Asthma and chronic obstructive pulmonary disease among older people in Australia

Deaths and hospitalisations

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Any enquiries about or comments on this publication should be directed to:

Australian Centre for Asthma Monitoring
Woolcock Institute of Medical Research
GPO Box M77
Missenden Road
Camperdown NSW 2050
Phone: (02) 9515 5160 (International +61 2 9515 5160)
Email: acam@asthmamonitoring.org

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Abbreviations

ABS	Australian Bureau of Statistics
ACAM	Australian Centre for Asthma Monitoring
ACS	Automated coding system
AIHW	Australian Institute of Health and Welfare
COPD	Chronic obstructive pulmonary disease
CT	Computerised tomography
ICD-9	International Classification of Diseases, 9th revision
ICD-10	International Classification of Diseases, 10th revision
ICD-10-AM	International Classification of Diseases, 10th revision, Australian modification
MCD	Multiple cause of death
RR	Rate ratio
UCD	Underlying cause of death

Highlights

Asthma and chronic obstructive pulmonary disease (COPD) can together be described as obstructive lung disease. Among people aged 55 years and over, obstructive lung disease is frequently listed as an associated cause of death or as an additional diagnosis among those hospitalised. Conventionally, information about deaths and hospitalisations refer to the underlying cause of death and principal hospital diagnosis. However, examining obstructive lung disease when it is recorded in other data fields provides an additional perspective to that obtained from the usual analyses.

This report examines recent deaths and hospitalisations data among people aged 55 years and over. Its main findings are that:

- Asthma was recorded on the death certificate as one of multiple causes of death nearly four times more often than it was identified as the underlying cause. Asthma was also recorded as one of multiple diagnoses in hospitalised patients three times more often than it was recorded as the principal diagnosis. For COPD, the number of deaths and hospitalisations doubled when multiple causes and diagnoses were included in the respective analyses. The involvement of obstructive lung disease in deaths and hospitalisations might be underestimated in conventional analyses that are based solely on underlying cause of death and principal diagnosis.
- Although hospitalisations due to COPD have changed little in recent years, hospitalisations due to asthma have steadily declined. The validity of this observation is supported by the finding that a declining trend in hospitalisations for asthma has also been seen among younger individuals, in whom misclassification with COPD is unlikely.
- Those who die or are hospitalised with obstructive lung disease are more likely to also have respiratory infections or heart failure than those without obstructive lung disease.
- Those dying or hospitalised with COPD are also more likely than those without COPD to have other smoking-related illnesses, such as lung cancer, while those dying or hospitalised with asthma are more likely to have musculoskeletal problems. This latter finding may be related to steroid-induced osteoporosis associated with the use of inhaled corticosteroids to manage asthma.
- Asthma is associated with depression or anxiety in both deaths and hospitalisations.

1 Introduction

The relation between asthma and COPD in the elderly

Asthma is a National Health Priority Area in Australia. It is a chronic respiratory condition characterised by the presence of widespread, variable airflow obstruction, airway inflammation and the respiratory symptoms that accompany this. Asthma in older people typically manifests as symptoms of shortness of breath, wheeze, chest tightness and cough, as in other age groups. However, these symptoms are not specific to asthma and particular problems arise in distinguishing asthma from certain other conditions among older people.

Chronic obstructive pulmonary disease (COPD) is also a serious, long-term respiratory disease that mainly affects older people who have been exposed to tobacco smoke. It is characterised by airflow obstruction and the respiratory symptoms that accompany this. Typically, the airflow obstruction in COPD is not highly variable and is largely irreversible. The disease that underlies COPD in most cases is emphysema, which involves destruction of the lung air sacs, making the lungs excessively floppy, and also scarring and obstruction of the small airways. People with this illness experience progressive shortness of breath on exertion.

Among older people, COPD and asthma can be difficult to distinguish as both conditions have similar manifestations despite very different causes and underlying pathologies. While these diagnoses can be distinguished by investigation, in particular detailed respiratory function tests and high resolution CT scans, these tests are not commonly performed in practice or in general health surveys. The major justification for distinguishing them in clinical practice would be to prescribe alternative management. However, the approaches to treatment of these conditions have tended to converge in recent years. In particular, inhaled corticosteroids, for many years the cornerstone of therapy for asthma, have been shown to reduce exacerbations (Burge et al. 2000) and prevent deaths (Sin et al. 2005) in people with moderate or severe COPD and are now widely recommended for this condition (Global Initiative for Chronic Obstructive Lung Disease 2005). There is also evidence that self-management, which has been an important element of asthma control strategies, can also have benefits for patients with COPD (Gadoury et al. 2005). Smoking cessation advice (Riemsma et al. 2003) is an important element of the medical management of patients with COPD who continue to smoke (Godtfredsen et al. 2002). However, there are health benefits from smoking cessation for all smokers, including those with asthma (Thomson & Spears 2005).

Deaths attributed to asthma have been decreasing in all age groups since the mid-1980s and hospital admissions, as well as length of stay, have been decreasing since the late-1990s. Approximately two-thirds of deaths that were attributed to asthma in Australia in 2003 occurred among people aged 65 years and over (ACAM 2005). Among adults, hospitalisation rates for asthma are also highest among people aged 65 years and over (ACAM 2005). However, the problems in identifying older people with asthma in clinical practice also affect the estimates of deaths and hospitalisations attributed to asthma in these age groups.

Hence, although there are some ways of distinguishing older persons with typical asthma from older persons with typical COPD, there is substantial overlap both in clinical manifestations and in the approach to disease management. For this reason it is appropriate to consider the diseases collectively, as obstructive airway diseases in older persons.

This overlap and convergence of asthma and COPD among older persons has important implications for the interpretation of mortality and health care utilisation data, in which events are classified as being attributable to one or the other of these two conditions. Furthermore, previous analyses of death data have been limited to examining the underlying cause of death and most analyses of hospitalisation data have been based on the principal diagnosis (see Box 1.1). Potentially, this could underestimate the full impact of obstructive airway diseases as a reason for hospitalisations and deaths when these are not coded as an underlying cause of death or the principal diagnosis but appear as another cause or diagnosis.

In recent years, mortality data in Australia have included information on all causes of death recorded on death certificates. Hospitalisation data also include additional diagnoses that were relevant to the episode of care. Hence there is the opportunity to utilise this additional information for examining whether there are broader impacts of asthma and COPD, the relationships between them and the potential for diagnostic confusion between these diseases.

In addition, the availability of these multiple cause and diagnosis data afford the opportunity to investigate other diseases and how these interact with asthma and COPD. In this way, these additional data can allow us to gain a better understanding of more complex patterns of mortality and morbidity, particularly in the elderly who have long-term conditions which often lead to increased risk of developing other conditions (ABS 2003).

In this report we present analyses of deaths and hospitalisations in Australia where asthma or COPD were one of multiple diseases or conditions recorded. We have used all available information on diseases or conditions in mortality data since 1997 and hospitalisation data since 1999.

Box 1.1: Terminology used in this report

Mortality

Underlying cause of death (UCD)	*The disease or injury which initiated the morbid train of events which led to death. This will be the cause of death recorded in Part I of the death certificate for which there are no other antecedent causes of death. There must always be an underlying cause. If only one cause is listed in Part I of the death certificate, then this will be the underlying cause.*
Associated cause of death	*Any cause listed on the death certificate other than the underlying cause (ABS 2003). This includes diseases listed in Part I or Part II of the death certificate.*
Multiple cause of death (MCD)	*All morbid conditions, diseases and injuries entered on the death certificate (either in Part I or Part II). These include those involved in the morbid train of events leading to death which were classified as either the underlying cause, the immediate cause, or any intervening causes and those conditions which contributed to the death, but were not related to the disease or condition causing death (ABS 2003). For example, 'asthma' as a 'multiple cause' would refer to all instances in which asthma is listed somewhere on the death certificate.*
Immediate cause of death	*This is the condition listed on Part I line (a) of the death certificate. It can also be the underlying cause if that is the only disease or condition listed above the line.*
Antecedent cause	*Any disease or condition, recorded in Part I of the death certificate, that gave rise to another disease or condition in the morbid train of events leading to death.*
Contributory condition/ Other significant condition/ Condition in Part II/ Condition below the line	*These are all terms used to describe conditions or diseases that are listed in Part II of the death certificate.*

Hospitalisation

Hospital separation/ Separation	*The formal process by which a hospital records the completion of treatment and/or care for an admitted patient. The episode of care may be completed by an admitted patient's discharge, death, transfer to another hospital or change in the type of care.*
Principal diagnosis	*The diagnosis established to be chiefly responsible for occasioning the episode of care or attendance at a health care facility.*
Additional diagnosis	*A further condition or complaint, whether coexisting with the principal diagnosis or arising during the episode of care or attendance at a health care facility.*
Any diagnosis	*All diagnoses included in the hospital separation record, therefore including the principal diagnosis and any additional diagnoses.*

