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Estimating the prevalence of chronic obstructive pulmonary disease using the National Integrated Health Services Information Analysis Asset

Technical report

AIHW

Estimating the prevalence of chronic obstructive pulmonary disease using the National Integrated Health Services Information Analysis Asset:

Technical report

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Contents

Summary

Chronic Obstructive Pulmonary Disease (COPD) is a chronic lung disease where air flow obstruction interferes with normal breathing, daily activities and quality of life. This airflow obstruction tends to become worse over time and cannot be fully reversed with treatment.

COPD is a leading causes of death and disease burden in Australia. Monitoring COPD prevalence is critical to understanding the health and economic burden of the disease on the Australian population and for health service planning.

National COPD prevalence is currently monitored by the Australian Institute of Health and Welfare (AIHW) using self-reported information from the Australian Bureau of Statistics (ABS) National Health Survey (NHS). The Burden of Obstructive Lung Disease (BOLD) Australia study provides national COPD estimates based on clinical assessment and lung function testing (Toelle et al. 2013). However, survey-based estimates can be quickly out-dated as surveys are time consuming and expensive to conduct, preventing annual updates. They are also less suited to analysis of small areas and population groups as they are based on samples rather than on information for all individuals in the population.

Using the National Integrated Health Services Information Analysis Asset (NIHSI AA) data to estimate COPD prevalence is a cost-efficient alternative to surveys that will allow estimates to be updated regularly, examined for specific population groups and across smaller areas.

People with COPD are identified in the NIHSI AA data through their health service use: dispensing of 2 or more COPD specific prescriptions or at least one diagnosis of COPD in hospital or emergency care data in the year up to the 30 June reference date.

NIHSI AA estimates of COPD prevalence are 32% lower than BOLD Australia and NHS estimates. This suggests that not all people captured by these survey estimates are accessing the health services used to identify people with COPD in the NIHSI AA data.

COPD is not usually diagnosed until it begins to affect a person's quality of life (Toelle et al. 2013). While undiagnosed COPD and mild COPD not managed with COPD-specific treatment cannot be captured, NIHSI AA estimates are a valuable source of information to monitor the prevalence of diagnosed COPD that is managed with specific medications or requires emergency or hospital care. People using these health services are an important group for population monitoring to inform health service planning.

Furthermore, identifying a cohort of people with COPD in linked health services data will enable analysis of COPD patient health outcomes and care pathways including general practitioner follow-up after hospitalisation and medication and health service use over time. This will provide invaluable information to assess the health and economic burden of COPD in Australia.

This report details how COPD prevalence is estimated using the NIHSI AA version 1.0 data.

Most of the NIHSI AA estimates of COPD in this report are for people aged 35 and over. This is consistent with recommendations for COPD screening as this is the age group most at risk of COPD.

Key findings

2.7% of people aged 35 and over were identified with COPD

Over 365,000 people aged 35 and over were identified in the NIHSI AA data with COPD at 30 June 2019 based on their health service use in the year before, a prevalence of 2.7%. This means that 270 people in every 10,000 aged 35 and over were taking medication or using emergency or hospital services for COPD between 1 July 2018 and 30 June 2019.

Of those, almost 66,200 people (18%) were newly identified with COPD. These people did not meet the age and service use criteria applied to identify people with COPD in the available NIHSI AA data before June 2019 (between July 2010 and June 2018).

Over 23,900 (6.8% of) people identified as having COPD at 30 June 2018 died within the following year. In contrast, 1.0% (135,000) of people aged 35 and over not identified with COPD at 30 June 2018 died in the following year.

COPD prevalence ranged from 0.2% among people aged 35–44 to 10% among those aged 85 and over. Most people identified with COPD were aged 65 to 84.

After adjusting for age differences, COPD prevalence was:

- 1.1 times as high among men compared with women.
- 1.3 times as high in *Inner regional* areas and *Outer regional, remote and very remote* areas as in *Major cities*.
- 2.1 times as high in the lowest socioeconomic areas as in the highest.

NIHSI AA COPD estimates increased each year from 2.1% at 30 June 2011 to 2.7% at 30 June 2017. Estimates were stable at about 2.7% between 30 June 2017 and 30 June 2019.

The increase up to 30 June 2017 is likely to be due to changes in the number and type of COPD markers available in the NIHSI AA data for case identification rather than an increase in the underlying prevalence of COPD. Most markers are available from 30 June 2017 and NIHSI AA estimates from this point appear to provide a reasonable time-series.

Over 90% of people identified with COPD were identified using PBS data

Over 90% of COPD cases identified in the NIHSI AA data were identified using Pharmaceutical Benefits Scheme (PBS) data. This proportion is largely consistent by age, sex and over time, although people aged under 55 and those 85 and over were slightly less likely to be identified based on the PBS-only case definition.

PBS data alone may provide a reasonable proxy for the NIHSI AA case definition to identify people with COPD where hospitalisations and ED data are not available, with some limitations.

Most NIHSI AA cases had additional evidence of COPD

The multi-source algorithm used to identify people with COPD provides a minimum threshold to classify cases, but most have additional evidence. Of cases at 30 June 2019:

- 69% had undergone spirometry testing since July 2010. Spirometry is used to formally diagnose COPD and other respiratory conditions.
- 68% had evidence of smoking history, a common risk factor for COPD, since July 2010.
- 68% were dispensed 6 or more prescriptions for COPD medications in the year before. Dispensing of 2 or more COPD prescriptions in a year was the minimum threshold used to identify a COPD case in the PBS data.

Different people were identified with COPD in PBS and self-reported data

COPD prevalence estimates from ABS National Health Surveys are based on a self-reported diagnosis of current and long-term bronchitis or emphysema. Comparing people aged 35 and over self-reporting these conditions in the 2014–15 and 2017–18 NHS with those meeting the PBS case definition in their respective survey reference years using Multi-Agency Data Integration Project (MADIP) data showed that:

- 47% of PBS cases self-reported they had bronchitis or emphysema.
- 29% of people self-reporting bronchitis or emphysema met the PBS case definition.
- People with emphysema were 3 times more likely to meet the PBS case definition (51%) than those with bronchitis (17%).

This shows that different, but somewhat overlapping, groups of people are identified as having COPD in PBS and self-reported data. These findings provide context to NHS prevalence estimates and could improve how COPD is prompted for and categorised in self-reported surveys.

1 Introduction

Chronic obstructive pulmonary disease (COPD) is a leading cause of death and disease burden in Australia. Over 6,300 deaths (almost 4% of all deaths) in 2020 were due to COPD (AIHW 2022b) and over 95,700 years of healthy life were lost to the disease in 2022 (AIHW 2022a). Monitoring COPD prevalence in Australia is critical to understanding the health and economic burden of the disease on the Australian population and for health service planning.

Routine health surveys can provide estimates of COPD prevalence: an estimated 485,000 (4.4%) Australians aged 40 and over have COPD, according to data from the Australian Bureau of Statistics (ABS) 2017–18 National Health Survey (NHS) (AIHW analysis of ABS 2019). COPD is captured in the NHS data as self-reported current and long-term bronchitis or emphysema. However, these estimates are limited by the self-reported nature of the survey and are subject to changes in the terms used to describe a diagnosis of COPD over time. Historical definitions of COPD emphasise the terms 'chronic bronchitis' and 'emphysema' (GOLD 2021). While people with COPD may have chronic bronchitis and/or emphysema, the defining diagnostic criteria of COPD is airflow limitation that is not fully reversible with treatment. Spirometry testing is required to confirm a diagnosis of COPD.

An Australian research collaboration with the international Burden of Obstructive Lung Disease (BOLD) study used spirometry testing and self-reported symptoms of breathlessness to identify people with COPD between 2006 and 2010 (Toelle et al. 2021). Using these data, weighted to the 2016 Australian Census, the study estimated that the prevalence of airflow limitation and clinical symptoms of breathlessness consistent with COPD was 4.4% among Australian's aged 40 and over. While the benefit of these estimates is that they are based on objective classification criteria, studies like this are not regularly updated due to the high cost to conduct them. This limits their use for routine disease monitoring.

The National Integrated Health Services Information Analysis Asset (NIHSI AA) is an enduring linked data asset developed by the Australia Institute of Health and Welfare (AIHW). The NIHSI AA provides de-identified information on health service use and mortality within Australia for individuals over time. The linked data comprises information on hospital admitted patient care services (hospitalisations), emergency department (ED) presentations, hospital outpatient services, Medicare Benefits Schedule (MBS) services, Pharmaceutical Benefits Scheme (PBS) (including Repatriation Pharmaceutical Benefits Scheme) dispensing, residential aged care services and deaths recorded on the National Death Index.

COPD treatment can be identified in NIHSI AA data where health service use is captured in COPD prescription dispensing in PBS data as well as in hospital and ED diagnosis codes.

This technical report describes the methods used to estimate the prevalence of COPD using the NIHSI AA data and how NIHSI AA estimates compare with survey sources. These methods were applied to derive estimates for the In-focus report: *Strengthening national COPD monitoring using linked health services data.*

What is COPD?

COPD is a heterogeneous lung condition characterised by chronic respiratory symptoms and persistent airflow obstruction that interferes with normal breathing (GOLD 2023; Yang et al. 2022).

There are multiple risk factors contributing to the development of COPD, including:

- Genetic factors and early life events that affect lung growth, including asthma.

- Infections that cause damage to the lungs.
- Tobacco smoking, including both active smoking and passive exposure to smoke. For support to quit smoking speak to your GP or call the Quitline (13 7848).
- Environmental factors, such as living or working in areas with exposure to dust, gas, smoke or other air pollutants.

There is currently insufficient evidence to conclude that vaping is a cause of COPD. However, further research and monitoring of this issue is warranted in view of recent increases in e-cigarette use and emerging evidence regarding their adverse effects on respiratory health (Gotts et al. 2019; NHMRC 2022).

COPD is a progressive condition, with symptoms typically worsening over time. Progressive dyspnoea (difficult or laboured breathing) is a common symptom of COPD. Other symptoms include chronic cough and sputum (mucus) production (GOLD 2023; Yang et al. 2022).

Respiratory symptoms and airflow obstruction associated with COPD are due to abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema) (GOLD 2023). The contribution of each of these conditions varies by person and may progress at different rates (Yang et al. 2022).

Persistent airflow obstruction is a defining feature of COPD (Box 1.1). In clinical practice, diagnosis of COPD is usually based on the presence of symptoms of breathlessness, cough and sputum production, a history of smoking or exposure to other noxious agents alongside persistent airflow obstruction.

Patients with COPD may also experience acute exacerbations or flare-ups. An exacerbation is defined as an event characterised by breathlessness, cough and/or sputum production that worsen over fewer than 14 days (GOLD 2023). Exacerbations are frequently due to respiratory tract infections and exposure to air pollution (GOLD 2023).

Box 1.1: Testing for airflow obstruction to diagnose COPD

Airflow limitation can be obstructive or restrictive. COPD is an obstructive lung condition. People with obstructive lung conditions have difficulty breathing air out of their lungs.

Spirometry is a clinical test used to identify airflow limitation and obstruction. The test provides information on 2 key measures:

- Forced expiratory volume (FEV_1). This is the maximum amount of air that an individual can breathe out in 1 second when breathing out as hard as they can.
- Forced vital capacity (FVC). The maximum about of air that an individual can breathe out after a deep breath, when breathing out as hard as they can.

The ratio of these 2 measures (FEV_1/FVC) is used to identify airflow obstruction. In adults, a ratio of 0.7 or above can be considered normal airflow. This means that when blowing out as hard as possible, in 1 second the individual can breathe out 70% or more of the maximum amount of air they can breathe out. A ratio of less than 0.7 indicates airflow obstruction.

To identify persistent airflow obstruction, the individual is given a short-acting bronchodilator (medication to make breathing easier) before the spirometry test. A ratio of less than 0.7 after taking bronchodilator medication indicates airflow obstruction that cannot be fully and quickly reversed with treatment. This is a key measure used to formally diagnose COPD.

It should be acknowledged that the 0.7 post broncho dilator cut off can underdiagnose COPD in younger and over diagnose in older people although GOLD continue to advocate for the 0.7 cut off (GOLD 2023). To overcome this limitation, results of spirometry can also be compared with reference values based on age, height, sex and race to determine airflow obstruction.

Project aims

The primary aim of the project is to estimate the prevalence of COPD in Australia using the National Integrated Health Services Information Analysis Asset (NIHSI AA). Specifically, this work aims to:

- Identify markers of COPD in component NIHSI AA data sources and develop a multi-source algorithm to identify people with COPD.
- Develop methods to apply the algorithm to estimate COPD prevalence in Australia, over time and by key demographics.
- Compare the prevalence of COPD derived using the NIHSI AA data with prevalence estimates from other sources to understand how well COPD prevalence can be captured using the NIHSI AA data and any limitations.

Structure of the report

This technical report has 10 chapters:

- Chapter 1 outlines the purpose and structure of the report. It includes information on how COPD is defined.
- Chapter 2 details the markers used to identify, and provide context to, COPD cases in the NIHSI AA data and the rationale for their selection.
- Chapter 3 describes how the NIHSI AA COPD case finding algorithm operates and presents analysis of COPD cases identified in the data.
- Chapter 4 describes the methods used to calculate COPD prevalence using the NIHSI AA data.
- Chapter 5 presents estimates of COPD prevalence produced using the NIHSI AA data.
- Chapter 6 compares NIHSI AA estimates with COPD estimates based on survey data.
- Chapter 7 compares people with COPD identified using the PBS case definition with those identified using self-reported conditions in NHS data.
- Chapter 8 discusses how this work adds to what we know about COPD in Australia.
- Chapter 9 presents factors to consider when interpreting estimates of COPD prevalence based on NIHSI AA data and opportunities that may improve capture of COPD cases in the future.
- Chapter 10 outlines next steps for this work.

2 How are COPD cases identified in the NIHSI AA data?

The treatment and management pathways for COPD patients involve multiple interactions with the health system that are captured in the NIHSI AA data.

Dispensing of medicines used specifically to manage COPD is recorded in the PBS dispensing data. This information, along with hospital and ED diagnosis information is used for COPD case finding.

Evidence of spirometry and of smoking history captured in the NIHSI AA provides additional information about COPD cases identified in the data.

Detail of the markers used to identify, and provide context to, COPD cases is presented in the following sections along with a rationale for their selection.

