributing factors including education, income and occupation as well as race or ethnicity.

The Socio-economic Indexes for Areas (SEIFA) Index of Relative Socioeconomic Disadvantage (IRSD) is one of four indexes developed by the ABS to measure socioeconomic characteristics associated with geographical locations (ABS 2006e) based on information from the Australian census. Each index summarises information relating to a variety of social and economic characteristics associated with families and households, personal education qualifications and occupation.

This report uses the SEIFA index as it provides a summary score for a range of key socioeconomic variables that are related to health status, including household income and resources, education, occupation, fluency in English, and Indigenous status. The index is constructed so that relatively advantaged areas have high index values.

Individual records were classified into quintiles of socioeconomic disadvantage according to the SEIFA value associated with the statistical local area (SLA) of usual residence of the individual. Quintile 1 (SEIFA 1) includes the most disadvantaged households and quintile 5 (SEIFA 5) includes the least disadvantaged households.

It is important to note that the index reflects the relative disadvantage of all people living in an area, not an individual. Therefore, this measure probably underestimates the true inequality in health at the individual level.

A1.12.4 Urban, rural and remote areas

Access to health and education services plays an important role in the successful treatment and management of asthma. For the purposes of this report, urban, rural and remote areas have been identified using the Australian Standard Geographical Classification (ASGC) of remoteness.

ASGC categories of remoteness

The ASGC is based on the Accessibility/Remoteness Index of Australia (ARIA), which measures remoteness solely on the basis of geographical accessibility, and excludes urban/rural, socioeconomic and population size factors. This index can be applied to any location in Australia. It is based on physical geography, whereby locations are classified on the basis of their proximity (that is, the distance people must travel on a road network) to the nearest of 738 service centres, which differ in size and, hence, in the availability of education and health services. The centres with small populations generally have a limited choice of general practitioners, specialists and hospital care.

Values of remoteness for populated localities are calculated by measuring the shortest road distance between a locality and the nearest of each of five different categories of service centres. Each of the populated localities across Australia has been assigned an ARIA index score to assess their remoteness from goods, services and opportunities for social interaction. (For full methodology, see ABS 2001.)

Table A1.12: ABS classes of remoteness, by ASGC and their definition

ASGC classification	ARIA index score	Definition
Major Cities of Australia	0.0–0.2	Geographical distance imposes minimal restriction upon accessibility to the widest range of goods, services and opportunities for social interaction
Inner Regional Australia	>0.2–2.4	Geographic distance imposes some restriction upon accessibility to the widest range of goods, services and opportunities for social interaction
Outer Regional Australia	>2.40–5.92	Geographic distance imposes a moderate restriction upon accessibility to the widest range of goods, services and opportunities for social interaction
Remote Australia	>5.92–10.53	Geographic distance imposes a high restriction upon accessibility to the widest range of goods, services and opportunities for social interaction
Very Remote Australia	>10.53–15.00	Locationally disadvantaged. Geographic distance imposes the highest restriction upon accessibility to the widest range of goods, services and opportunities for social interaction

Note: ABS = Australian Bureau of Statistics; ASGC = Australian Standard Geographical Classification; ARIA = Accessibility/Remoteness Index of Austalia.

This report examines data for the five ASGC/ARIA classes where these data are available. However, in some instances, the three broader areas of major cities, inner regional and outer regional or remote areas have been used where cell sizes are too small for accurate estimation in the more detailed classification.