Other terminology

Attributed to [a disease or condition]	*Indicates that the disease or condition was the underlying cause of death or principal diagnosis in a hospital separation.*
Involving [a disease or condition]	*Indicates that the disease or condition was either the underlying or an associated cause of death, or the principal or an additional hospital diagnosis.*

Objectives

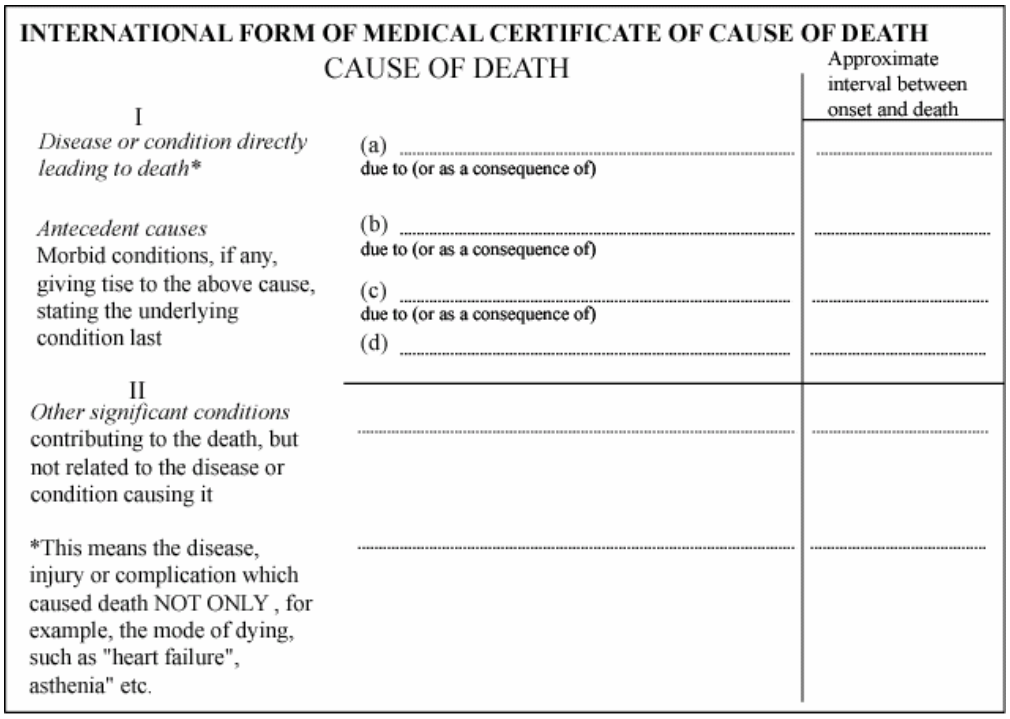
- To assess the potential under-estimation of the involvement of asthma and COPD in deaths and hospitalisations that occurs when analyses are limited to the underlying cause of death and principal diagnosis among people aged 55 years and over.
- To assess the extent to which misclassification or variation in classification between asthma and COPD among older people may influence observed time trends in asthma deaths and hospitalisations.
- To identify the major co-morbidities observed among older patients dying or hospitalised with asthma or COPD.

Cause of death data in Australia

In Australia, deaths are compiled by the Australian Bureau of Statistics (ABS) and held in the National Mortality Database. Before 1997, Australian death data were only available for underlying cause of death (UCD); that is, the disease or condition that is considered to have initiated the train of morbid events that led directly to the death (Box 1.1). Since 1997, multiple cause of death (MCD) data have been compiled by the ABS. These data contain more information from death certificates including the other conditions or diseases that were considered to be antecedent and associated causes of death (ABS 2003).

Death certification process

To understand cause of death data, we first need to clarify the process by which cause of death is assigned during death certification. The cause of death section of the death certificate has two parts (see Figure 1.1). Part I, which is often also referred to as 'above the line', includes the disease that directly led to death and its antecedent causes. Part II, also referred to as 'below the line', includes any other significant conditions that contributed to the death but were not directly related to the disease or condition causing death.



INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

CAUSE OF DEATH

		Approximate interval between onset and death
I *Disease or condition directly leading to death**	(a) ..... due to (or as a consequence of)	.....
Antecedent causes Morbid conditions, if any, giving tise to the above cause, stating the underlying condition last	(b) ..... due to (or as a consequence of) (c) ..... due to (or as a consequence of) (d)	....
II *Other significant conditions* contributing to the death, but not related to the disease or condition causing it	.....	.....
*This means the disease, injury or complication which caused death NOT ONLY , for example, the mode of dying, such as "heart failure", asthenia" etc.	.....	.....

Figure 1.1: Death certificate used in Australia

The immediate cause of death (that is, the disease or condition which led directly to death) should be entered on Part I, line (a). If the direct cause of death on Part I, line (a) was due to, or arose as a consequence of, another disease, this condition should be entered on Part I, line (b). If this condition was due to a third condition or disease, then this third condition should be reported on Part I, line (c). Similarly, a condition antecedent to the condition reported on Part I, line (c) should be reported on Part I, line (d). Any additional conditions that relate to the cause of death are entered on Part I, line (d). The underlying cause of death is the condition for which there are no further antecedent causes of death reported, and as such will be on the lowest line completed in Part I. All conditions other than the underlying cause of death in Parts I and II are recorded as associated causes.

For example, a direct cause of death may be 'respiratory failure' recorded on line (a), the antecedent cause of this may be 'Viral exacerbation of asthma, 3 days' recorded on line (b) which in turn may have occurred as a result of 'Asthma, 50 years' recorded on line (c). As such, the underlying cause of such a death would be 'Asthma'. The presence of ischaemic heart disease for the past 10 years may have been another significant condition that contributed to the death but was not related to the underlying cause and recorded in Part II.

Comparability of death data over time

Comparability of mortality data over time is affected by how data are collected, processed and classified. In recent years, there have been two major changes to the way mortality data are processed and classified. First, since 1997, deaths data have been processed using an automated coding system (ACS) and second, also from 1997, the classification used to code causes of death was changed to the International Classification of Diseases, revision 10 (ICD-10).

Before this, between 1979 and 1996, a manual processing system and the International Classification of Diseases, revision 9 (ICD-9) were used. With the introduction of ACS and ICD-10, MCD data became available in electronic form. However, the introduction of two changes simultaneously means that the impacts of the changes individually cannot be assessed. For instance, it is not possible to assess the impact of ICD-10 on the coding of associated causes of death because MCD data using ICD-9 are not available. It has been shown that the introduction of ICD-10 did have a substantial impact on reported rates of death attributed to asthma as the underlying cause in older age groups (Baker et al. 2004). Therefore, it is plausible that this change has also had an impact on the coding of asthma as a multiple cause of death.

Data quality issues

Death rates for asthma may change due to changes in disease prevalence, the patterns of disease severity and how the condition is treated (Jalaludin et al. 1999). However, they may also alter in response to changes in other factors including diagnostic practices; how deaths are recorded on death certificates; and coding systems to assign the causes of the condition (Beasley et al. 1999) (Figure 1.2). There is evidence that the specificity of attribution of death to asthma is very poor among older persons (Campbell et al. 1992; Sidenius et al. 2000).

As described above, the distinction between asthma and COPD is uncertain in some cases and sometimes other respiratory and cardiovascular conditions may also mimic these disorders. This problem is particularly important among people aged 55 years and over. This uncertainty allows the potential for variation among health practitioners in how they apply these diagnostic labels on death certificates (Guite & Burney 1996; Smyth et al. 1996).

Studies that code a sample of deaths in the same year, using both the previous and new classification systems, provide information to allow interpretation of the effect of these changes on reported event rates. However, the impact of changes in diagnostic practice is more difficult to assess and may require the use of expert panels to review the accuracy of death certification.

The most recent studies on the accuracy of death certificates in Australia in assigning asthma as a cause of death occurred in the late 1980s and early 1990s (Campbell et al. 1992; Jenkins et al. 1992). These studies assessed deaths where asthma was assigned as an underlying cause or an associated cause and found that, with increasing age at death, mortality attributed to asthma was overestimated.