Markers of COPD in hospitalisations data

Both admission and separation (discharge) dates for hospital records with either a principal or additional diagnosis of *J43.- Emphysema* or *J44.- Other chronic obstructive pulmonary disease* were used as markers of COPD.

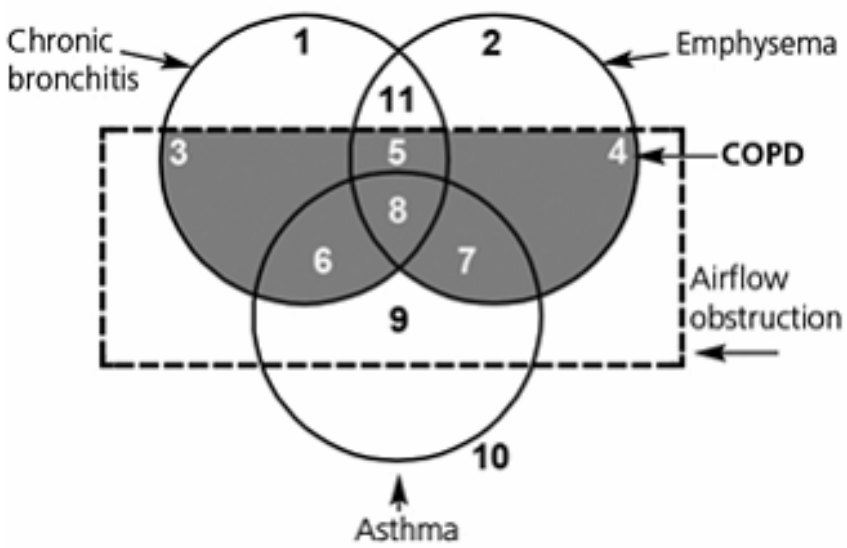
COPD cases were identified in hospitalisations data where a person had one or more markers of COPD in the year before the reference date.

Recording of a condition as a principal or additional diagnosis in hospitalisations data indicates that the condition was treated during the episode of care. Both principal and additional diagnoses of COPD were used to identify COPD treatment in hospitalisations data.

Diagnoses recorded in hospitalisations data are coded in accordance with the ICD-10-AM after applying the Australian Coding Standards (ACS).

According to the ACS 1008 *Chronic obstructive pulmonary disease (COPD)*, the term COPD describes a condition of chronic bronchitis with obstruction possibly due to chronic asthma and/or emphysema or chronic tracheobronchitis. It emphasises that the important terms in coding COPD are ‘chronic’ and ‘obstruction’. This standard has not changed over the 7th–10th editions of the ICD-10-AM that are in scope of the NIHSI AA version 1.0 data. The grey sections in Figure 2.1 are classified as COPD based on this definition.

Figure 2.1: Schema of chronic obstructive pulmonary disease



Key:

1. Chronic bronchitis
2. Emphysema
3. Chronic bronchitis with obstruction = COPD
4. Emphysema with obstruction = COPD
5. Chronic bronchitis & emphysema w obstruction = COPD
6. Chronic bronchitis & asthma w obstruction = COPD
7. Emphysema & asthma w obstruction = COPD
8. Chronic bronchitis, emphysema & asthma w obstruction = COPD
9. Asthma
10. Airflow obstruction
11. Chronic bronchitis and emphysema

Based on the inclusions specified in the ICD-10-AM Tabular index, *J44.- Other chronic obstructive pulmonary disease* is coded where there is documentation in the medical notes of the combinations of clinical descriptions, or diagnosis terms shown in Figure 2.2.

For example, documentation of chronic bronchitis with emphysema will be assigned a code from *J44.-*, as will asthma that is described as chronic and obstructive. This suggests that a diagnosis code of *J44.-* may be sufficient to identify treatment of a COPD case in hospitalisations data.

Figure 2.2: Clinical descriptions for coding *J44.- Other chronic obstructive pulmonary disease*

Chronic and
+ bronchitis and
  + asthmatic (obstructive), and/or
  + Emphysematous and/or
  + with:
    + airways obstruction and/or
    + emphysema

OR

Chronic and
+ obstructive and
  + Asthma and/or
  + Bronchitis and/or
  + Tracheobronchitis

However, several studies have used ICD-10-based diagnosis codes to define a COPD cohort for research, identify COPD-related hospitalisations, estimate risk of COPD or estimate COPD prevalence (AIHW 2023a; Gershon et al. 2009; Greulich et al. 2017; Laforest et al. 2016; Lim et al. 2018; Lix et al. 2018; NHA 2020; Parkin et al. 2020; PHAC 2018). There is some variation in the ICD-10 codes used across these studies with the most common codes used being:

- *J41.- Simple and mucopurulent chronic bronchitis*
- *J42.- Unspecified chronic bronchitis*
- *J43.- Emphysema*
- *J44.- Other chronic obstructive pulmonary disease*.

As such, codes *J41.-*, *J42.-* and *J43.-* were also considered for inclusion as markers of COPD treatment.

A small number of studies have estimated the prevalence of airflow limitation consistent with COPD and the intersection with chronic bronchitis and emphysema (Marsh et al. 2008; Mejza et al. 2017; Soriano et al. 2003; Viegi et al. 2004). Findings suggest a diagnosis of chronic bronchitis may be less likely than a diagnosis of emphysema to be a true case of COPD (Marsh et al. 2008; Soriano et al. 2003; Viegi et al. 2004).

This is supported by findings from comparisons of hospital diagnosis codes for chronic bronchitis, emphysema and 'other COPD' with COPD PBS dispensing using the NIHSI AA.

Hospitalisations data from July 2018 to June 2019 were used to flag people aged 35 and over at 30 June 2019 who were separated from hospital in the period with a diagnosis of chronic bronchitis, emphysema or 'other COPD' in those years. PBS data were then used to flag those people who were dispensed 2 or more COPD prescriptions between July 2018 and June 2019. Dispensing of 2 or more COPD prescriptions is used to identify COPD cases in PBS data in this report (see 'Markers of COPD in PBS data' in Chapter 2 'How are COPD cases identified in the NIHSI AA data?' for details).

Table 2.1 shows that the proportion of people who were dispensed 2 or more COPD prescriptions in the year varies depending on their hospital diagnoses:

- 25% of people with at least one chronic bronchitis diagnosis met the dispensing criteria.
- 35% of those with at least one emphysema diagnosis met the dispensing criteria.
- 51% of those with at least one diagnosis of 'other COPD' met the dispensing criteria.

Diagnosis codes *J43.-: Emphysema* and *J44.-: Other chronic obstructive pulmonary disease* are used to identify COPD cases in hospitalisations data in this report.

Table 2.1: Proportion of people with COPD-related hospital diagnoses dispensed 2 or more COPD prescriptions, July 2018 to June 2019

Hospital diagnosis	People with the diagnosis (N)	People with the diagnosis and 2+ COPD scripts dispensed (N)	People with the diagnosis and 2+ COPD scripts dispensed (%)
Chronic bronchitis only (J41.- or J42.- only)	510	101	19.8
Chronic bronchitis and emphysema/'other COPD' (J41.- or J42.-, and one of J43.- or J44.-)	67	42	62.7
Chronic bronchitis total (J41.- or J42.-)	*577*	*143*	*24.8*
Emphysema only (J43.- only)	866	252	29.1
Emphysema and chronic bronchitis/'other COPD' (J43.- and one of J41.-, J42.-, J44.-)	330	163	49.4
Emphysema total (J43.-)	*1,196*	*415*	*34.7*
'Other COPD' only (J44.- only)	73,061	37,474	51.3
'Other COPD' and chronic bronchitis/emphysema (J44.- and one of J41.-, J42.-, or J43.-)	394	203	51.5
'Other COPD' total (J44.-)	*73,455*	*37,677*	*51.3*

Source: AIHW NIHSI AA version 1.0.

The hospitalisations data case definition

Hospitalisations data include information on the date of admission and the date of separation. COPD is a chronic condition and so a diagnosis of COPD is considered current at the time of admission. As a small number of hospitalisations can span multiple years, admission and separation dates can span multiple reporting periods. To ensure the most complete capture of COPD cases, both admission and separation dates for hospitalisation records with either a principal or additional diagnosis of J43.- or J44.- in the year before the reference date were used as markers of COPD.

Hospitalisations data for the period July 2010 to June 2019 were used to identify COPD cases in this report.

Markers of COPD in emergency department data

Presentation dates for ED records with either a principal or additional diagnosis of emphysema or COPD were used as markers of COPD.

COPD cases were identified where a person had one or more markers of COPD in ED data in the year before the reference date.

ED records contain diagnostic information for a principal diagnosis and 2 additional diagnoses. Often only a principal diagnosis is recorded in ED data which may lead to some under-reporting of COPD where it would otherwise be recorded as an additional diagnosis. Additional diagnosis information was included in analysis where available.

Emphysema and COPD diagnoses are used to identify COPD cases in ED data consistent with case identification in hospitalisations data.

Before July 2018, diagnoses in the emergency department dataset were coded inconsistently across the states and territories. Between July 2013 and July 2018 diagnoses were coded using the following classifications:

- Systematized Nomenclature of Medicine—Clinical Terms—Australian version, Emergency Department Reference Set (SNOMED CT-AU EDRS).
- International Classifications of Diseases, 9th Revision, Clinical Modification (ICD-9-CM), 2nd edition.
- International Classifications of Disease and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) 6th edition, 7th edition, 8th edition, 9th edition and 10th edition.

The AIHW uses mapping files to assign 3-character ICD-10-AM codes to different classifications. Following mapping, around 96% of principal diagnoses can be mapped to valid ICD-10-AM diagnosis codes (AIHW 2019). The ICD-10-AM coding standard has not changed over the 6th–10th editions that are in scope of the NIHSI AA version 1.0 ED data.

From July 2018, the Emergency Department ICD-10-AM 10th edition principal diagnosis short list was used by all states and territories to code diagnoses. Diagnosis information in ED data is expected to be more consistent across states and territories from this point onwards.

The codes in Table 2.2 were used to identify emphysema and COPD ED presentations in the NIHSI AA data.

The emergency department care case definition

Diagnoses of emphysema and chronic obstructive pulmonary disease in ED data were used as markers of COPD. One or more ED presentations in the year before the reference date was used for case identification.

ED data for the period July 2013 to June 2019 were available to identify COPD cases.

Table 2.2: Codes used to identify emphysema and COPD ED presentations in NIHSI AA data

Classification	Description	Code
	Emphysema	
SNOMED CT-AU EDRS[(a)]	Panacinar emphysema	4981000
	Obstructive emphysema	16846004
	Unilateral emphysema	45145000
	Centriacinar (Centrilobular) emphysema	68328006
	Pulmonary emphysema	87433001
ICD-9-CM	Emphysema	492
ED ICD-10-AM short list[(b)]	Emphysema	J43
	COPD	
SNOMED CT-AU EDRS[(a)]	COPD	13645005
	Chronic obliterative bronchiolitis	47938003
	Upper respiratory tract obstruction	68372009
	Respiratory obstruction	79688008
	End stage COPD	135836000
	Chronic obstructive bronchitis	185086009
	Chronic asthmatic bronchitis	195949008
	Acute exacerbation of COPD	195951007
	COPD with acute lower respiratory infection	196001008
	Acute infective exacerbation of COPD	285381006
	Mild COPD	313296004
	Moderate COPD	313297008
	Severe COPD	313299006
	Acute exacerbation of COPD with asthma	1751000119100
	COPD co-occurrent with acute bronchitis	106001000119101
	Asthma-COPD overlap syndrome (ACOS)	10692761000119100
ICD-9-CM	Obstructive chronic bronchitis	491.2
	Chronic obstructive asthma	493.2
	Chronic airways obstruction, not elsewhere classified	496
ED ICD-10-AM short list [(b)]	Other chronic obstructive pulmonary disease	J44

Notes

(a) Not all SNOMED codes were represented in the data

(b) ICD-10-AM ED shortlist comprises: J43.9 (emphysema), J44.0 (Chronic obstructive pulmonary disease with acute lower respiratory infection), J44.1 (Chronic obstructive pulmonary disease with acute exacerbation, unspecified), J44.9 (Chronic obstructive pulmonary disease, unspecified).

Markers of COPD in PBS data

COPD-specific prescriptions with a restricted or authority required (streamlined) listing on the PBS for the treatment of COPD were used as markers of COPD.

COPD cases were identified where a person was dispensed 2 or more COPD-specific prescriptions in the year before the reference date.

The NIHSI AA contains information about drugs dispensed under the Schedule of Pharmaceutical Benefits (PBS) and the Repatriation Schedule of Pharmaceutical Benefits (RPBS) (collectively referred to as PBS data in this report).

PBS data are recorded when a prescription is dispensed (when the prescribed medication is prepared and given to the person, usually by a pharmacist). Data captured include the unique PBS item code associated with each drug. The item code can be used to join additional information from the item map, including:

- Anatomical Therapeutic Chemical (ATC) [(a)] code
- the type of drug: active ingredient, form, strength
- whether there are any restrictions on the conditions a drug can be prescribed to treat.

(a) The ATC Classification System is a drug classification system that classifies the active ingredients of drugs according to the organ or system on which they act and their therapeutic, pharmacological and chemical properties.

This information can be used, in combination with an understanding of the medication used in maintenance treatment of COPD, to identify potential disease cases within the PBS data.

Medication used for maintenance treatment of COPD are considered to provide the most stable markers as they are prescribed for regular use. In contrast, medication used to manage COPD exacerbations are only dispensed as needed and often used to manage exacerbations for other respiratory conditions as well. For these reasons they are not considered reliable markers of COPD.