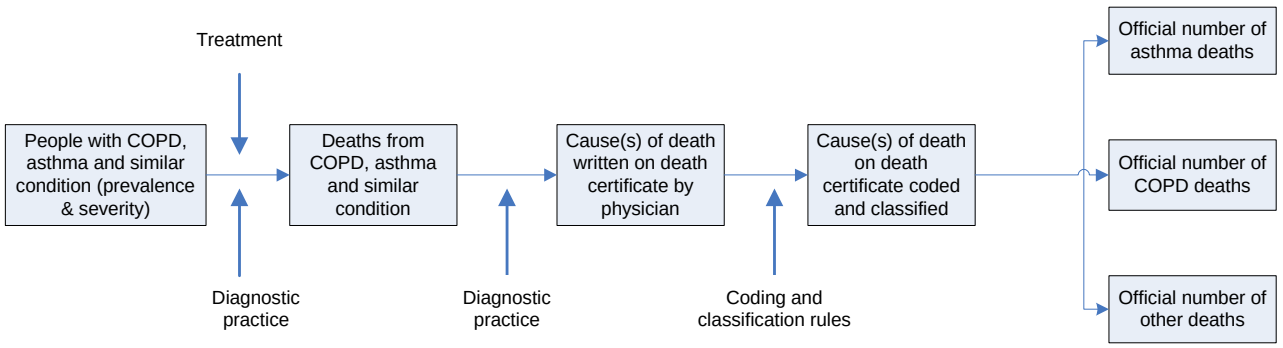


Figure 1.2: Factors affecting death certificate coding

Similar studies in Europe and the United States revealed variable accuracy (36% to 84%) among countries, age groups and years. Studies comparing accuracy between age groups found that accuracy decreases with increasing age of the decedent (Campbell et al. 1992; Jorgensen et al. 2000; Sears et al. 1986; Sidenius et al. 2000) and the accuracy of certification of asthma as the underlying cause of death approaches 100% in people aged less than 35 years (Sidenius et al. 2000). In older patients, deaths wrongly classified as asthma could often be attributed to other forms of respiratory disease, especially COPD, and in some cases cardiovascular disease (Smyth et al. 1996). However, a low level of accuracy (38%) has also been reported among children aged 1 to 4 years where the diagnosis may be complicated by other respiratory conditions, particularly respiratory infections (Jorgensen et al. 2000).

Thus, the quality of asthma and COPD data may be compromised by changes in diagnostic practice and classification and coding, particularly in older age groups. As the overall number of deaths in older age groups attributed to COPD is much greater than for asthma (AIHW 2004), misclassification between these two diseases would potentially have a greater impact on the estimates of deaths attributed to asthma than those attributed to COPD.

Hospitalisation data in Australia

In Australia, records of all hospital separations are compiled nationally in the National Hospital Morbidity Database. The term 'hospital separation' refers to the formal process by which a hospital records the completion of treatment or care for an admitted patient (see Box 1.1). For the purposes of this report, hospital separations will also be referred to as 'hospitalisations'.

While each individual can only die once, it is possible for an individual to have several episodes of hospitalisation. Hence, in contrast to the National Mortality Database, in which each record refers to one individual, each record in the National Hospital Morbidity Database refers to an episode of hospitalisation, and people who were hospitalised more than once contribute more than one record to the database. This lack of independence between individual events recorded in the database has implications for the interpretation of these data. For example, we would expect a tendency for diagnostic labels to track within the same individual over successive episodes of hospitalisation. This should be considered when interpreting these data and particularly when comparing hospitalisation and mortality data.

Hospital diagnosis coding in Australia

In order to interpret hospitalisation statistics, it is important to understand the process by which hospital diagnoses are coded. Each hospitalisation record includes the principal diagnosis, which is the condition designated as the chief reason for the hospitalisation event. This diagnosis is obtained from the hospital medical record following the hospital separation and coded by professional coders at the hospital clinical information (medical records) department. Additional diagnoses may similarly be recorded. These are defined as conditions that coexist with the principal diagnosis for the hospitalisation. According to the *National health data dictionary* (National Health Data Committee 2003), additional diagnoses should be included on the basis of being conditions that require continuing clinical evaluation or monitoring and/or necessitate additional nursing care during the hospitalisation. Conditions that relate to an earlier episode of care and had no bearing on patient management during the current episode should not be included as additional diagnoses. Hence, the basis for determining whether a condition should be recorded as an

additional diagnosis for a given hospitalisation depends on (1) how and where in the medical record the diagnoses are recorded and (2) whether that documentation is judged by the clinical coder to meet the criteria for additional diagnosis according to the Australian Coding Standards.

Comparability of hospitalisation data over time

All hospital diagnoses in Australia have been coded using ICD-10-AM since 1998. In July 2000, ICD-10-AM second edition was released. With each edition of ICD-10-AM, guidelines were provided to coders. In particular, these guidelines included details regarding the instances in which a condition should be recorded as an additional diagnosis. With the release of ICD-10-AM second edition, the guidelines for coding additional diagnoses were clarified to reduce 'overcoding'. These guidelines emphasised that additional diagnoses should be coded only when they met the criteria for being conditions that were significant in the episode of care. This was implemented to prevent the coding of conditions that were not significant in terms of treatment, diagnostic procedures or increased nursing care and/or monitoring (National Centre for Classification in Health 2005). In 2005, the National Centres for Classification in Health, who were responsible for the revised guidelines, carried out a time series analysis to assess the impact of the revisions on the coding of additional diagnoses (National Centre for Classification in Health 2005). This analysis identified a number of conditions for which the rate of coding as additional diagnoses had substantially declined following the introduction of ICD-10-AM second edition. Generally, these decreases were greatest in the year immediately after the release of the second edition. However, there were further decreases in subsequent years. Among the conditions identified were asthma (ICD-10-AM J45 or J46) and chronic obstructive pulmonary disease (ICD-10-AM J44 only). This study reported that asthma diagnoses reduced by 68% between 1999–2000 and 2002–03 and the direction of change was consistent across all states, although the magnitude was greater in New South Wales, Queensland, South Australia and Victoria. In the same period, chronic obstructive airways disease reduced by 47% consistently across most states, although there was a slight increase in the Northern Territory.

These findings suggest that the recording of additional diagnoses has changed over time since the introduction of revised guidelines with ICD-10-AM second edition from July 2000. The largest change occurred immediately after the release of the second edition, however further decreases continued in subsequent years. Since there was no dual coding—that is, coding using both the old and new systems—it is not possible to establish with certainty whether the observed changes are the result of real changes in hospitalisation rates or are an artefact introduced by the coding change.

2 Methods

Data sources

Deaths

The data on deaths in Australia used in this report were obtained from the National Mortality Database. This database is held at the Australian Institute of Health and Welfare (AIHW) and comprises annual death records from the State Registrars of 'Births, Deaths & Marriages'. These data are supplied to the AIHW each year by the Australian Bureau of Statistics (ABS) following the release of its annual publication of Australian death statistics.

Since 1997, multiple cause of death data have been compiled for Australia by the ABS. Both the underlying and associated causes of death recorded in these data have been coded using the International Classification of Diseases revision 10 (ICD-10). In this report we analysed multiple cause of death data for two conditions, asthma (ICD-10: J45–J46) and COPD, including chronic bronchitis, emphysema and bronchiectasis (ICD-10: J40–J44, J47), for all people aged 55 years and older for the years 1997 to 2003.

Hospitalisations

Data on hospitalisations were obtained from the National Hospital Morbidity Database, which is held at the AIHW. The National Hospital Morbidity Database is a collection of confidentialised summary records for episodes of care in public and private hospitals in Australia. Selected variables from state and territory hospital separation data are forwarded to the AIHW and are included in the National Hospital Morbidity Database. These variables include basic demographic information of the patient, principal and additional diagnoses codes and other information relating to care and treatment during the hospitalisation.

In this report, we have analysed multiple diagnoses in hospitalisations data for the two conditions asthma (ICD10-AM codes J45 and J46) and COPD (including chronic bronchitis, emphysema and bronchiectasis (ICD10-AM codes J40–J44 and J47)) among all people aged 55 years and older. These data were obtained from 1999–00 to 2003–04, which represented the first year in which ICD-10-AM was used nationally until the most recent year available.

In this report, we have confined analyses of additional diagnoses data to the most recent available year (2003–04) to minimise the effect of changes to the coding guidelines that came into effect from July 2000. The exception to this limitation is the time series analysis, in which we have used additional diagnosis data from 1999–00 to 2003–04 (see 'Comparability of hospitalisation data over time' in Section 1 for further explanation).

Data analysis

The ABS has published information to guide researchers on the most appropriate methods for analysis of multiple cause of death data (ABS 2003). We have adopted some of these approaches in this report for the analysis of multiple causes of death as described below.

Statistical methods

Deaths

Descriptive statistics on deaths involving asthma or COPD were calculated according to whether these were the underlying cause of death or one of multiple causes of death, separately for males and females. We examined the number of associated causes that were included on records where asthma or COPD was the underlying cause of death. We also calculated the proportions of records where asthma or COPD were reported as the underlying cause of death relative to the total number where these diagnoses were mentioned as one of multiple causes of death.

We calculated age-standardised annual rates of death involving asthma or COPD to examine the trends in these conditions separately for asthma and COPD as underlying cause or one of multiple causes of death.

We also investigated the association among various causes of death, including asthma and COPD together, using the multiple causes of death data. These associations were estimated as rate ratios. The ratio of the incidence of death involving 23 'other cause' groups (including COPD as one group) among people who had died with asthma as one of multiple causes of death to the incidence of such deaths in people who had died without asthma represents the rate ratio for death involving other diseases associated with asthma. Rate ratios for death involving asthma and other diseases associated with COPD were estimated in a similar manner. Standard errors and 95% confidence intervals were estimated for each rate ratio (Rothman & Greenland 1998).