A list of medications used in the maintenance treatment of COPD was compiled based on information and recommendations made in the Therapeutic Guidelines (Therapeutic Guidelines Limited 2020) and the Lung Foundation Australia's COPD-X Guidelines (Yang et al. 2022). These are:

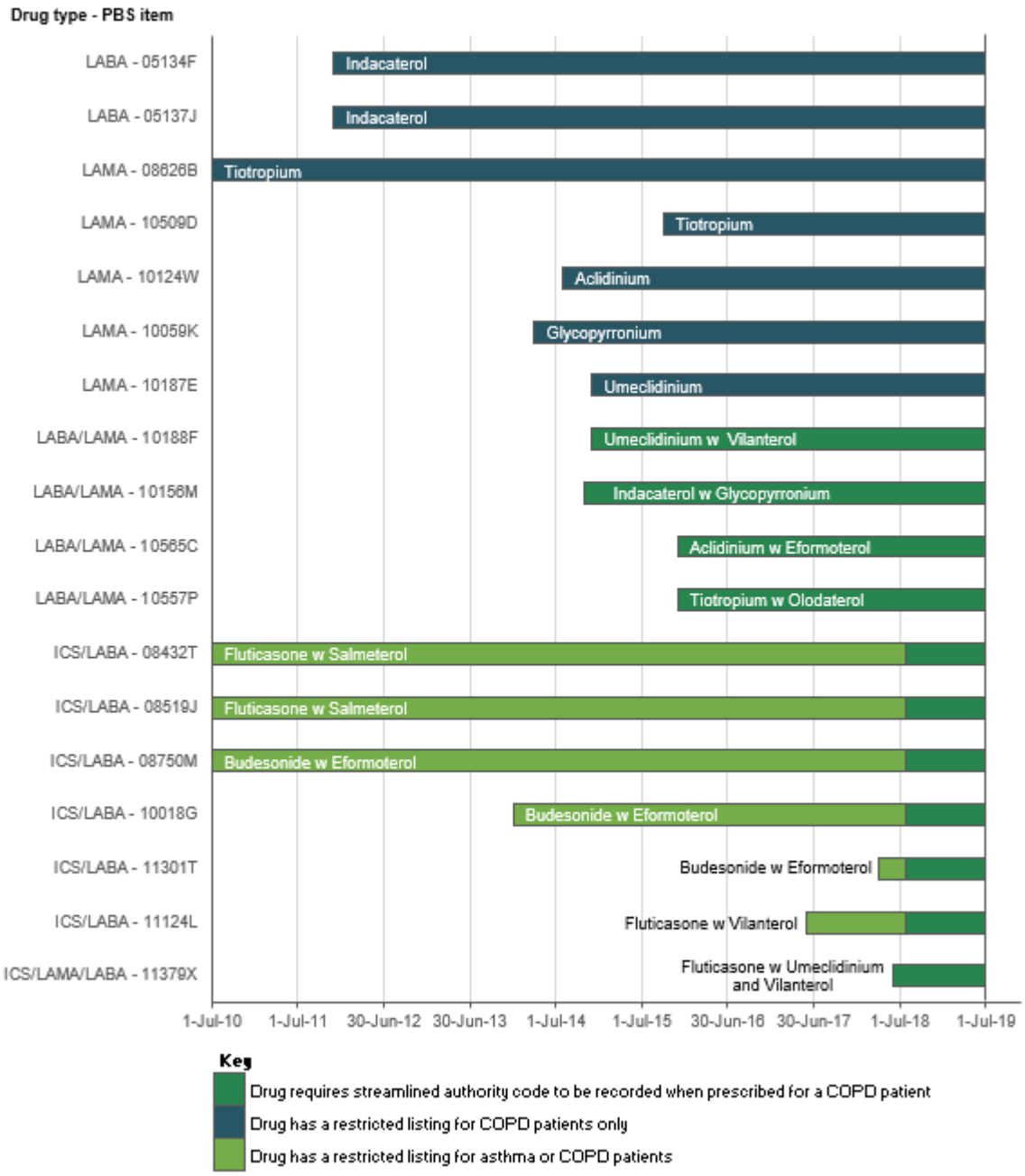
- Long-acting beta2 agonists (LABAs): eformoterol, indacaterol and salmeterol.
- Long-acting muscarinic antagonists (LAMAs): aclidinium, glycopyrronium, tiotropium and umeclidinium.
- LABA/LAMA combinations.
- High-dose inhaled corticosteroids (ICS) in combination with LABA (ICS/LABAs).
- An ICS/LABA/LAMA combination of fluticasone with umeclidinium and vilanterol.

A German COPD cohort study found that more than 90% of subjects who had COPD were taking a LABA or LAMA medication in mono, dual or triple therapy (Graf et al. 2018). Using dispensing of prescriptions for these medications as markers is considered likely to capture the majority of COPD cases.

Figure 2.3 provides an overview of the PBS item codes used as markers of COPD. These items are for medications that have a restricted or authority required (streamlined) listing on the PBS for the treatment of COPD. Dispensing of these medications is referred to as COPD-specific prescription dispensing or COPD prescription dispensing in this report.

For further information on PBS restrictions see: https://www.pbs.gov.au/info/healthpro/explanatory-notes/section1/Section_1_2_Explanatory_Notes.

Figure 2.3: COPD markers in PBS data, July 2010 to July 2019



Source: AIHW analysis of PBS data maintained by the Department of Health and Aged Care and sourced from Services Australia.

The PBS items in Figure 2.3 are colour-coded according to their associated restriction status on the PBS:

- Items that are listed as 'Authority required (Streamlined)' (AS–COPD) are shown in dark green. These items can only be dispensed when the prescription is written on an authority prescription form and includes the 4-digit streamlined authority code corresponding to the condition being treated. They are expected to provide a good indication of COPD diagnosis, where this information is recorded at the time of dispensing. Some limitations to the use of these codes relate to differences in prescriber

and dispensing software that may affect the likelihood of a streamlined authority code being recorded at the time of dispensing and the accuracy of the code. Mis-itemisation may occur when a drug is listed for multiple indications.

This group comprises LABA/LAMA combinations, ICS/LABA combinations from 1 August 2018 and the ICS/LABA/LAMA combination added to the PBS on 1 June 2018.

- Items with a restricted COPD listing (R–COPD) are shown in blue. R-COPD items are expected to provide a good indication of COPD diagnosis where product information indicates items should not be used to treat asthma (as in the case of indacaterol monotherapy) or all items for a medicine with the same form and strength have a restricted COPD listing. Where an item with a restricted COPD listing has the same active ingredient, form, strength, maximum quantity, repeats and pack size as an item with a restricted listing for asthma, the item may be somewhat less effective in identifying a COPD case.

This group consists of LABAs and LAMAs listed on the PBS over the study period.

- Items that have a restricted status for the treatment of asthma and COPD (R–asthma and COPD) are shown in light green. These items are expected to provide low confidence in COPD diagnosis alone. However, as the restriction status for most of these items was changed to require a streamlined authority code on 1 August 2018 dispensing before 1 August 2018 is counted by the algorithm where a streamlined authority code for COPD is recorded in the data for the individual from 1 August 2018.

This group comprises ICS/LABA combinations before August 2018.

It is important to note that PBS data only capture medication dispensing. Data are not available on prescriptions written by a health professional that are not dispensed to the patient, and it is not possible to determine whether, when or how the medicine was used.

Testing thresholds for the PBS case definition

COPD prevalence is currently routinely monitored by the AIHW based on self-reported current and long-term bronchitis or emphysema collected as part of the ABS NHS collection. Self-reported COPD and airflow limitation were captured in the emphysema group.

Case definitions based on different thresholds of the number of COPD-specific PBS prescriptions dispensed in a year were tested to determine how this affected the level of agreement between PBS cases and self-reported current and long-term bronchitis or emphysema. The case definitions tested ranged from one or more COPD-specific prescriptions up to 6 or more COPD-specific prescriptions dispensed in a year.

Testing was performed using a cohort of 22,300 people in the 2014–15 and 2017–18 NHS who were linked to the Medicare Consumer Directory (MCD) within the Multi-Agency Data Integration Project (MADIP 2014–2018).

Challenges identifying people with COPD from self-reported data include the self-reported nature of the survey and changes in the terms used to describe COPD over time. These limit the use of this comparison to evaluate the PBS case definition. See Chapter 7 ‘How does COPD-specific prescription dispensing compare with self-reported conditions?’ for further information on these limitations. Nonetheless, comparison can provide some context on how different PBS case definitions thresholds perform against this reference.

Overlap and agreement measures

Five measures were used to describe the overlap and agreement of COPD cases classified using the PBS case definition with those who self-reported current and long-term bronchitis or emphysema in the 2014–15 and 2017–18 NHS. In this analysis self-reported condition information provides the reference standard against which the PBS case definition is evaluated.

The measures used were the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and Kappa (κ). These measures have been used in similar studies comparing administrative data case definitions with self-reported conditions (Lix et al. 2006; Lujic et al. 2017) and are described in Box 2.1.

Box 2.1: Key measures

Sensitivity: is the true positive rate. It represents the proportion of people who self-reported bronchitis or emphysema who also met the PBS case definition. This tells us how many people self-reporting bronchitis or emphysema are having COPD-specific prescriptions dispensed.

Specificity: is the true negative rate. It represents the proportion of people who did not self report bronchitis or emphysema who were not identified as a COPD case (using the PBS case definition).

Positive Predictive Value (PPV): is the proportion of people who met the PBS case definition who also self-reported bronchitis or emphysema. This tells us how many people being dispensed COPD-specific medication are self-reporting bronchitis or emphysema.

Negative Predictive Value (NPV): is the proportion of people who didn't meet the PBS case definition who also didn't self-report bronchitis or emphysema.

Kappa: a measure of agreement between two sources, each of which is measured on a binary scale (that is, disease present/absent). It represents the proportion agreement corrected for chance and is used to measure the agreement between COPD cases identified using PBS data and those who self-reported bronchitis or emphysema. The interpretation of κ used in this report is (Altman 1991):

- Poor agreement: $\kappa < 0.20$
- Fair agreement: $\kappa = 0.20$ to 0.39
- Moderate agreement: $\kappa = 0.40$ to 0.59
- Good agreement: $\kappa = 0.60$ to 0.79
- Very good agreement: $\kappa = 0.80$ to 1.00.

An additional measure, the F-1 score was also produced. However, this measure is more commonly used to evaluate models and results were found to be largely consistent with Kappa values so the F-1 score is not reported.

Lower thresholds had higher sensitivity and better overall agreement

The evaluation of dispensing thresholds of one or more up to 6 or more COPD-specific prescriptions against self-reported bronchitis or emphysema shows the trade-off between the sensitivity and PPV of the prescription criteria with increasing thresholds. There is a much larger reduction in sensitivity (from 32% to 21%) as the threshold for the number of prescriptions is increased, compared with the smaller increase in PPV (from 45% to 50%, Table 2.3).

Table 2.3: Testing different thresholds of PBS prescription dispensing against self-reported bronchitis or emphysema, people aged 35 and over in 2014-15 and 2017-18

Number of prescriptions used to identify a PBS case	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Kappa
1 or more	32.3	98.1	45.0	96.8	0.35
2 or more	29.3	98.4	46.7	96.7	0.34
3 or more	27.0	98.6	48.0	96.6	0.32
4 or more	24.9	98.7	48.2	96.5	0.31
5 or more	23.4	98.9	50.0	96.5	0.30
6 or more	21.1	99.0	50.5	96.4	0.28

Source: 2014-15 and 2017-18 NHS linked with PBS (MADIP 2014-2018).

Fair agreement was found between PBS COPD-specific prescription dispensing and self-reported bronchitis and emphysema with the highest values of agreement for one or more prescriptions (kappa = 0.35) and 2 or more prescriptions (kappa = 0.34, Table 2.3).

A threshold of one or more COPD-specific prescription dispensing was the most sensitive threshold but was considered more likely to misclassify non-cases as cases due to the potential for people to have a single prescription dispensed as a trial of medication. The changes in sensitivity also need to be considered carefully due to the caveats around the self-reported definition of COPD as bronchitis or emphysema (see Chapter 7 ‘How does COPD-specific prescription dispensing compare with self-reported conditions?’ for details).

The PPV increased from 45% to 47% when increasing the threshold from one or more to 2 or more COPD-specific prescription dispensing in the reference year (Table 2.3). This is a larger increase in PPV compared with the change from 47% to 48% when the threshold is increased from 2 or more to 3 or more COPD-specific prescriptions dispensed in a year.

The specificity and NPV were consistently high across all thresholds tested. The specificity ranged between 98% to 99% and the NPV ranged between 96% and 97%. This is partly due to most people not identified as a PBS case not self-reporting bronchitis or emphysema.

These results show that a threshold of 2 or more COPD-specific prescriptions dispensed in a year for the PBS case definition provides a balance of increased PPV while maintaining a sensitive threshold.

The PBS case definition

Prescription dispensing was counted at the date of supply. The COPD medications used as markers of COPD are prescribed for regular use although some people may only need to take these medications during part of the year, particularly if their risk of exacerbation is related to seasonal variations.

COPD cases were identified where a person had been dispensed 2 or more COPD-specific prescriptions in the year before the reference date.

Dispensing for the period July 2010 to June 2019 was used to identify COPD cases in this report.

Markers of lung function testing and smoking history

Evidence of spirometry being performed and of smoking history captured in the NIHSI AA can provide additional context to the COPD cases identified using the PBS, hospitalisations and ED data.

Spirometry

A COPD diagnosis is confirmed after spirometry (see 'Box 1.1' for further information). Evidence of spirometry being performed can be found in MBS data. However, as the results and interpretation of the spirometry test are not captured in the data, this information cannot be used to identify cases. Spirometry that is not eligible for MBS payment (for example, in spirometry performed in hospitalised patients) will also not be included. Furthermore, spirometry is known to be underused in diagnosis of COPD (Zwar et al. 2011) and at the same time it is used in the diagnosis of other respiratory conditions, including asthma.

Therefore, evidence of spirometry will not be used as a marker of COPD but will be used to provide context to COPD cases identified using other markers. It can suggest that a COPD case identified in other data sources was made with the use of spirometry.

Evidence of spirometry testing was found using the MBS item codes listed in Table 2.4.

The data were analysed for the period July 2010 to June 2019. More than 99% of COPD cases were linked with the MBS data used in analysis.

Table 2.4: MBS spirometry items included in analysis

Code	Short description	Currency
11503	Complex lung function tests[a]	1/12/1991—current
11506	Office-based spirometry[b]	1/12/1991—current
11509	Measurement of respiratory function	1/12/1991—31/10/2018
11512	Laboratory-based spirometry[c]	1/12/1991—current
11505	Office-based spirometry (Diagnosis)	1/11/2018—current
11507	Fractional Exhaled Nitric Oxide (FeNO) spirometry	1/11/2018—current

Notes

(a) From 1 November 2018, item 11503 includes a broader range of common complex lung function tests that are supported by clinical evidence.