Hospitalisations

We adapted the methods used to analyse multiple cause of death data to similarly analyse multiple diagnosis hospitalisation data. This was done by treating the principal diagnosis in hospitalisation data in the same way as the underlying cause of death in mortality data and the additional diagnoses in hospitalisation data as the associated causes of death in mortality data.

3 Results

Deaths

Descriptive analysis

From 1997 to 2003, 94,633 records of death were identified among people aged 55 years and over, where either asthma (ICD-10: J45–J46) or COPD (ICD-10: J40–J44, J47) were recorded as the underlying or associated causes of death. Asthma was one of multiple causes of death on 8,165 death records and recorded as the underlying cause of death on 2,223 (27%) of these records. Therefore, death certificate data indicate that asthma was a contributing factor in nearly four times the number of deaths than are indicated by the underlying cause of death data alone. During the same period, COPD was one of multiple causes of death on 87,403 records, which is over 10 times the number of deaths involving asthma. It was the underlying cause of death in nearly half (45%) of these records (Table 3.1).

Table 3.1: Deaths where asthma or COPD are the underlying cause or mentioned anywhere on death certificates, people aged 55 years and over, Australia, 1997–2003

	Asthma			COPD		
	Males	Females	Persons	Males	Females	Persons
Underlying cause of death (%)	801 (26)	1,422 (28)	2,223 (27)	23,398 (43)	15,672 (48)	39,070 (45)
Multiple cause of death	3,090	5,075	8,165	54,997	32,406	87,403

Source: National Mortality Database.

On average, two associated causes of death were recorded on death certificates where either asthma or COPD was the underlying cause of death. No causes other than the underlying cause were mentioned in 12% of deaths where asthma, and 7% of deaths where COPD, was one of multiple causes (Table 3.2).

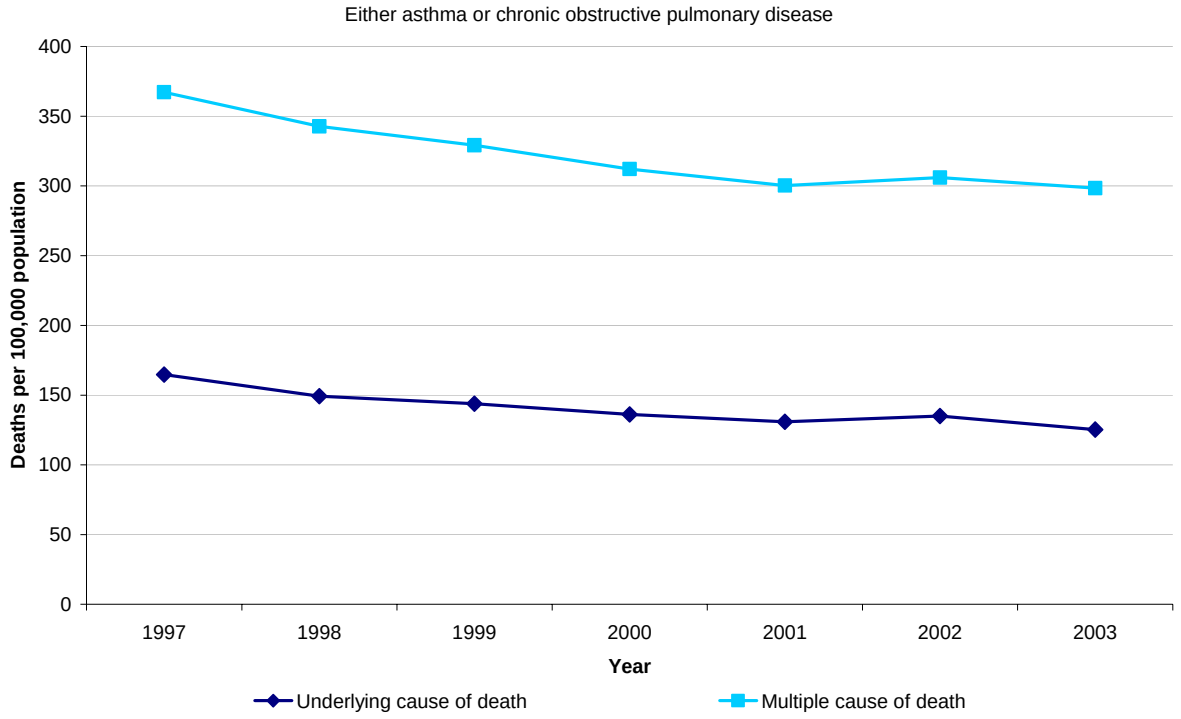
Table 3.2: Number of associated causes on death certificates for asthma and COPD, people aged 55 years and over, Australia, 1997–2003

	Underlying cause of death	
Number of associated causes	Asthma	COPD
Mean	2.10	2.25
None (underlying cause reported alone)	276 (12%)	2,896 (7%)
One	525 (24%)	10,254 (26%)
Two	670 (30%)	11,553 (30%)
Three	401 (18%)	7,671 (20%)
Four or more	351 (16%)	6,696 (17%)

Source: National Mortality Database.

Time trends

During the period 1997 to 2003, the age-standardised rate of deaths attributed to obstructive lung disease (that is, either asthma or COPD), as the underlying cause, among people aged 55 years and over, decreased by 24% from 165 to 125 deaths per 100,000 population. Where asthma or COPD was one of multiple causes of death, the rate declined by 19% from 367 to 298 deaths per 100,000 population (Figure 3.1).

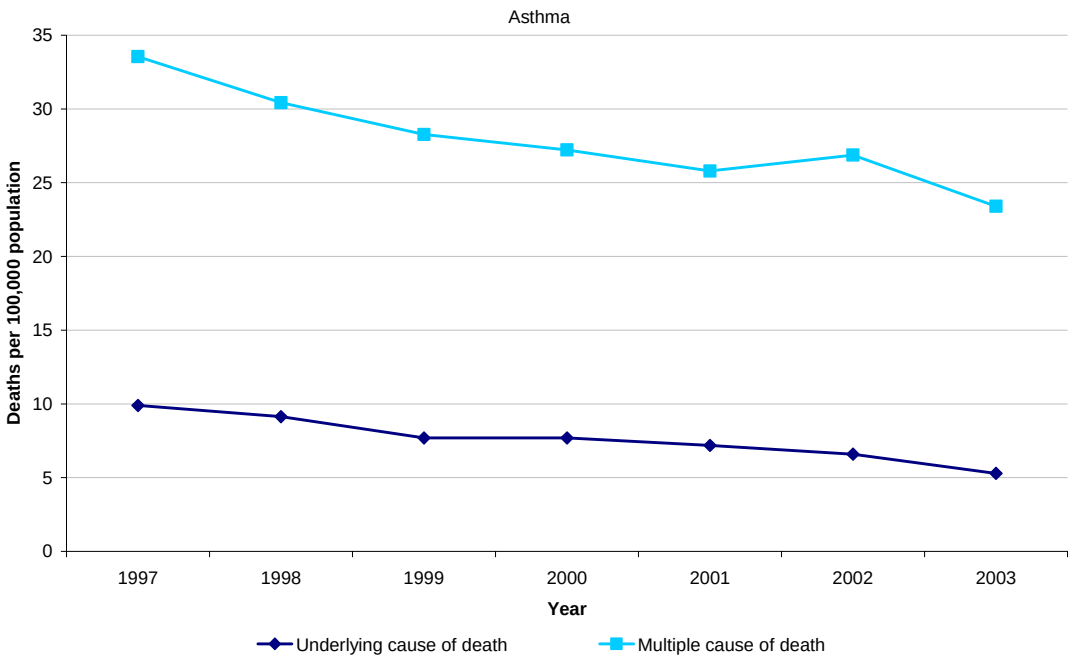


Note: Age standardised to the 2001 estimated resident population of Australia.

Sources: National Mortality Database and Australian Bureau of Statistics.