(b) Before 1 November 2018, item 11506 includes both diagnosis and monitoring purpose. From 1 November 2018, item 11506 is indicated for monitoring purpose.

(c) From 1 November 2018, item 11512 includes services that were previously provided under item 11509.

Smoking history

Evidence of smoking history can be indicated by dispensing of prescriptions prescribed to aid in smoking cessation in PBS data. In addition, hospitalisations data includes tobacco and nicotine-related diagnoses that can be used to identify probable smoking status. This information can provide additional context to COPD cases.

It is important to note that a history of past or current smoking is not captured where this is not recorded in the patient history or coded at separation, where these medications are not dispensed or obtained over-the-counter, and if hospitalisation is not required for treatment.

It is important to note that smoking is not essential for the diagnosis of COPD unlike in the past and not all people who have a history of smoking will be able to be identified using the information available in these data sources. Smoking history will not be captured where

medication is accessed without a prescription through pharmacies, supermarkets or online outside the PBS system, where hospitalisation is not required for treatment or where smoking history is not recorded in the patient history or coded at separation.

Drugs used in nicotine dependence including Bupropion, nicotine replacement therapy and Varenicline are used to assist in smoking cessation. Dispensing of these drugs in PBS data is flagged using the item codes in Table 2.5.

Table 2.5: PBS item codes used to identify drugs used in nicotine dependence

ATC code	Item code	Drug name	Currency
N06AX12	08465M	Bupropion	1/02/2001–-current
N06AX12	08710K	Bupropion	1/02/2004–-current
N07BA01	03414Q	Nicotine	1/02/2011–-current
N07BA01	04571N	Nicotine	1/08/1994–-current
N07BA01	04572P	Nicotine	1/08/1994–-current
N07BA01	04573Q	Nicotine	1/08/1994–-current
N07BA01	04576W	Nicotine	1/11/1995–-current
N07BA01	04577X	Nicotine	1/11/1995–-current
N07BA01	04578Y	Nicotine	1/11/1995–-current
N07BA01	05465P	Nicotine	1/02/2011–-current
N07BA01	05571F	Nicotine	1/01/2012–-current
N07BA01	05572G	Nicotine	1/01/2012–-current
N07BA01	05573H	Nicotine	1/01/2012–-current
N07BA01	09198D	Nicotine	1/12/2008–-30/06/2014
N07BA01	10076H	Nicotine	1/04/2014–-current
N07BA01	11612E	Nicotine	1/02/2019–-current
N07BA01	11617K	Nicotine	1/02/2019–-current
N07BA01	11618L	Nicotine	1/02/2019–-current
N07BA01	11619M	Nicotine	1/02/2019–-current
N07BA03	05469W	Varenicline	1/02/2011–-current
N07BA03	09128K	Varenicline	1/01/2008–-current
N07BA03	09129L	Varenicline	1/01/2008–-current

Evidence of tobacco use is captured in ICD-10-AM diagnosis codes in hospitalisations data. The codes in Table 2.6 are used to indicate current or previous tobacco use.

Table 2.6: ICD-10-AM codes used to identify tobacco use

ICD-10-AM code	Description
F17.0–-F17.9	Mental and behavioural disorders due to use of tobacco (harmful and dependent use)
T65.2	Toxic effects of Tobacco and nicotine
Z86.43	Personal history of tobacco use disorder
Z71.6	Counselling for tobacco use disorder
Z72.0	Tobacco use, current

Dispensing of drugs used in nicotine dependence in PBS data and ICD-10-AM diagnoses related tobacco use in hospitalisations data were analysed for the period July 2010 to June 2019 to provide information on whether a case had a history of smoking.

3 How does the NIHSI AA COPD case finding algorithm operate?

Key findings

- More than 90% of NIHSI AA COPD cases were identified using PBS data. This proportion was largely consistent across estimates by age, sex and over time although people aged under 55 and 85 and over were slightly less likely to be identified in a PBS-only case definition.
- Most people identified with COPD in the NIHSI AA data had additional evidence to support they have COPD.
- Most people were consistently classified by the algorithm over time.

How the multi-source algorithm is defined

An algorithm is a set of rules to be followed in calculations or solving problems. The multi-source algorithm describes the set of rules applied to identify COPD cases using the combined PBS, ED and hospitalisations data within the NIHSI AA.

The multi-source algorithm counts the number of people aged 35 and over at 30 June each year who were identified as a COPD case in PBS, ED or hospitalisations data in the 1-year look-back period, who did not die before the reference date. COPD cases counted at each reference date were identified if they met at least one the following case definitions:

- PBS case: a person dispensed 2 or more COPD-specific prescriptions in the year before the reference date.
- Hospitalisation case: one or more admissions or separations with a principal or additional diagnosis of *J43: Emphysema* or *J44: Other COPD* in the year before the reference date.
- ED case: one or more ED presentations with a principal or additional diagnosis equivalent to ICD-10-AM J43 or J44 in the year before the reference date. Diagnoses recorded as SNOMED or ICD-9 codes were first mapped to ICD-10-AM codes.

See Chapter 2 ‘How are COPD cases identified in the NIHSI AA data?' for full details of each case definition.

Why a 1-year look-back is used for case identification

Choosing an appropriate look-back period requires consideration of how COPD is diagnosed, what can be usefully measured with the available data, as well as any limitations.

A 1-year look-back period is used for case identification in the NIHSI AA data to monitor the prevalence of COPD based on health service use over time. This look-back period was chosen to identify people with diagnosed COPD, alive at the 30 June reference date, who used health services in the year before. This measure provides a useful starting point for health service planning into the next year.

The 1-year look-back period prevents increasing overestimating of COPD prevalence over time by not counting cases from their first marker in the data onwards. There are several reasons why this would overestimate COPD prevalence over time:

- NIHSI AA data do not contain information on when an individual migrates to or from Australia. As such, using an all-time look-back to count COPD cases from their first marker of COPD onwards would increasingly overestimate COPD prevalence over time.
- The diagnosis of COPD may involve trialling medication to confirm the condition. A patient may be trialled on COPD-specific medication if COPD is suspected but this medication will be discontinued if a different condition is confirmed. A higher threshold to confirm a case would be required to avoid continuing to count unconfirmed cases of COPD identified based on trialling medication and avoid increasingly overestimating COPD prevalence over time due to this. However, this would risk missing a larger number of people with mild COPD who only need to use COPD-specific prescriptions during certain times of the year when they are at most risk of exacerbation.
- If a clinical diagnosis of COPD is not initially based on the use or correct interpretation of diagnostic testing or spirometry the label of COPD may persist and inform future diagnostic coding in hospital and ED or on death certificates and associated COPD-specific medication use despite the actual lack of a correct diagnosis of COPD.

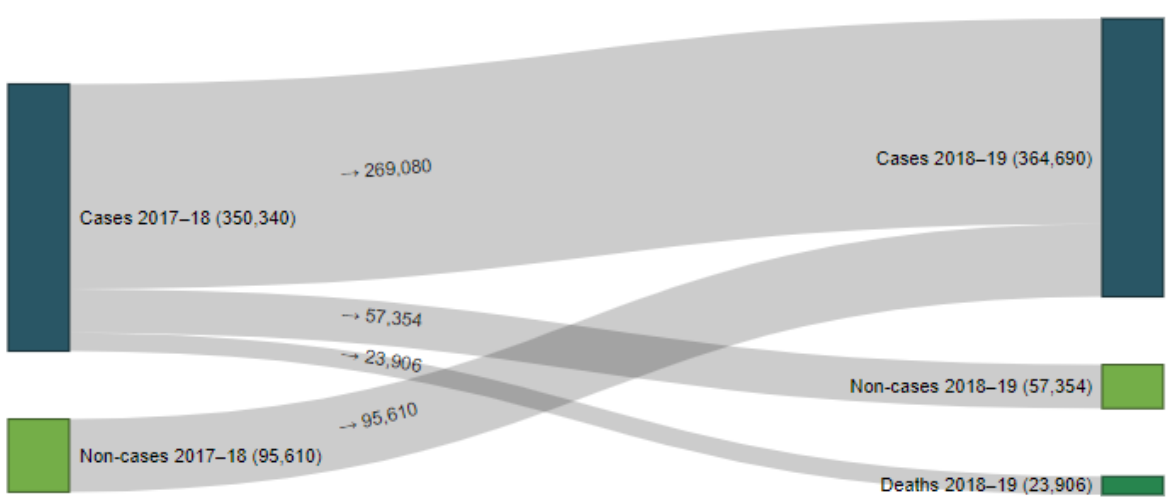
Most people are consistently classified over time

The NIHSI AA multi-source algorithm counts people who are dispensed specific COPD medication or use specific COPD services in the year before the reference date as a COPD case at each reference date. This means that some individuals classified as a COPD case at one reference date are not classified as a case at the next, depending on their service use. Potential reasons for this are described in Box 3.1.

Of the 350,000 people identified with COPD at 30 June 2018:

- 77% continued to be classified as a case at 30 June 2019
- 16% were no longer classified as a case at 30 June 2019
- 6.8% died in the following year up to 30 June 2019 (Figure 3.1).

Figure 3.1: NIHSI AA COPD case classification at 30 June 2018 and 30 June 2019



Note: Bars are weighted by the number of people in each group.

Source: AIHW NIHSI AA version 1.0 (Appendix Table A1).

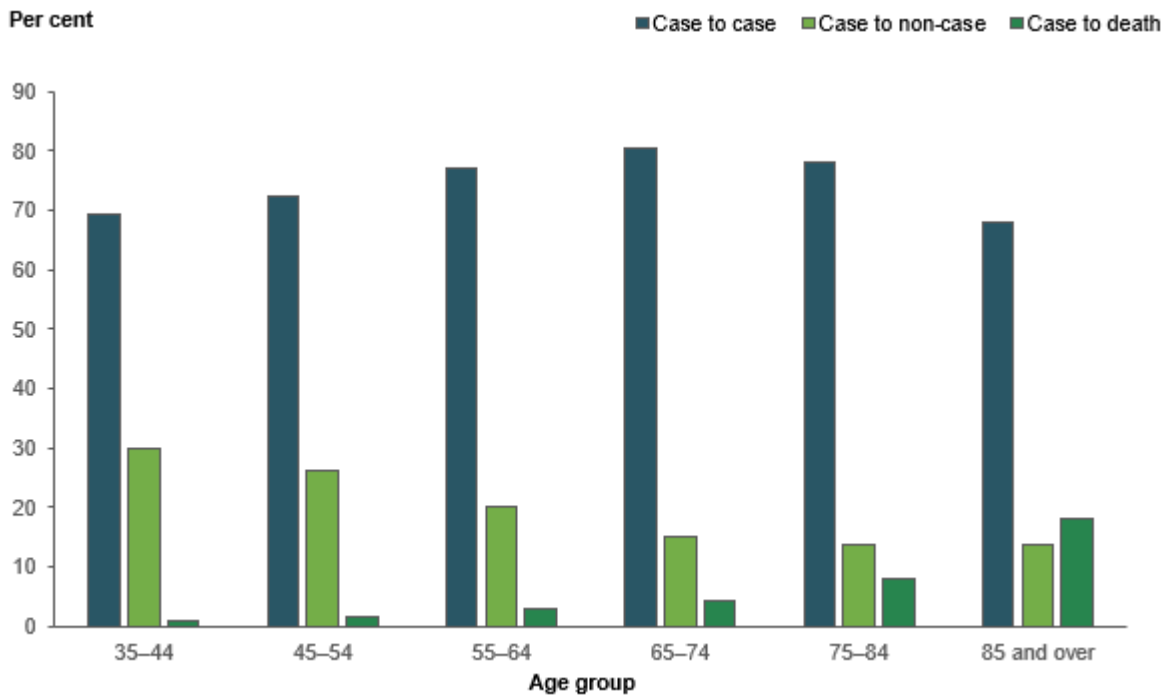
The proportions of people in each group varied by age group (Figure 3.2). Consistency in case classification across the 2 reference periods was:

- highest (81%) among those aged 65–74.
- lowest (68%) among those aged 85 and over. This is due to the large proportion of cases at 30 June 2018 (18%) who died before 30 June 2019.

In contrast, the proportion of cases at 30 June 2018 not classified as a case at 30 June 2019 was:

- highest (30%) among those aged 35–44. This may be due to these cases being milder and not requiring services each year, or trialling medication that is later discontinued as part of determining treatment or confirming a diagnosis. People travelling overseas for extended periods in this age group may also be a factor.
- Lowest (14%) among those aged 75–84 and 85 and over. This will partly be due to the larger proportions of deaths of cases in these age groups.

Figure 3.2: Changes in case classification 30 June 2018 and 30 June 2019, by age at 30 June 2018



Note: Percentages are of COPD cases classified at 30 June 2018 in each age group.

Source: AIHW NIHSI AA version 1.0 (Appendix A Table A1).

Box 3.1. Why some people with COPD may not be identified or not consistently identified by the NIHSI AA algorithm

There are several reasons why a person with COPD may not be identified by the multi-source algorithm or may not be consistently identified over time. These include:

- Undiagnosed cases of COPD will not be captured by the multi-source algorithm.
- Mild cases of COPD not requiring treatment with COPD-specific medication and not requiring hospital or emergency care will not be captured. Those only requiring these treatments sporadically throughout the observation period will not be consistently identified as cases.
- Some people prescribed COPD medication will not have the prescription dispensed, or not dispensed regularly enough to be captured at each reference point. Others may receive COPD medication outside of the PBS at different times. For example, through Aboriginal health services or while in prison.
- Cases where COPD medication is discontinued or changed to non-specific COPD medications or other forms of treatment may not be consistently identified. This may result from trialling medications as part of the diagnosis process but where an alternative diagnosis is confirmed. It may also occur when medication becomes ineffective and oxygen is needed instead.
- Migration out of Australia or a missing link to a death record may explain why some cases are not identified in the data in later years.

More than 90% of people identified with COPD are found using PBS data

More than 365,000 people were identified with COPD in the NIHSI AA data at 30 June 2019. The proportion of cases identified in each data source was:

- PBS: 93% of all people identified with COPD met the PBS case definition with 82% of all cases identified in PBS data only.
- hospitalisations: 16% of all people identified with COPD met the hospitalisations data case definition with 4.8% of all cases identified in hospitalisations data only.
- ED: 7.4% of all people with COPD met the ED case definition with 0.9% of all cases identified in ED data only.