Figure 3.1: Age-standardised rate of deaths involving either asthma or COPD, people aged 55 years and over, Australia, 1997–2003

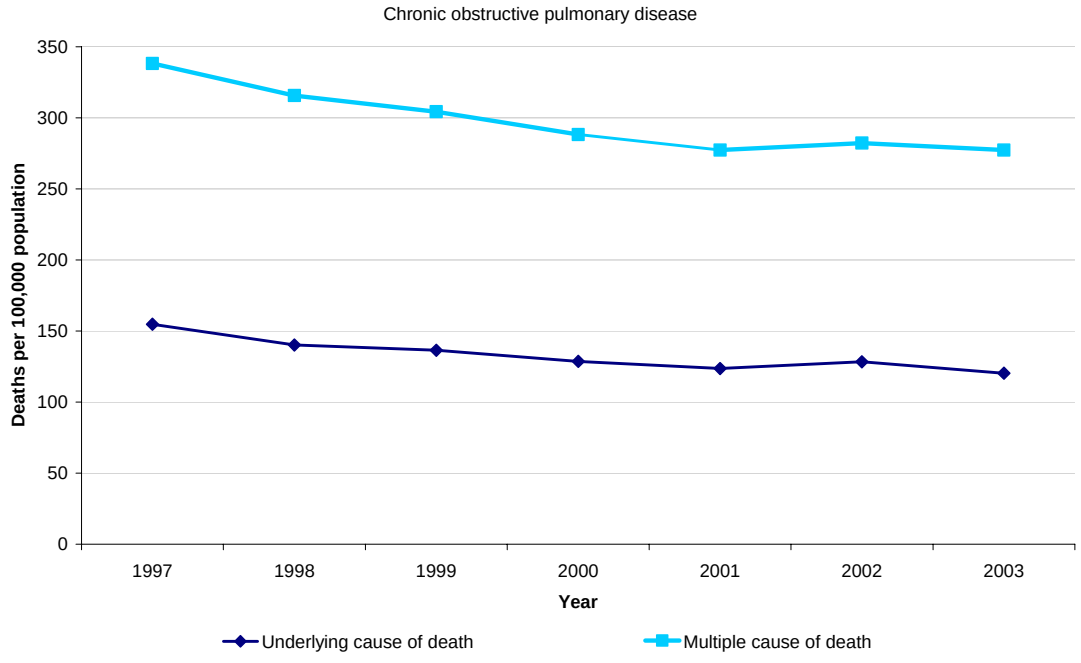
The age-standardised rate of deaths attributed to asthma as the underlying cause decreased by 47% from 9.9 to 5.2 per 100,000 population (Figure 3.2). Where asthma was recorded as one of multiple causes of death, the age-standardised rate decreased by 32% from 34 to 23 per 100,000 population. These decreases are substantially greater than those observed for asthma and COPD combined because the rates of deaths involving COPD are approximately 10 times those involving asthma and overwhelm the trends in asthma when data are combined. Where COPD was the underlying cause of death, the rate declined by 23% from 155 to 120 per 100,000 population. The rate of deaths where COPD was one of multiple causes of death declined by only 18% between 1997 and 2003, from 338 to 277 per 100,000 population. These decreases were modest in comparison to the declines observed for asthma. Furthermore, most of this decline occurred between 1997 and 2001, while between 2001 and 2003 the death rate plateaued (Figure 3.3).



Note: Age standardised to the 2001 estimated resident population of Australia.

Sources: National Mortality Database and Australian Bureau of Statistics.

Figure 3.2: Age-standardised rate of deaths involving asthma, people aged 55 years and over, Australia, 1997–2003



Note: Age standardised to the 2001 estimated resident population of Australia.

Sources: National Mortality Database and Australian Bureau of Statistics.

Figure 3.3: Age-standardised rate of deaths involving COPD, people aged 55 years and over, Australia, 1997 to 2003

Disease associations in multiple cause of death data

Over the period 1997 to 2003, 1% of deaths among people aged 55 years and over, for which either asthma or COPD was designated as one of multiple causes of death, actually included both asthma and COPD in the record. In 286 of these 935 deaths (31%), asthma was the underlying cause and COPD was an associated cause and in 263 deaths asthma was an associated cause and COPD was the underlying cause. The remaining 386 deaths in this group comprised those where both asthma and COPD were recorded as associated causes and another condition was the underlying cause.

Asthma with other conditions

Among all people aged 55 years and over, those who had died with asthma as one of multiple causes of death also had musculoskeletal disease as one of multiple causes of death nearly twice as often as those who had died without asthma (RR: 1.9). Other conditions that occurred more commonly as one of multiple causes of death with asthma were depression and anxiety (RR: 1.6), diabetes mellitus (RR: 1.5), heart failure, (RR: 1.4), other respiratory diseases (excluding COPD, influenza and pneumonia) (RR: 1.4) and ischaemic heart disease (RR: 1.3). There were many other conditions where asthma was less likely to be recorded as one of multiple causes of death. The rate of COPD among people who had died where asthma was a cause was similar to that among people who died without asthma (RR: 1.0) (Table 3.3).

COPD with other conditions

Among people aged 55 years and over, those who had died with COPD as one of multiple causes of death also had other respiratory disorders (excluding asthma, pneumonia and influenza) recorded more than twice as often as those who did not have COPD (rate ratio (RR): 2.2). Other diseases that occurred more commonly as multiple causes of death with COPD were influenza and pneumonia (RR: 1.5), heart failure (RR: 1.5), lung cancer (RR: 1.4), mental disorder (RR: 1.4), musculoskeletal disease (RR: 1.3), accidents (RR: 1.2), depression and anxiety (RR: 1.2), and ischaemic heart disease (RR: 1.1). Having asthma as a multiple cause of death was no more common among people who had died with COPD than people who had died without COPD (RR: 1.0) (Table 3.4).

Table 3.3: Deaths where selected condition groups were present with asthma as multiple causes of death, people aged 55 years and over, Australia, 1997–2003

Selected condition (ICD-10 groups)	Deaths with asthma and another selected condition	All deaths with the selected condition	Rate ratio[(a)]	95% confidence interval
Infectious disease (A00–B99)	392	50,804	0.75	0.68–0.82
Malignant neoplasm excluding lung cancer (C00–C97, C40–C97, D03–D48)	1,260	215,517	0.57	0.54–0.59
Lung cancer (C30–C39, D02)	290	50,233	0.56	0.50–0.63
Blood disorders (D50–D89)	198	21,424	0.90	0.78–1.03
Diabetes mellitus (E10–E14)	1,020	68,105	1.46	1.38–1.55
Mental disorder excluding depression and anxiety (F00–F29, F50–F90)	603	74,699	0.78	0.72–0.84
Depression and anxiety (F30–F48)	115	6,972	1.61	1.34–1.94
Nervous system disease (G00–G99)	672	62,264	1.05	0.97–1.13
Ischaemic heart diseases (I20–I25)	3,306	254,907	1.26	1.23–1.30
Heart failure (I50)	1,730	119,079	1.42	1.36–1.46
Cerebrovascular diseases (I60–I69)	888	137,356	0.63	0.59–0.67
Other circulatory system disease (I00–I15, I26–I49, I51–I52, I70–I99)	2,856	381,012	0.73	0.70–0.75
Influenza and pneumonia (J10–J18)	1,263	121,795	1.01	0.96–1.06
COPD (J40–J44, J47)	935	87,403	1.03	0.97–1.09
Other respiratory disease (J00–J06, J20–J39, J60–J99)	1,391	98,756	1.37	1.31–1.44
Digestive system disease (K00–K93)	653	69,578	0.91	0.85–0.98
Skin disease (L00–L99)	84	8,827	0.92	0.75–1.14
Musculoskeletal disease (M00–M99)	578	29,597	1.91	1.77–2.07
Renal failure (N17–N19)	591	79,857	0.72	0.66–0.77
Other genitourinary disease (N00–N19, N20–N99)	153	21,687	0.68	0.58–0.80
Other symptoms (R00–R99)	927	82,163	1.10	1.03–1.17
Accidents (V01–X59)	224	20,596	1.06	0.93–1.20
Intentional self harm (X60–X84)	10	3,701	0.26	0.14–0.48

(a) Asthma or no asthma with each condition group as multiple causes of death.

Source: National Mortality Database.

Table 3.4: Deaths where selected condition groups were present with COPD as multiple causes of death, people aged 55 years and over, Australia, 1997–2003

Selected condition (ICD-10 groups)	Deaths with COPD and another selected condition	All deaths with the selected condition	Rate ratio[(a)]	95% confidence interval
Infectious disease (A00–B99)	4,930	50,804	0.87	0.84–0.89
Malignant neoplasm excluding lung cancer (C00–C97, C40–C97, D03–D48)	12,345	215,517	0.49	0.48–0.50
Lung cancer (C30–C39, D02)	7,569	50,233	1.43	1.40–1.47
Blood disorders (D50–D89)	1,873	21,424	0.77	0.74–0.81
Diabetes mellitus (E10–E14)	6,054	68,105	0.79	0.77–0.81
Mental disorder excluding depression and anxiety (F00–F29, F50–F90)	10,937	74,699	1.38	1.36–1.41
Depression and anxiety (F30–F48)	890	6,972	1.18	1.10–1.27
Nervous system disease (G00–G99)	4,170	62,264	0.58	0.56–0.60
Ischaemic heart diseases (I20–I25)	29,454	254,907	1.05	1.04–1.07
Heart failure (I50)	18,896	119,079	1.52	1.50–1.54
Cerebrovascular diseases (I60–I69)	7,739	137,356	0.48	0.47–0.49
Other circulatory system disease (I00–I15, I26–I49, I51–I52, I70–I99)	25,171	381,012	0.57	0.56–0.58
Influenza and pneumonia (J10–J18)	19,472	121,795	1.54	1.52–1.56
Asthma (J45, J46)	935	8,165	1.04	0.98–1.12
Other respiratory disease (J00–J06, J20–J39, J60–J99)	21,036	98,756	2.18	2.16–2.21
Digestive system disease (K00–K93)	6,588	69,578	0.84	0.82–0.87
Skin disease (L00–L99)	751	8,827	0.75	0.70–0.81
Musculoskeletal disease (M00–M99)	4,038	29,597	1.28	1.23–1.32
Renal failure (N17–N19)	8,178	79,857	0.92	0.90–0.94
Other genitourinary disease (N00–N19, N20–N99)	1,684	21,687	0.68	0.65–0.71
Other symptoms (R00–R99)	9,334	82,163	1.03	1.01–1.06
Accidents (V01–X59)	2,631	20,596	1.18	1.14–1.23
Intentional self harm (X60–X84)	84	3,701	0.19	0.15–0.23

(a) COPD or no COPD with each condition group as multiple causes of death.

Source: National Mortality Database.

Hospitalisations

Descriptive analysis

Between 1999–00 and 2003–04, there were 294,993 hospitalisations among people aged 55 years and over, where either asthma (ICD-10: J45–J46) or COPD (ICD-10: J40–J44, J47) was the principal diagnosis. In 2003–04, asthma was one of multiple diagnoses in 20,796 hospital records and was the principal diagnosis in 6,171 (30%) of these. Therefore in 2003–04, asthma was involved in more than three times the number of hospitalisations than indicated by principal diagnosis alone. In the same year, COPD was a diagnosis on 120,126 records, which is six times that of asthma. It was the principal diagnosis in 55,038 (46%), indicating it was involved in more than twice the number of hospitalisations than indicated by the principal diagnosis alone (Table 3.5).

Table 3.5: Hospitalisations where asthma or COPD are principal diagnosis or any diagnosis mentioned, people aged 55 years and over, Australia, 2003–04

	Asthma			COPD		
	Males	Females	Persons	Males	Females	Persons
Principal diagnosis (%)	1,655 (25)	4,516 (32)	6,171 (30)	30,586 (44)	24,452 (48)	55,038 (46)
Any diagnosis	6,563	14,233	20,796	69,266	50,860	120,126

Source: National Hospital Morbidity Database.

In 2003–04, hospital records where the principal diagnosis was COPD averaged 3.0 additional diagnoses and those in which the principal diagnosis was asthma averaged 1.9 additional diagnoses (Table 3.6).

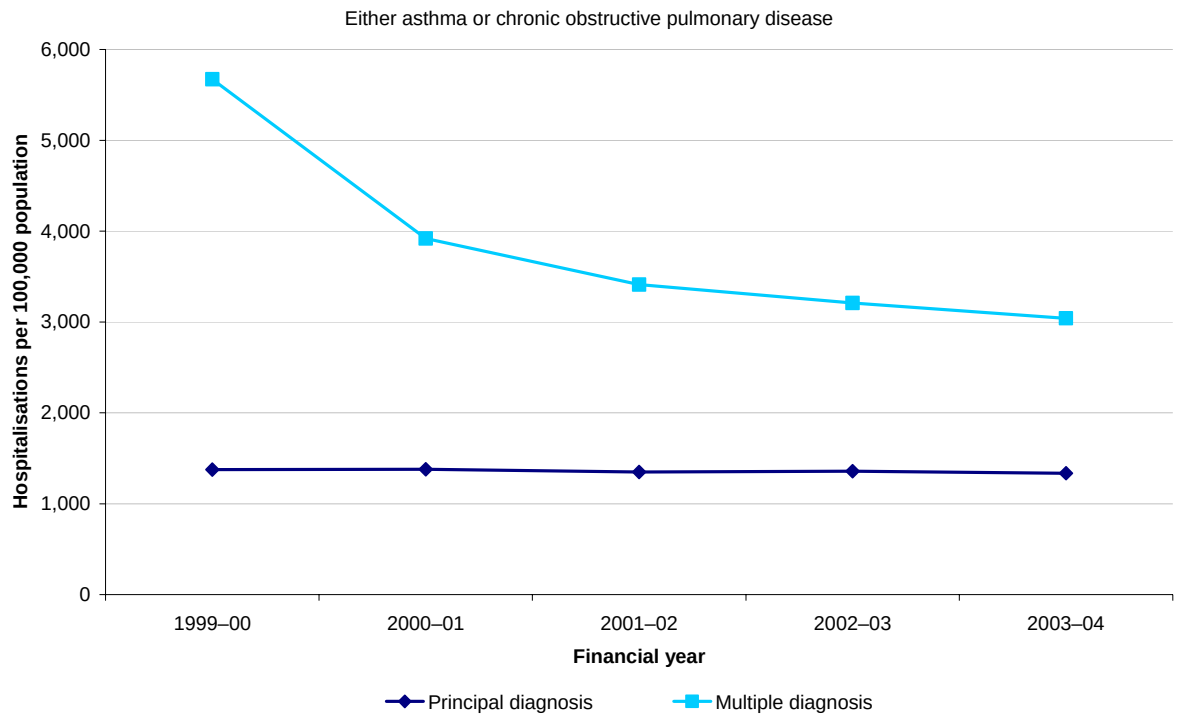
Table 3.6: Number of hospital diagnoses for asthma and COPD, people aged 55 years and over, Australia, 2003–04

	Principal diagnosis	
Number of additional diagnoses	**Asthma**	**COPD**
Mean	1.89	3.03
None (principal diagnosis recorded alone)	1,591 (26%)	6,217 (11%)
One	1,784 (26%)	12,168 (22%)
Two	1,089 (18%)	10,742 (20%)
Three	688 (11%)	7,962 (14%)
Four or more	1,089 (17%)	17,949 (33%)

Source: National Hospital Morbidity Database.

Time trends

During the five-year period 1999–00 to 2003–04, the age-standardised rate of hospitalisations, where asthma or COPD was the principal diagnosis, remained stable among people aged 55 years and over. However, where either asthma or COPD was any diagnosis (that is, the principal or an additional diagnosis), the rate declined by 46% from 5,672 to 3,041 separations per 100,000 population (Figure 3.4). The greatest proportion of this decrease occurred in the first year interval 1999–00 to 2000–01 when the rate decreased by 31% with a further 22% decrease in total over the remaining four years. This corresponds to the release of revised coding guidelines and is discussed further in Section 4.



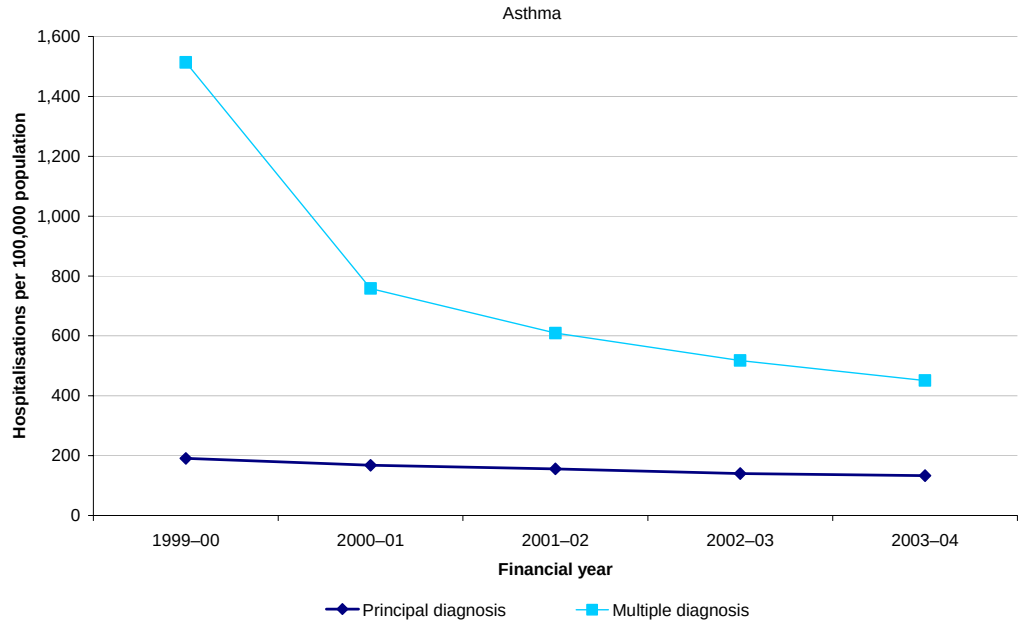
Note: Age standardised to the 2001 estimated resident population of Australia.

Sources: National Hospital Morbidity Database and Australian Bureau of Statistics.

Figure 3.4: Age-standardised rate of hospitalisations involving asthma or COPD, people aged 55 years and over, Australia, 1999–00 to 2003–04

When examining asthma alone, the age-standardised rate of hospitalisations in which asthma was the principal diagnosis decreased over the five-year period by 30% from 191 to 133 separations per 100,000 population (Figure 3.5). There was a much greater decrease in the rate where asthma was recorded as any diagnosis (70%) from 1,514 to 451 separations per 100,000 population between 1999–00 and 2003–04. Again, the largest reduction in this rate occurred in the first year between 1999–00 and 2000–01 (50% decrease).