These proportions were largely consistent over time.

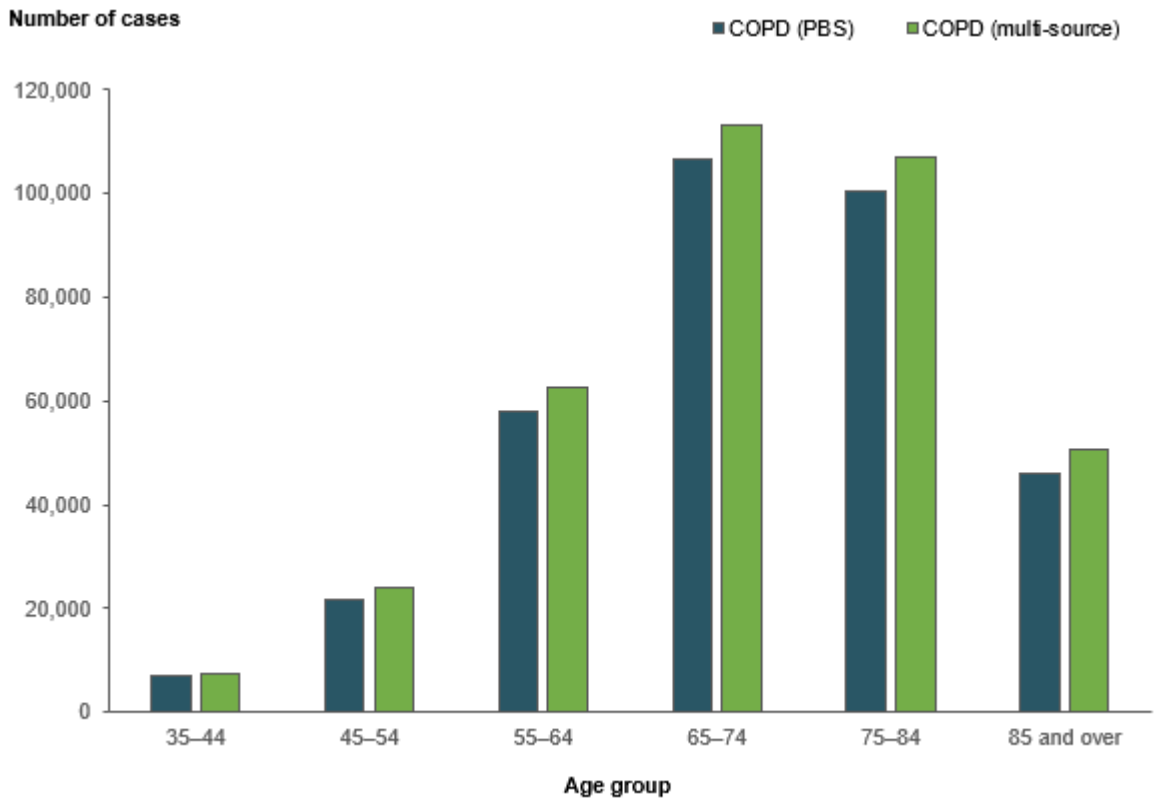
The multi-source algorithm identified 11% of people with COPD in multiple data sources. That is, 11% of cases met both the PBS case definition and either the ED or hospitalisations case definition or met all 3 case definitions.

Half (50%) of people identified with COPD were men and half women. This was the same for people identified by both the PBS case definition and multi-source algorithm (Appendix A Table A2).

The age distributions of PBS cases and cases identified by the multi-source algorithm are compared in Figure 3.3. The distributions are largely consistent. The PBS case definition identifies between 93% and 94% of cases captured by the multi-source algorithm in the 55–64, 65–74 and 75–84 age groups (Appendix A Table A2). This is compared with between 90% and 91% of cases in the other age groups.

This shows that most NIHSI AA COPD cases are identified using PBS data and that in the absence of ED and hospitalisations data, estimates based on PBS data will identify most of the COPD cases identified by the NIHSI AA algorithm.

Figure 3.3: Age distribution of PBS and multi-source COPD cases at 30 June 2019



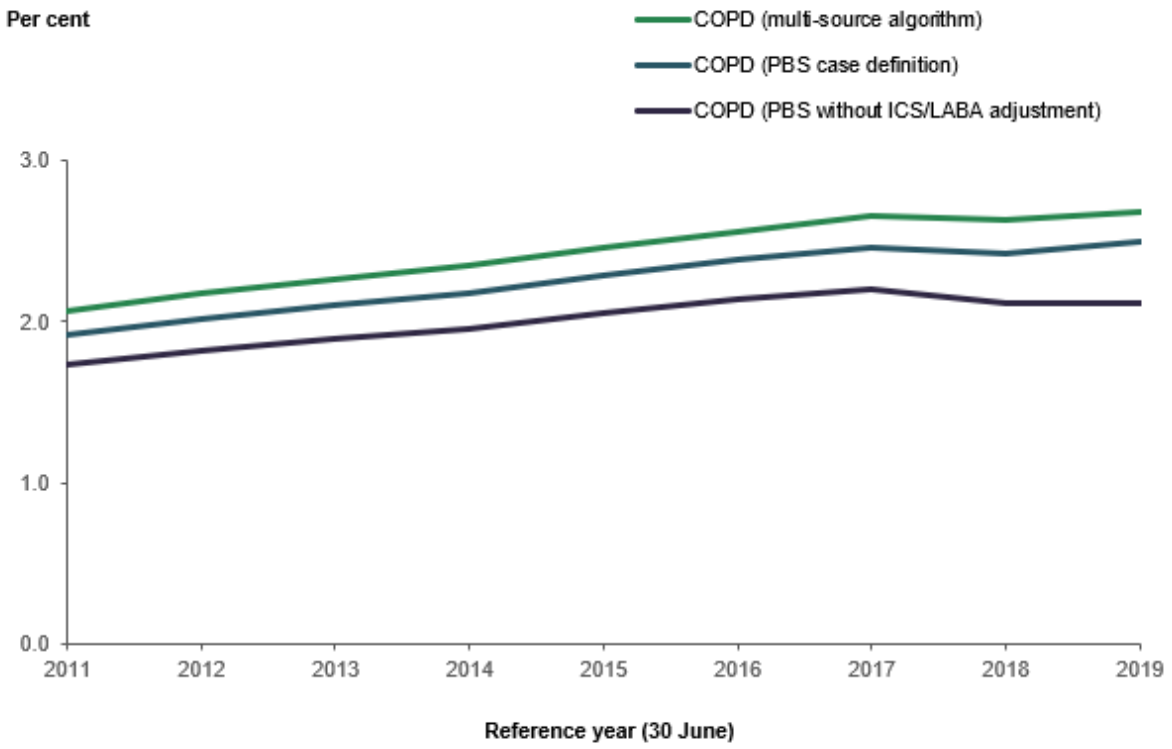
Source: AIHW NIHSI AA version 1.0 (Appendix A Table A2).

From August 2018, ICS/LABA combinations on the PBS required a streamlined authority code to be recorded at the time of dispensing. This code indicates whether the medication was prescribed to treat asthma or COPD.

The PBS case definition for the multi-source algorithm counts all ICS/LABA prescription dispensing for a person as COPD-specific if the individual had any ICS/LABA prescriptions dispensed with an authority streamlined code for COPD from August 2018. ICS/LABA dispensing for these people is counted retrospectively so that ICS/LABA dispensing before the introduction of the streamlined authority codes in August 2018 is counted in COPD estimates from 30 June 2011 to 30 June 2018. It is also applied to data from 1 July 2018 and after the introduction of the streamlined authority codes to account for missing streamlined authority information on dispensing of some prescriptions. Without this adjustment, only COPD estimates from 30 June 2019 onwards could use ICS/LABA dispensing to identify people with COPD.

The effect that this adjustment has on prevalence estimates can be seen by comparing the trendlines for ‘COPD (PBS without ICS/LABA adjustment)’ and ‘COPD (PBS case definition)’ in Figure 3.4. PBS estimates from 30 June 2011 to 30 June 2017 that don’t count any ICS/LABA dispensing are about 11% lower than estimates using the PBS case definition. The difference is slightly larger (18%) between these estimates at 30 June 2019. This may be due to the combined effect of an increase in people with COPD transitioning to ICS/LABA dual therapy at this point alongside a period of uptake in entering the authority streamline codes after they are introduced that means not all ICS/LABA dispensing from August 2018 will have a streamlined authority code.

Figure 3.4: Comparing PBS and multi-source COPD prevalence estimates at 30 June, 2011 to 2019



Source: AIHW NIHSI AA version 1.0 (Appendix A Table A3).

It is important to note that individuals only dispensed ICS/LABA for COPD before August 2018 could never have their ICS/LABA dispensing counted to identify them as a COPD case and will be missed by the multi-source algorithm unless they also had other markers of COPD (in ED or hospitalisations data).

Most COPD cases identified have additional evidence to support they have COPD

The multi-source algorithm provides a minimum threshold to classify COPD cases. Additional evidence to support that people identified as having COPD have the condition is found where cases exceed this minimum threshold, have evidence of spirometry testing (which is used to formally diagnose COPD), or have a history of smoking (a major risk factor for COPD).

It is important to note that while evidence of spirometry being performed can be found in the data, the results of testing are not available to provide evidence of a diagnosis. Furthermore, not all people with COPD will have a smoking history and those with a smoking history who do not receive treatment in hospital, who do not use medication or purchase medication over-the-counter (without a prescription) cannot be identified.

Of the 365,000 people identified with COPD at 30 June 2019:

- 68% of all cases had evidence of a smoking history between July 2010 and June 2019.
- 68% of people identified based on PBS data were dispensed COPD prescriptions 6 or more times in the year.
- 69% of all people identified had one or more spirometry tests between July 2010 and June 2019. 28% of all people identified with COPD had one or more spirometry tests in the year leading up to 30 June 2019.
- 46% of all people identified were dispensed COPD prescriptions 6 or more times in the 1-year look-back period and had one or more spirometry tests between July 2010 and June 2019.
- 32% of people identified based on hospitalisations data had multiple separations for emphysema or ‘other COPD’ in the year.

Of all people identified with COPD at 30 June 2019, 3.4% met the minimum threshold of being dispensed exactly 2 COPD prescriptions in the 1-year look-back period. These people may have been newly diagnosed with COPD during the reporting period or only require these medications during certain months of the year when their risk of exacerbation is elevated.

Information on deaths in the NIHSI AA version 1.0 is available from July 2010 to December 2019, with cause of death information from July 2010 to December 2018. Cause of death is not used as a marker of COPD (as the individual is not alive to be counted at the reference date) but can provide information to assess the performance of the multi-source algorithm. An underlying or associated cause of death of *J43.-: Emphysema* and *J44.-: Other chronic obstructive pulmonary disease* was used to identify COPD deaths.

Of the 347,000 people identified with COPD at 30 June 2017, 7.0% (24,300) died in the following year (Appendix A Table A9). Of those who died, 46% (11,300) had COPD as either the underlying or an associated cause of death. These proportions were largely stable over the NIHSI AA observation period.

In contrast, 1.1% (135,000) of people not identified with COPD at 30 June 2017 died in the following year of which 3.9% (5,200) had COPD listed as a cause of death. Of the 5,200 non-cases with COPD listed as a cause of death, 38% (2,000) met conditions to be counted as a case at the next reference date (30 June 2018) but died before. These proportions were fairly stable over the observation period.

Possible reasons why a person with COPD may not be classified as a case by the multi-source algorithm are described in Box 3.1.

These results provide evidence that most cases identified by the multi-source algorithm are likely to have COPD.

4 How do we measure COPD prevalence?

This chapter describes the methods used to calculate COPD prevalence using the NIHSI AA data. Point prevalence is estimated at 30 June each year (referred to as the reference date). Prevalence counts are of the number of people alive at each reference date who were identified with markers of COPD in the health services data in the year before.

The at-risk population

The Australian and New Zealand Guidelines for the management of COPD (COPD-X guidelines) recommend that COPD be considered in all smokers and ex-smokers who are aged 35 and over (Yang et al. 2022). The Lung Foundation Australia's (2023) position paper recommends that screening for COPD be performed for all at-risk individuals aged 35 years and older. The paper recommends that, in addition to individuals who are smokers or ex-smokers, individuals should undergo screening where they meet one of the following conditions:

- were previously or are currently exposed to dust, gas or fumes through work
- cough several times most days, or cough up phlegm or mucus most days
- become out of breath more easily than others of a similar age
- experience chest tightness or wheeze
- have frequent chest infections.

Although people may be diagnosed with COPD before age 35, people aged 35 and over are the focus of analysis in this report, consistent with recommendations for COPD screening, due to the higher risk of a respiratory condition being COPD from this age.

Inclusion criteria and derived variables

Analysis of the NIHSI AA version 1.0 was restricted to people:

- not missing information to calculate age
- alive and aged 35 and over at 30 June at each reference date. Individuals with a calculated age of 115 years and over at the reference date (<0.01% of individuals identified in the data) were excluded from analysis due to this being an implausible age.

Records dated after an individual's date of death and after 30 June 2019 were excluded from analysis.

Sex was derived as the most recent, unique, value recorded for an individual across NIHSI AA version 1.0 data sources. Depending on the data source and recording practices, sex may be patient reported, or recorded by a staff member. It may also be based on an existing record for the patient, which may no longer reflect how they identify. It is important to note that it is not known if the people completing these records interpreted sex to mean sex at birth or gender identity.

State of usual residence was derived at 30 June 2019 as the most recent unique value recorded across NIHSI AA version 1.0 data sources for each individual.

Statistical Area level 2 (SA2) information was derived at 30 June 2019 as the most recent, unique value recorded across data sources using data from 1 July 2017 to 30 June 2019. This was then mapped to the 2016 ABS Socio-Economic Index for Areas (SEIFA) Index of Relative Socio-economic Disadvantage (IRSD) and Australian Statistical Geography

Standard 2016 Remoteness Areas to produce results by population-based socioeconomic area quintiles and remoteness. For more information see:

- Socio-Economic Indexes for Areas (SEIFA) 2016: https://www.abs.gov.au/ausstats/abs@.nsf/mf/2033.0.55.001
- Remoteness Structure: https://www.abs.gov.au/statistics/statistical-geography/remoteness-structure

Denominator population

As the NIHSI AA is a service-based data set, activity for people is only captured in the data if and when they use these services or have their death recorded in Australia.

NIHSI-derived population estimates were compared with ABS Estimated Resident Population (ERP) and found to be largely similar across demographics including age group, sex and state/territory.

Considering this, national ERP data at each reference date were used as the denominator for COPD prevalence estimates using NIHSI AA data. The ERP at 30 June represents the estimated number of living usual residents in Australia at that point in time. There may be a small proportion of overseas visitors who may not be considered usual residents of Australia who are counted in the NIHSI AA data as they used health services.

Aggregated SA2 (2016) population data for 2019, mapped to 2016 SEIFA IRSD areas were used as the denominator for estimates by socioeconomic area. Remoteness area (2016) population data for 2019 was used as the denominator for estimates by remoteness area.

Estimates by population groups and for trends are age-standardised. The standard population used to calculate the age-standardised prevalence was the Australian ERP at 30 June 2001.

While PBS data are national in scope, ED and hospitalisations data from Western Australia (WA) and the Northern Territory (NT) were not included in the NIHSI AA version 1.0. Sensitivity analysis was performed with COPD case counts (identified from PBS, ED and hospitalisations data) and ERP counts for WA, NT, and ‘Other territories’ excluded from the calculation. No substantial difference was observed between national estimates and estimates excluding WA, NT and ‘Other territories' as most COPD cases were identified using the PBS data (Appendix A Table A4).

For people aged 35 and over at 30 June 2019 the prevalence of COPD was:

- 2.8% based on PBS, ED and hospitalisations and ERP data for the selected states combined (excluding WA, the NT, and ‘Other territories’).
- 2.7% based on cases identified using national PBS data and available ED and hospitalisations data, using the national ERP as the denominator.

There is small variation in the difference between estimates for the selected states and national estimates by age and sex. Comparing the ratio of these estimates shows that estimates for the selected states are between 1% and 5% higher than national estimates. The difference is largest in the youngest age groups (35–39 to 50–54).

National estimates were considered robust and appropriate for reporting based on these results.

5 What is the prevalence of COPD identified in the NIHSI AA data?

Key findings

More than 365,000 (2.7% of) people aged 35 and over were identified with COPD in the NIHSI AA data at 30 June 2019 based on their service use in the year before. Of those, almost 66,200 people (18%) had not been identified in the data with COPD previously (between July 2010 and June 2018).

Most people identified with COPD were aged 65 to 84. COPD prevalence ranged from 0.2% among people aged 35–44 to 10% among those aged 85 and over.

After adjusting for age, the prevalence of COPD was higher among men than women, and higher in the lowest socioeconomic areas compared with the highest. COPD prevalence was lower in *Major cities* than in other areas, after adjusting for age.

NIHSI AA COPD estimates increased from 2.1% at 30 June 2011 to 2.7% at 30 June 2017. Estimates were stable at about 2.7% between 30 June 2017 and 30 June 2019. The increase up to 30 June 2017 is likely to be due to changes in the number and type of COPD markers available for case identification rather than an increase in the underlying prevalence of COPD in the population. Most markers are available from 30 June 2017 and NIHSI AA COPD estimates from this point onwards appear to provide a reasonable time-series.

Variation by age group and sex

More than 365,000 people aged 35 and over were identified with COPD at 30 June 2019 based on their service use in the year before, a prevalence of 2.7% among that age group. This means that 270 people in every 10,000 aged 35 and over were taking medication or using emergency or hospital services for COPD between 1 July 2018 and 30 June 2019.

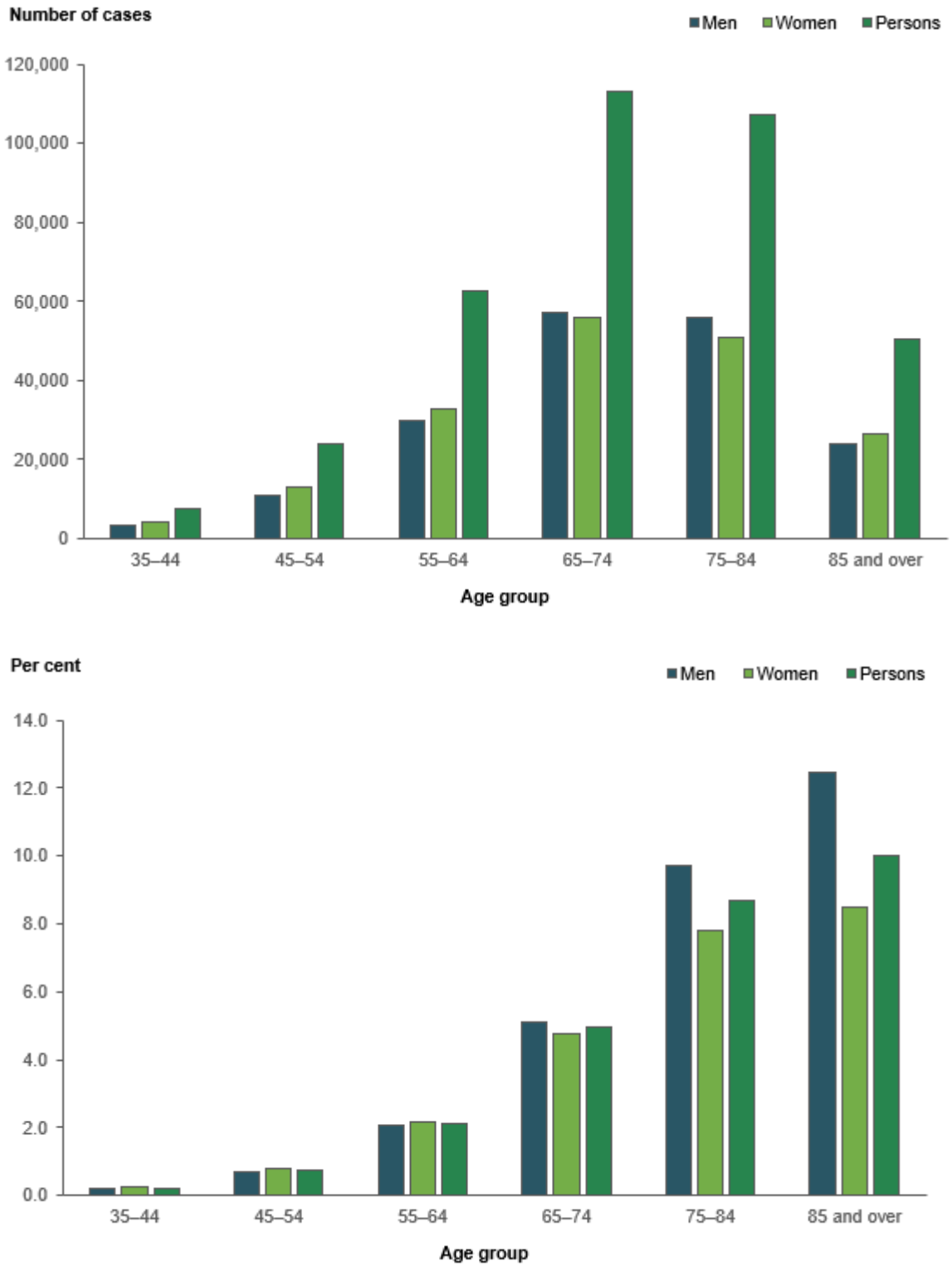
More than 181,000 men and almost 184,000 women were identified as having COPD. The prevalence of COPD was similar among men compared with women after adjusting for age differences using age standardisation.

The number of people identified with COPD varied by age group ranging from fewer than 7,600 among those aged 35–44 to more than 113,000 among those aged 65–74 (Figure 5.1). An additional 107,000 people aged 75–84 were identified with COPD so that 60% of all people were identified among people aged 65–84. This pattern is largely consistent when stratified by sex.

The prevalence of COPD increased with age, ranging from 0.2% among those aged 35-44 to 10% among those aged 85 and over (Figure 5.1). COPD prevalence was:

- similar among women and men aged 35–64 (age groups 35–44, 45–54 and 55–64).
- higher among men than women from the age of 65 years (age groups 65–74, 75–84 and 85 and over).

Figure 5.1: Number and prevalence of people with COPD by age group and sex, 30 June 2019



Source: AIHW NIHSI AA version 1.0 (Appendix A Table A5).

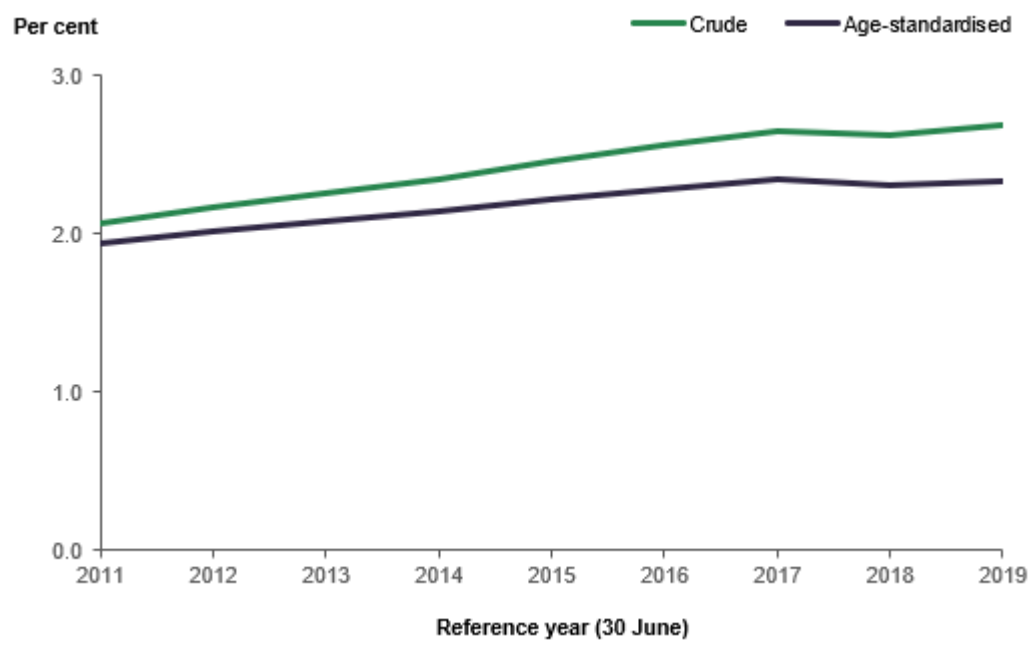
Changes over time

The number of COPD cases identified in the NIHSI AA data increased from about 245,000 at 30 June 2011 to 365,000 at 30 June 2019.

COPD prevalence estimated using the NIHSI AA increased from 2.1% at 30 June 2011 to 2.7% at 30 June 2017. NIHSI AA COPD estimates then stabilised, ranging from 2.6% at 30 June 2018 to 2.7% at 30 June 2019. This increase in prevalence can be seen in both unadjusted (crude) and age-standardised estimates (Figure 5.2).

The increase up to 30 June 2017 is likely to be due to changes in the number and type of COPD markers available over the NIHSI AA version 1.0 observation period, rather than to an underlying increase in COPD prevalence.

Figure 5.2: COPD prevalence (crude and age-standardised), people aged 35 and over at 30 June in each reference year



Note: Age-standardised to the 2001 Australian population.

Source: AIHW NIHSI AA version 1.0 (Supplementary data extract).

Several new treatment options were added to the PBS over the 2014–15 and 2015–16 periods that had restricted listings for COPD or required a streamline authority code for COPD to be recorded at the time of dispensing (Figure 2.3). The 30 June 2017 prevalence estimate is the first where these additional markers were available across the full look-back period.

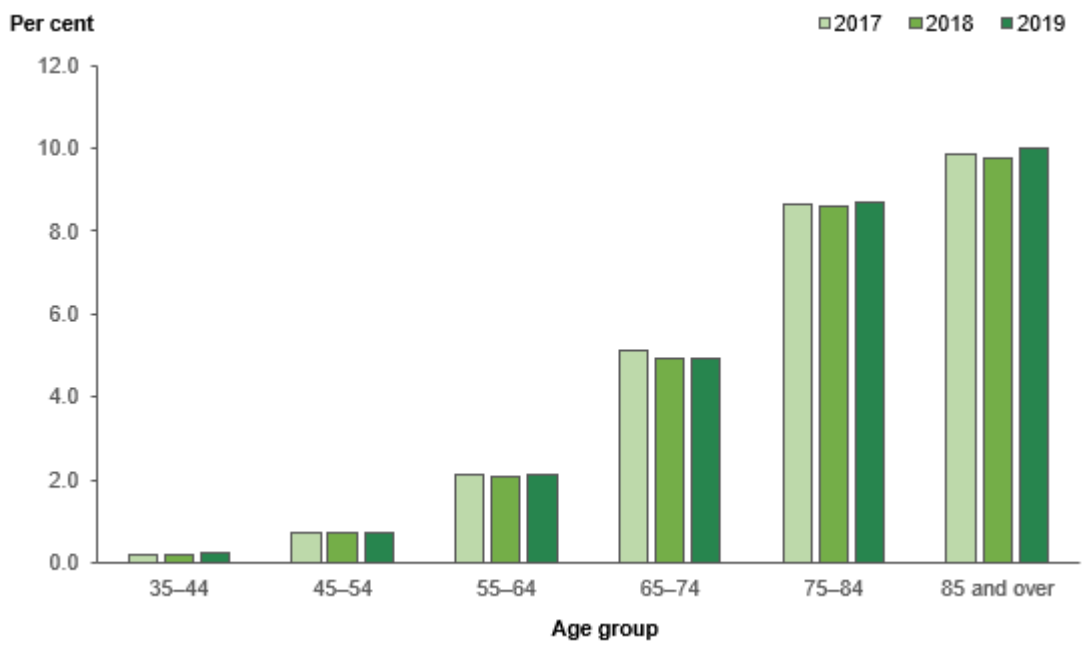
ED diagnosis information is available from July 2013 and is coded consistently across states and territories to the Emergency Department ICD-10-AM 11th edition principal diagnosis short list from July 2018. This means that ED cases can be identified from 30 June 2014 onwards although inconsistencies in recording may affect how well cases are captured before July 2018. Data are expected to be more consistent across states and territories from July 2018.