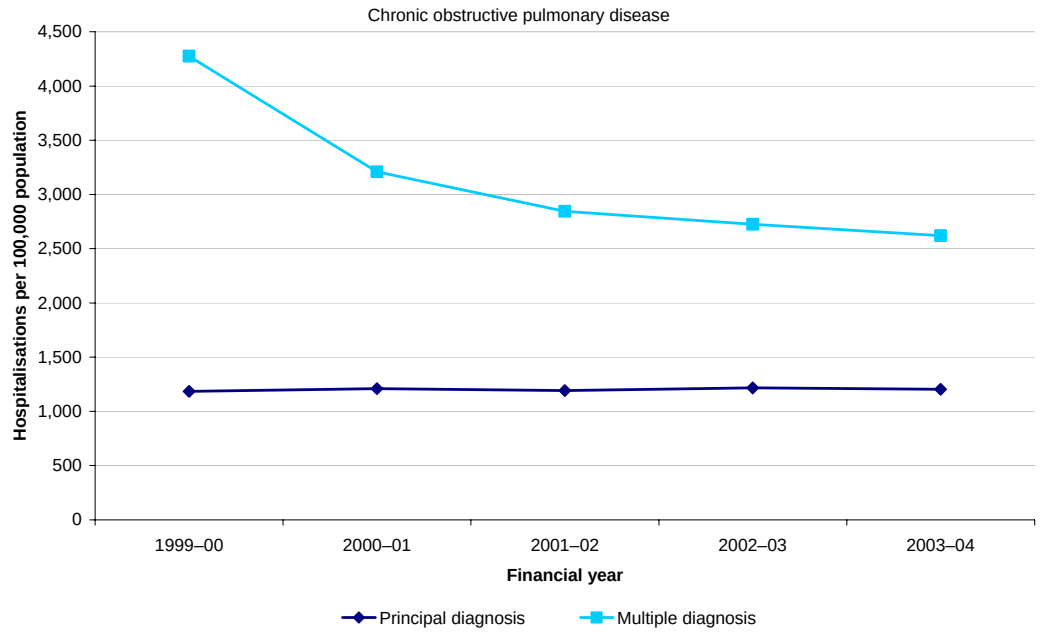
The rate of hospitalisations in which COPD was the principal diagnosis remained stable between 1999–00 and 2003–04. Among hospitalisations where COPD was any diagnosis, the hospitalisation rate decreased by 18% from 3,209 to 2,601 separations per 100,000 population between 2000–01 and 2003–04 (Figure 3.6).



Note: Age standardised to the 2001 estimated resident population of Australia.

Sources: National Hospital Morbidity Database and Australian Bureau of Statistics.

Figure 3.5: Age-standardised rate of hospitalisations involving asthma, people aged 55 years and over, Australia, 1999–00 to 2003–04



Note: Age standardised to the 2001 estimated resident population of Australia.

Sources: National Hospital Morbidity Database and Australian Bureau of Statistics.

Figure 3.6: Age-standardised rate of hospitalisations involving COPD, people aged 55 years and over, Australia, 1999–00 to 2003–04

Disease associations in multiple diagnosis data

In 2003–04, asthma and COPD both occurred as diagnoses in 1,405 hospitalisations among people aged 55 years and over. In 283 of these, asthma was the principal diagnosis and COPD was an additional diagnosis; in 480, asthma was an additional diagnosis and COPD was the principal diagnosis; and in the remaining 642, both asthma and COPD were recorded as additional diagnoses and another condition was the principal diagnosis.

Asthma and co-morbidities

COPD was a diagnosis nearly twice as often when asthma was also diagnosed than when asthma was not diagnosed (unadjusted rate ratio (RR): 1.9) during episodes of hospitalisation in people aged 55 years and over. Hospitalisations where asthma was diagnosed were also four times as likely to also have influenza and pneumonia diagnosed (RR: 4.0). Other diseases that occurred more commonly as hospital diagnoses with asthma were other respiratory conditions excluding COPD (RR: 4.0), heart failure (RR: 2.9), depression and anxiety (RR: 2.1), ischaemic heart disease (RR: 1.5), other circulatory diseases (RR: 1.5), and infectious diseases (RR: 1.5) and diabetes (RR: 1.5) (Table 3.7).

COPD and co-morbidities

Asthma was diagnosed with COPD twice as often as without COPD (unadjusted RR: 2.0) among episodes of hospitalisation in people aged 55 years and over. Hospitalisations where COPD was diagnosed were also over seven times as likely to also have influenza or pneumonia as a diagnosis (unadjusted RR: 7.6). Several other diseases that were also strongly associated diagnoses with COPD included heart failure (RR: 6.3), other respiratory diseases (RR: 4.5), mental disorders (RR: 3.4), infectious diseases (RR: 2.6), lung cancer (RR: 2.4), ischaemic heart disease (RR: 1.9), depression and anxiety (RR: 1.8) and other circulatory diseases (RR: 1.7) (Table 3.8).

Table 3.7: Hospitalisations where selected condition groups were present with asthma as multiple diagnoses, people aged 55 years and over, Australia, 2003–04

Diagnosis group	Hospitalisations with asthma and another selected condition	All hospitalisations with the selected condition	Rate ratio[(a)]	95% confidence interval
Infectious disease (A00–B99)	2,039	225,746	1.48	1.42–1.54
Malignant neoplasm excluding lung cancer (C00–C97, C40–C97, D03–D48)	1,584	950,372	0.27	0.26–0.28
Lung cancer (C30–C39, D02)	130	49,571	0.43	0.36–0.51
Blood disorders (D50–D89)	1,465	187,277	1.28	1.22–1.34
Diabetes mellitus (E10–E14)	3,703	414,531	1.46	1.42–1.51
Mental disorder excluding depression and anxiety (F00–F29, F50–F90)	1,155	174,017	1.08	1.02–1.15
Depression and anxiety (F30–F48)	1,331	102,931	2.12	2.02–2.24
Nervous system disease (G00–G99)	1,856	239,340	1.27	1.21–1.32
Ischaemic heart diseases (I20–I25)	3,143	340,772	1.51	1.46–1.56
Heart failure (I50)	2,082	118,246	2.91	2.79–3.03
Cerebrovascular diseases (I60–I69)	531	97,640	0.89	0.82–0.96
Other circulatory system disease (I00–I15, I26–I49, I51–I52, I70–I99)	7,963	874,145	1.49	1.47–1.52
Influenza and pneumonia (J10–J18)	1,879	77,341	4.04	3.86–4.22
COPD (J40–J44, J47)	1,405	120126	1.92	1.82–2.02
Other respiratory disease (J00–J06, J20–J39, J60–J99)	3,971	165,192	3.99	3.88–4.11
Digestive system disease (K00–K93)	3,992	850,829	0.76	0.74–0.79
Skin disease (L00–L99)	1,007	164,893	1.00	0.94–1.06
Musculoskeletal disease (M00–M99)	3,914	447,251	1.43	1.39–1.47
Renal failure (N17–N19)	954	445,377	0.35	0.33–0.37
Other genitourinary disease (N00–N19, N20–N99)	1,622	345,282	0.77	0.73–0.80
Other symptoms (R00–R99)	3,759	690,697	0.89	0.86–0.91

(a) Asthma or no asthma with each condition group as multiple diagnoses.

Note: External causes for accidents and intentional self harm not included.

Source: National Hospital Morbidity Database.

Table 3.8: Hospitalisations where selected condition groups were present with COPD as multiple diagnoses, people aged 55 years and over, Australia, 2003–04

Diagnosis group	Hospitalisations with COPD and another selected condition	All hospitalisations with the selected condition	Rate ratio[(a)]	95% confidence interval
Infectious disease (A00–B99)	18,519	225,746	2.56	2.52–2.60
Malignant neoplasm excluding lung cancer (C00–C97, C40–C97, D03–D48)	9,648	950,372	0.22	0.22–0.23
Lung cancer (C30–C39, D02)	4,101	49,571	2.38	2.31–2.46
Blood disorders (D50–D89)	10,567	187,277	1.65	1.62–1.68
Diabetes mellitus (E10–E14)	20,331	414,531	1.46	1.44–1.49
Mental disorder excluding depression and anxiety (F00–F29, F50–F90)	18,575	174,017	3.38	3.33–3.43
Depression and anxiety (F30–F48)	6,378	102,931	1.79	1.75–1.84
Nervous system disease (G00–G99)	10,505	239,340	1.26	1.24–1.29
Ischaemic heart diseases (I20–I25)	20,723	340,772	1.87	1.84–1.89
Heart failure (I50)	22,109	118,246	6.25	6.16–6.33
Cerebrovascular diseases (I60–I69)	4,088	97,640	1.19	1.15–1.23
Other circulatory system disease (I00–I15, I26–I49, I51–I52, I70–I99)	44,365	874,145	1.69	1.67–1.71
Influenza and pneumonia (J10–J18)	17,982	77,341	7.55	7.44–7.65
Asthma (J45, J46)	1,405	20,796	1.97	1.87–2.08
Other respiratory disease (J00–J06, J20–J39, J60–J99)	22,290	165,192	4.45	4.39–4.51
Digestive system disease (K00–K93)	19,433	850,829	0.58	0.57–0.59
Skin disease (L00–L99)	7,796	164,893	1.36	1.33–1.39
Musculoskeletal disease (M00–M99)	15,454	447,251	0.97	0.96–0.99
Renal failure (N17–N19)	11,519	445,377	0.70	0.69–0.72
Other genitourinary disease (N00–N19, N20–N99)	9,193	345,282	0.73	0.72–0.75
Other symptoms (R00–R99)	27,510	690,697	1.16	1.15–1.18

(a) COPD or no COPD with each condition group as multiple diagnoses.