Changes in the PBS and ED data over time mean that NIHSI AA version 1.0 COPD prevalence estimates stabilise between 30 June 2017 and 30 June 2019 and appear to provide a reasonable time-series from this point.

Variation by age group and sex

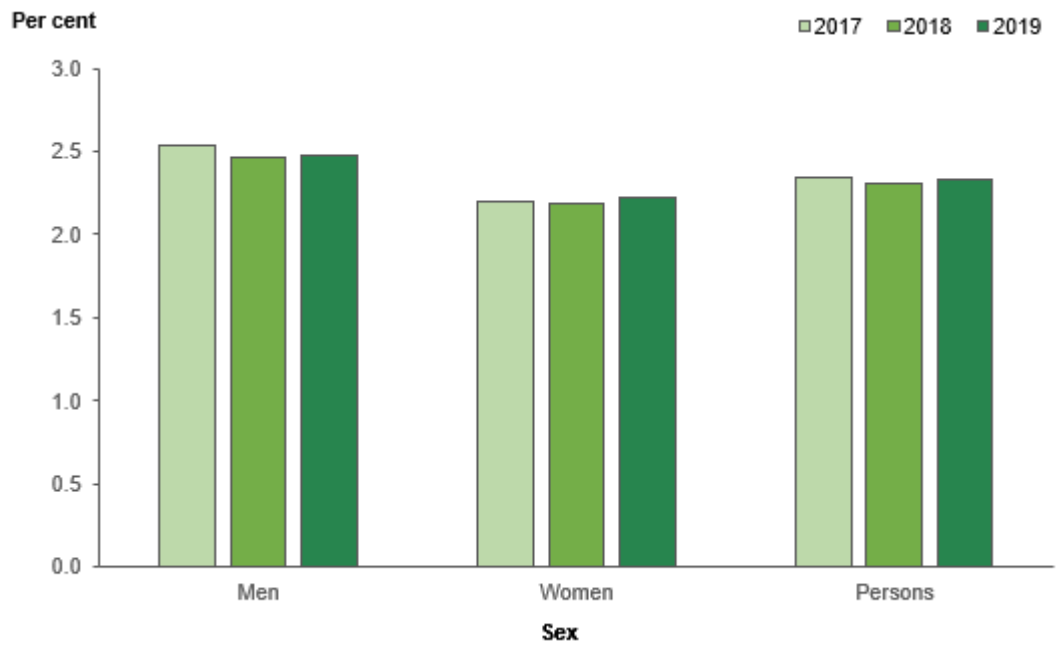
NIHSI AA estimates of total COPD prevalence stabilise between 30 June 2017 and 30 June 2019. This pattern is largely consistent when estimates are stratified by both age group (Figure 5.3) and sex (Figure 5.4).

Figure 5.3: Prevalence of COPD by age group at 30 June, 2017 to 2019



Source: AIHW NIHSI AA version 1.0 (Appendix A Table A6).

Figure 5.4: Prevalence (age-standardised) of COPD by sex, people aged 35 and over at 30 June, 2017 to 2019



Note: estimates are age-standardised to the 2001 Australian population.

Source: AIHW NIHSI AA version 1.0 (Appendix A Table A6).

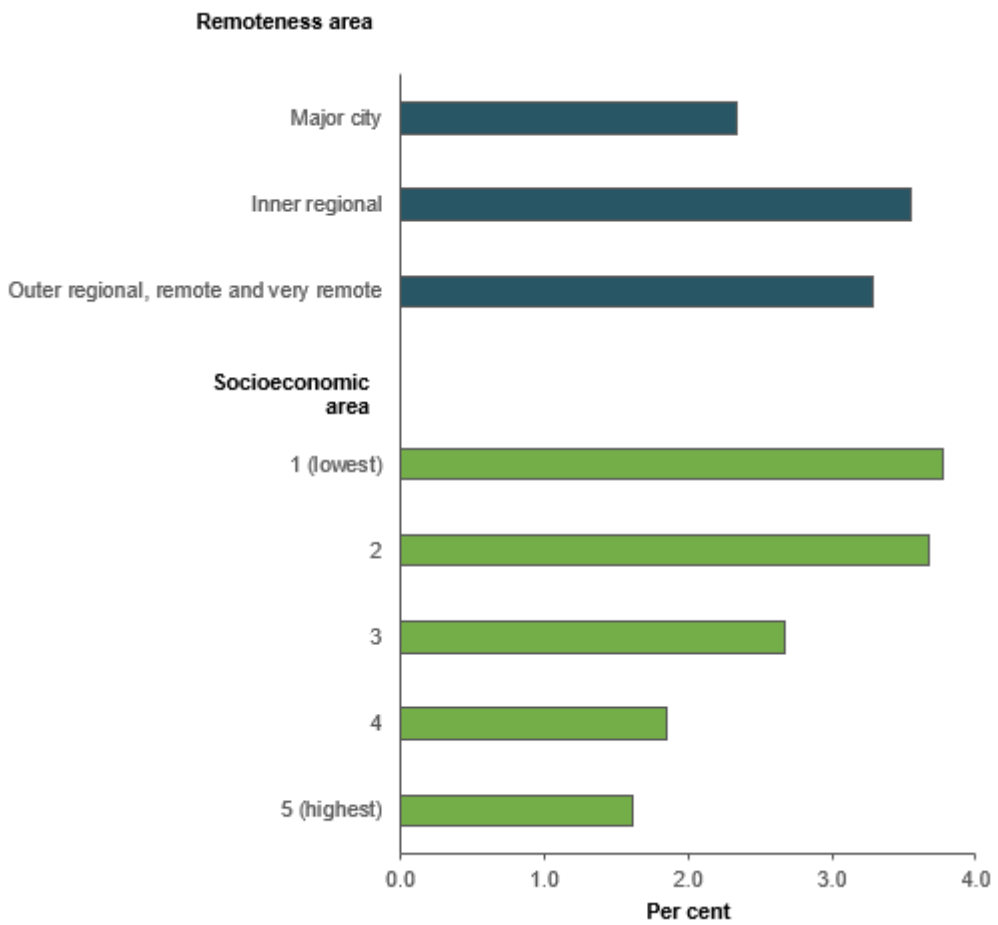
Variation between population groups

The prevalence of COPD varied by socioeconomic and remoteness areas (Figure 5.5).

The prevalence of COPD at 30 June 2019 was 3.6% in *Inner regional* areas, 3.3% in *Outer regional, remote and very remote* areas (grouped) and 2.3% in *Major cities.* The age-standardised prevalence of COPD in *Inner regional* areas and *Outer regional, remote and very remote* areas was 1.3 times as high as in *Major cities.*

COPD prevalence was 3.8% in the lowest socioeconomic areas and 1.6% in the highest socioeconomic areas. After adjusting for age, the prevalence of COPD was 2.1 times as high in the lowest socioeconomic areas as in the highest.

Figure 5.5: Prevalence of COPD by socioeconomic and remoteness area, 30 June 2019



Notes

1. Socioeconomic areas are classified according to population-based quintiles using the Index of Relative Socio-Economic Disadvantage (IRSD) based on Statistical Area Level 2 (SA2) of usual residence.
2. Remoteness areas are classified according to the Australian Statistical Geography Standard 2016 Remoteness Areas structure based on Statistical Area Level 2 (SA2) of usual residence.

Source: AIHW NIHSI version 1.0 (Appendix Table A7).

When interpreting these results it is important to note that prevalence estimates by area may be affected by the type and availability of services, and data on services, for people with COPD in different areas. Hospitalisations and ED data for Western Australia and the Northern Territory are not available in NIHSI AA version 1.0 and medicines dispensed through remote Aboriginal health services cannot be associated with an individual and cannot be attributed to a person to identify someone with COPD.

Newly identified cases of COPD and deaths

New cases of COPD identified at the 30 June 2019 reference date include people who:

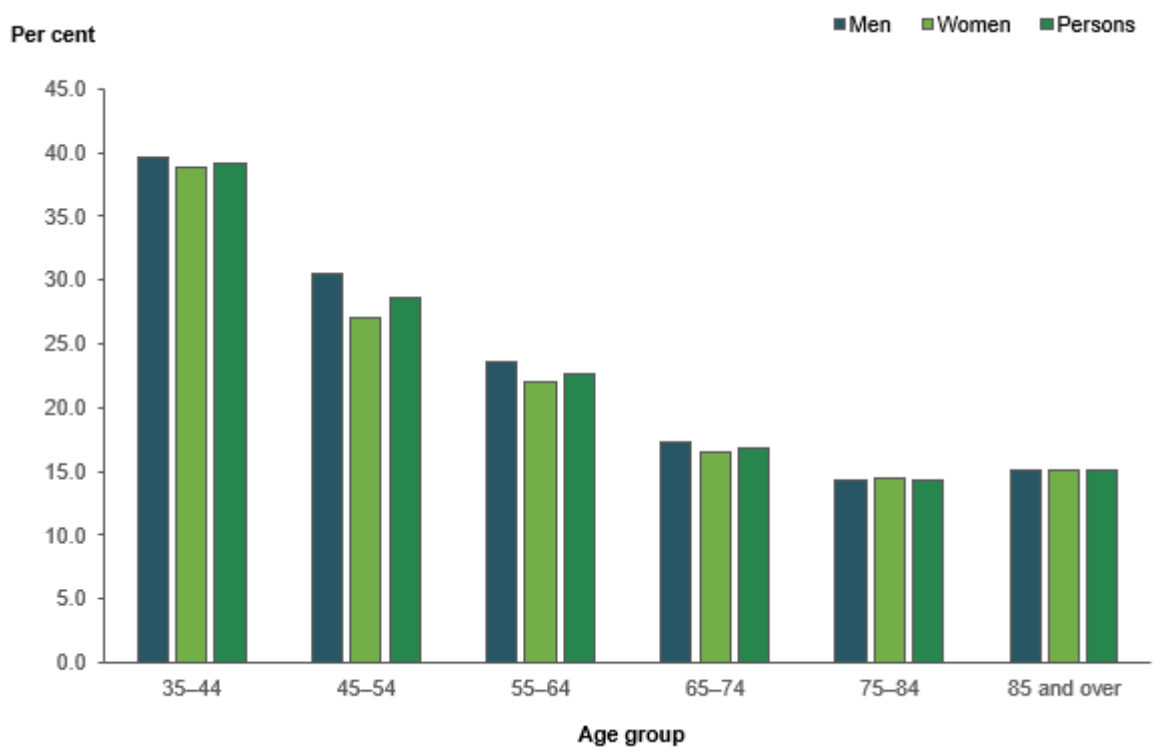
- met the age and health service use conditions to be identified as a COPD case between 1 July 2018 and 30 June 2019
- did not meet the conditions to be counted as a COPD case between 1 July 2010 and 30 June 2018
- were alive at the reference date.

Counts and proportions of new cases do not include people who otherwise met these conditions but who died before 30 June 2019. This provides a useful starting point for health service planning into the next year.

Of the 365,000 people aged 35 and over identified as having COPD at 30 June 2019, almost 66,200 (18%) met the age and health service use criteria to be identified as having COPD for the first time between 1 July 2018 and 30 June 2019 (Appendix A Table A8).

The proportion of newly identified cases was similar for men and women across most age groups. It was higher among men than women in the 45–54 year age group (Figure 5.6).

Figure 5.6: Newly identified NIHSI AA COPD cases, as a proportion of total cases, people aged 35 and over at 30 June 2019, by age group and sex



Note: An 8–year look-back period was used to identify new cases of COPD at 30 June 2019 that did not meet the age and service use criteria to be identified as cases between July 2010 and June 2018.

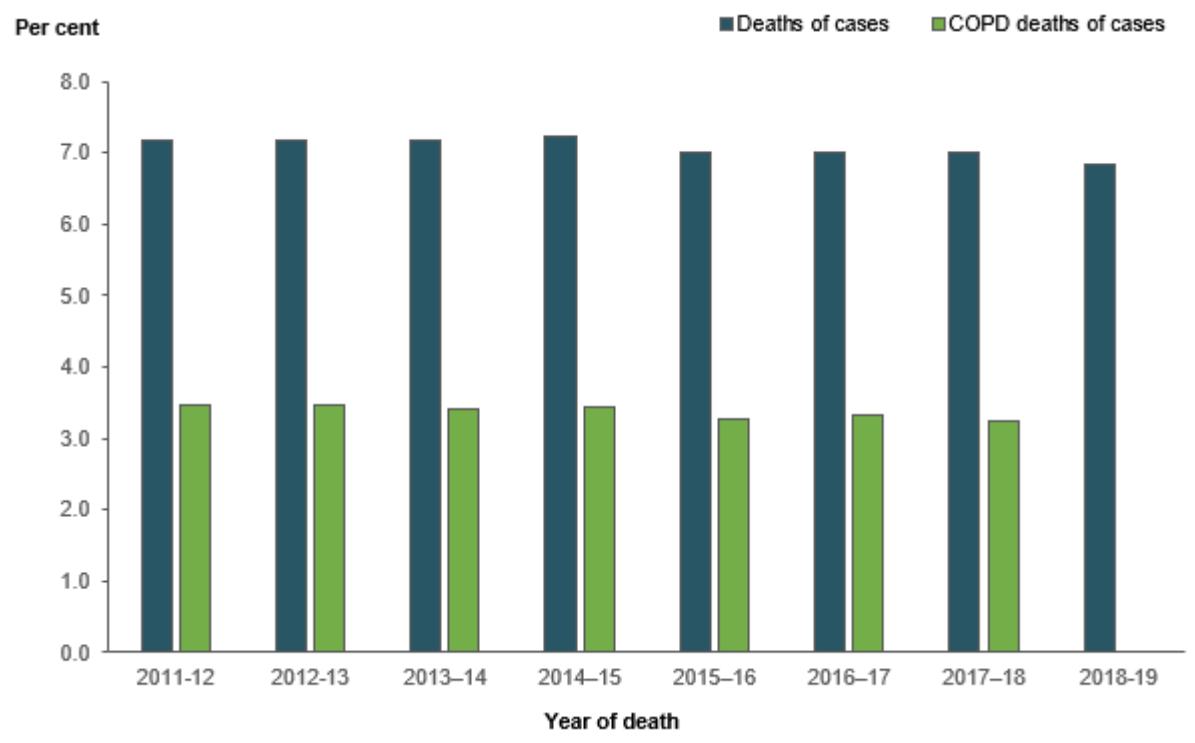
Source: AIWH NIHSI AA version 1.0 (Appendix A Table A8).