Note: External causes for accidents and intentional self harm not included.

Source: National Hospital Morbidity Database.

4 Discussion

In this report, we have investigated the relationship between asthma and COPD in death certification and hospitalisations among older Australians. The purpose of this was: to assess the potential underestimation of the impact of asthma and COPD on deaths and hospitalisations that occurs when analyses are limited to underlying cause of death and principal diagnosis; to assess the extent to which misclassification between asthma and COPD may influence observed time trends in asthma deaths and hospitalisations; and to identify the major co-morbidities observed among patients dying or hospitalised with asthma or COPD.

Summary of findings

Among people aged 55 years and over, COPD is a far more common cause of deaths and hospitalisations than asthma. There were 10 times as many deaths where COPD was mentioned on the death certificate and six times as many hospitalisations where COPD was a diagnosis. As COPD is overwhelmingly the more common of these two conditions, misclassification of asthma as COPD will only have a small impact on COPD statistics. However, misclassification through inaccurate recording, miscoding, or misdiagnosis, of even a small proportion of COPD as asthma, will potentially have a substantial impact on asthma statistics.

Multiple cause of death data identified nearly four times more deaths where asthma was a cause than an underlying cause alone. For COPD, double the deaths were identified. In hospitalisation data, asthma was reported as any diagnosis in three times more hospitalisations than as a principal diagnosis only and for COPD, twice the number of hospitalisations were identified. This raises the possibility that the involvement of these diseases in deaths and hospitalisations may be underestimated by investigating only the underlying cause of death or the principal hospital diagnosis.

Time trends

Over time, there has been a decrease in hospitalisations and deaths involving asthma and COPD among people aged 55 years and over. Deaths involving asthma and COPD declined between 1997 and 2003, with this decrease being most marked in asthma. As the trends in these two diseases are in parallel, misclassification of asthma and COPD is less likely to explain the trends in asthma.

Hospitalisations where asthma or COPD were reported as any diagnosis decreased sharply in the year between 1999–00 and 2000–01. This was coincident with a change in the guidelines for coding additional diagnoses and suggests that this decrease is an artefact of coding rather than a true change in disease patterns. Where asthma was the principal diagnosis, the rate of hospitalisations decreased steadily over the period 1999–00 to 2003–04. However, where COPD was the principal diagnosis, the rate of hospitalisations was stable over this period. Hence, it is possible that the declining trend in hospitalisations for asthma among persons aged 55 years and over could be ascribed to a tendency to attribute more hospitalisations to COPD. However, the declining trend in hospitalisations for asthma in this

older age group is consistent with the declining trend in younger age groups, where misclassification with COPD is not likely. Hence, on balance, it is most probable that the decline in hospitalisations for asthma is a validly observed trend and is not the result of misclassification with COPD.

Disease associations

COPD and asthma appeared together in 1% of deaths where either of these conditions was recorded as a cause of death among people aged 55 years and over. Overall, this prevalence of both conditions as multiple causes of death was not greater than would be expected by chance. However, in hospitalisation records, asthma and COPD were diagnosed together approximately twice as often as they were diagnosed separately. The circumstances under which both asthma and COPD would be expected to both be recorded on a death certificate or hospitalisation record include:

1. deaths or hospitalisations involving COPD in people who also have features of asthma;
2. people with asthma who die or present to hospital with fixed airflow obstruction and, therefore, both asthma and COPD are recorded; and
3. cases where there is uncertainty regarding whether the death or hospitalisation was caused by asthma or COPD, so both are recorded.

Asthma is positively associated with a number of other conditions among people aged 55 years and over in both mortality and hospitalisation data. Deaths where asthma is a cause are almost twice as likely to also have musculoskeletal disease as a cause. The link between these two conditions may be related to the increased risk of osteoporosis, with associated fractures, in people with asthma who have required oral steroids for a sustained period during life (Mortimer et al. 2005). Asthma was also associated with a 60% higher occurrence of anxiety and depression in cause of death data. This is consistent with reports of greater levels of psychological distress and poorer quality of life impacts among people with asthma (Ampon et al. 2005; Goldney et al. 2003). In hospitalisation data, asthma was most strongly associated with other respiratory conditions and influenza and pneumonia, which is consistent with asthma exacerbations requiring hospitalisation that are triggered by respiratory infections.

COPD is also associated with a number of other conditions. In both mortality and hospitalisation data, COPD was associated with other respiratory infections, influenza and pneumonia, which, as for asthma, is consistent with exacerbations of the disease that are triggered by respiratory infections. COPD was also associated with heart failure and lung cancer. These associations are almost certainly explained by a common link to smoking.

While other conditions that are associated with asthma are often also associated with COPD (for example, respiratory infections), there are a number of substantial differences in coexisting diseases with asthma and COPD, particularly the prominence of asthma with musculoskeletal disease and depression and anxiety in mortality data.

Limitations in this study

- Currently, it is not possible to differentiate between the contribution of various associated causes or additional diagnoses to the death or hospitalisation. Therefore, our analyses are limited in being able to identify the involvement of asthma or COPD as associated causes or additional diagnoses. Nonetheless, the criteria for coding these conditions require that they have contributed to the death, or were significant or relevant in the episode of hospital care. If these criteria have been applied it is likely that associated causes of death and additional diagnoses are important in assessing the true impact of these conditions.
- Hospitalisation records are based on hospitalisation events, not the individual patients who were hospitalised. Unlike deaths, hospitalisations can occur to the same individual on multiple occasions. Therefore, patients who were hospitalised more than once contribute more than one record. This means that hospitalisation data are less able to reflect independent events than mortality data as individuals will have similar diagnoses in each hospitalisation. This is particularly important when comparing hospitalisation and mortality data.
- This study used data coded using ICD-10. Compared to ICD-9, ICD-10 is more effective at classifying either asthma or COPD separately. This is evidenced by trends in mortality data using comparability factors (Baker et al. 2004). However, this does not necessarily mean that ICD-10 is more accurate, though it may be better at differentiating mutually exclusive groups. Further study is needed to ascertain the accuracy of disease classification in mortality and hospitalisation data.
- Clarification to guidelines with new editions of ICD-10-AM regarding the reporting of additional diagnoses has led to improved coding practice and a drop in the number of additional diagnoses of asthma or COPD. This is because new guidelines more clearly indicate that only diseases which affect the hospital stay should be included as additional diagnoses (National Centre for Classification in Health 2005). Therefore, apart from trends over time, analyses of additional diagnoses were limited to the most recently available year of data, for which it is more likely that the guidelines had been implemented consistently.

Conclusions

Analysis of multiple diagnosis data is a complex task and it is important for the researcher to understand the clinical relationships between diseases, and hence, possible relationships between causes of death. Researchers should also be aware of known data quality issues relating to cause of death data that have been summarised in Section 2 (see also 'Explanatory notes' in *Deaths, Australia, 2004* (ABS cat. no. 3302.0) and *Causes of death, Australia, 2004* (ABS cat. no. 3303.0). Studies have shown that the specificity of attribution of death to asthma is relatively poor among older persons (Jenkins et al. 1992; Sidenius et al. 2000). In these studies, the attribution of death to asthma was found to be substantially overestimated and was often confused with COPD. In practice, differentiating between these diseases presents difficulties and may not be particularly useful in older persons. Therefore, our investigation has analysed overall patterns and trends in mortality and hospitalisations involving both these diagnoses, together as well as separately. This may be a more appropriate approach to monitoring morbidity and mortality involving obstructive lung disease among older people.

The results of this study indicate that COPD is a far more common cause of hospitalisation and death among older Australians than asthma and, therefore, misclassification of COPD and asthma may impact on estimations of deaths and hospitalisations attributed to asthma. In view of the evidence that these conditions overlap substantially in their clinical manifestations and management, there is value in considering both of these conditions together when analysing morbidity and mortality data.

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