Information on deaths in the NIHSI AA version 1.0 is available from July 2010 to December 2019, with cause of death information available from July 2010 to December 2018.

Of people with COPD identified at 30 June 2018, 6.8% (almost 24,000 people) died in the following year (Appendix A Table A9). This proportion was fairly stable across the NIHSI AA observation period (July 2010 to June 2019) (Figure 5.7). In contrast, 1.0% (135,000) of people aged 35 and over not identified with COPD at 30 June 2018 died in the following year.

Of people identified with COPD who died in the following year, COPD was listed as a cause of death for almost half (46%) of them (as their underlying or associated cause of death).

Figure 5.7: Deaths and COPD deaths within 1-year, proportion of cases aged 35 and over at 30 June 2011 to 2019



Note: Cause of death information is not available for the full 2018–19 period.

Source: AIWH NIHSI AA version 1.0 (Appendix A Table A9).

6 How do NIHSI AA COPD estimates compare with survey sources?

NIHSI AA estimates of people with COPD aged 40 and over at 30 June 2018 and NHS 2017–18 estimates for people aged 40 and over are used for comparisons in this section. These are used to align as much as possible with the age group and reference date available from the BOLD Australia 2016 study (Toelle et al. 2021).

Key findings

The prevalence of COPD among people aged 40 and over at 30 June 2018 is estimated at 3.0% using the NIHSI AA data. This is lower when compared with estimates produced from the BOLD Australia study and using NHS data (4.4% each). Several factors contribute to these differences including:

- BOLD Australia estimates are based on results of spirometry testing conducted as part of the study and include people who meet the criteria for chronic airflow limitation with breathlessness, regardless of whether COPD was diagnosed previously. People with undiagnosed COPD cannot be captured in NIHSI AA or NHS estimates.
- NHS estimates are based on self-reported current and long-term bronchitis or emphysema, but not everyone with these conditions will have COPD or be dispensed COPD-prescriptions so would not be captured in NIHSI AA or BOLD Australia estimates.
- People with mild COPD that are not being treated with the COPD-specific prescriptions used to identify cases and those who do not require emergency or admitted patient care in the look-back period are not captured in NIHSI AA estimates.

Comparisons with BOLD Australia estimates

The BOLD Australia study is considered a robust source of COPD prevalence estimates. The study used spirometry testing to identify people with COPD in data collected between 2006 and 2010 (Toelle et al. 2021). Using these data, weighted to the 2016 Australian Census, the study estimated that 8.3% (95% confidence interval: 6.6%–10.0%) of Australians aged 40 and over had persistent airflow limitation, regardless of symptoms. See ‘Box 6.1’ for further details.

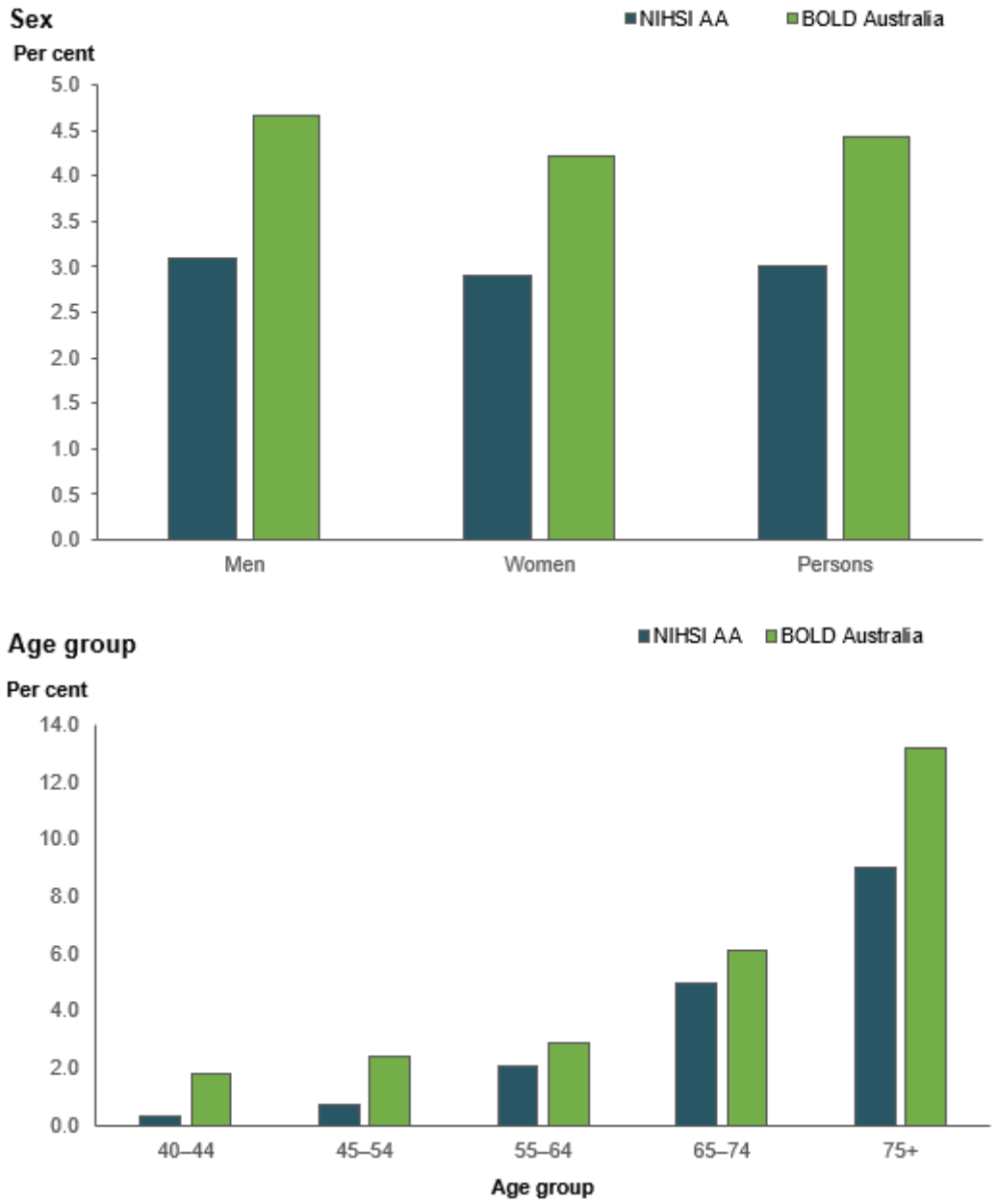
COPD is defined in terms of both persistent airflow limitation and chronic respiratory symptoms such as breathlessness, cough and sputum production (GOLD 2023). Breathlessness is the most characteristic symptom of COPD (GOLD 2023). When the presence of persistent airflow limitation was combined with self-reported symptoms of any level of breathlessness the BOLD Australia study estimate of COPD prevalence was 4.4%.

Analysis of NIHSI AA data identified 3.0% of people aged 40 and over with COPD at 30 June 2018, which is lower than the BOLD Australia estimate. This difference is largely consistent across both men and women but varies somewhat by age group with the difference largest in younger age groups. This may reflect the potential underestimation of mild COPD likely to occur at younger ages (Figure 6.1).

Comparisons with BOLD Australia estimates of airflow limitation and breathlessness by age group show that NIHSI AA estimates range between:

- 85% lower in those aged 40–44 (0.3% compared with 1.8%).
- 19% lower in those aged 65–74 (4.9% compared with 6.1%)

Figure 6.1: Comparison of COPD prevalence estimates NIHSI AA (30 June 2018) and BOLD Australia (2016), people aged 40 and over, by sex and age group



Notes: BOLD Australia estimates are based on persistent airflow limitation and self-reported breathlessness. Sources: AIHW NIHSI AA version 1.0; Toelle et al. 2021 (Appendix A Table A10).

Differences between BOLD Australia and NIHSI AA estimates of COPD will be influenced by several factors. Notably, BOLD Australia data has also been used to show that almost 50% of COPD cases identified in a sample of Australians were probably undiagnosed (Petrie et al. 2021). People with undiagnosed COPD cannot be captured in NIHSI AA estimates. Considering this, it may be expected that NIHSI AA COPD estimates are lower than BOLD Australia estimates.

Box 6.1: How COPD is classified in the BOLD Australia study

COPD diagnosed as part of the BOLD Australia study is COPD that meets the criteria for Global Initiative for Chronic Obstructive Lung Disease (GOLD) stage one or higher airflow limitation.

Spirometry is used to identify airflow limitation. The test provides information on 2 key measures:

- Forced expiratory volume (FEV_1). This is the maximum amount of air that an individual can breathe out in one second when breathing out as hard as they can.
- Forced vital capacity (FVC). The maximum about of air that an individual can breathe out after a deep breath, when breathing out as hard as they can.

To identify airflow limitation that cannot be fully reversed, the individual is given a short-acting bronchodilator (medication to make breathing easier) before the spirometry test.

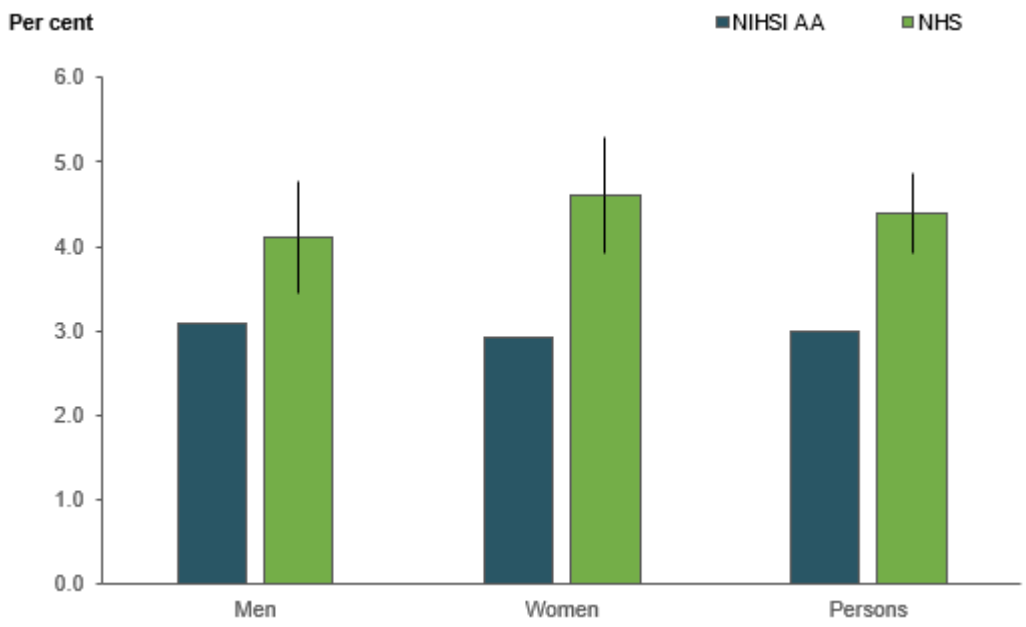
The BOLD Australia study used reference values for Caucasians from the Global Lung Initiative (GLI) to determine whether the post-bronchodilator FEV_1/FVC ratio was below the lower limit of normal (LLN) and diagnose COPD.

Comparisons with NIHSI AA estimates are based on airflow limitation and the symptom of breathlessness rather than airflow limitation alone. Breathlessness in the BOLD Australia study was classified as mild, moderate or severe according to responses to questions about whether breathlessness was experienced with different activities and the level of breathlessness experienced.

Comparisons with National Health Survey estimates

COPD prevalence is currently routinely monitored by the AIHW based on self-reported current and long-term bronchitis or emphysema collected as part of the ABS NHS. Self-reported COPD and airflow limitation were captured in the emphysema group. Figure 6.2 shows a comparison of NHS and NIHSI AA COPD estimates.

Figure 6.2: Comparison of NHS (2017–18) and NIHSI AA (30 June 2018) COPD prevalence estimates, people aged 40 and over, by sex



Notes

1. The vertical line extending through the NHS estimates represents the 95% confidence interval for the estimate.
2. NHS COPD is defined as self-reported bronchitis or emphysema. Self-reported COPD and chronic airflow limitation are captured in the emphysema category.

Sources: AIHW NIHSI AA version 1.0; AIHW analysis of ABS NHS 2017–18 (ABS 2019) (Appendix A Table A11).

Based on the NHS 2017–18 data it is estimated that 4.4% (95% confidence interval: 3.9%–4.8%) of Australian's aged 40 and over have COPD (AIHW analysis of ABS 2019).

This is higher than the 3.0% estimated using the NIHSI AA data. The higher NHS estimate may be due to the inclusion of self-reported bronchitis as not everyone with chronic bronchitis is likely to have fixed airflow obstruction and be taking COPD medication. Furthermore, people self-reporting mild COPD not accessing the health services used to identify COPD cases in the NIHSI AA data will not be captured.

Factors influencing comparisons with NHS estimates are explored further in the following chapter through detailed comparisons of PBS case classification with self-reported NHS conditions.

7 How does COPD-specific prescription dispensing compare with self-reported conditions?

Key findings

Of people aged 35 and over who participated in the 2014–15 and 2017–18 NHS:

- 29% of those who self-reported bronchitis or emphysema met the PBS case definition for identifying COPD.
- Those who self-reported emphysema were three times as likely to meet the PBS case definition (51%) compared with those who self-reported bronchitis (17%).
- 47% of those who met the PBS case definition self-reported bronchitis or emphysema.
- 70% of those who met the PBS case definition self-reported any chronic lower respiratory disease (asthma, bronchitis or emphysema).

This shows that there are differences in the groups of people who met the PBS case definition from what has been used in estimates of the prevalence of COPD based on self-reported current and long-term bronchitis or emphysema in national health surveys.

Testing how well an administrative data case definition classifies cases is ideally performed against a gold standard. COPD diagnosed with spirometry is considered the gold standard, however, there is no readily available data that links PBS, hospitalisations and ED data with clinically diagnosed COPD cases and non-cases.

Self-reported data from the ABS NHS are currently used to monitor the prevalence of COPD (based on people who reported bronchitis or emphysema) in the absence of regularly updated diagnostic surveys (AIHW 2023a). The 2014–15 and 2017–18 NHS have been linked to PBS data in the Multi-Agency Data Integration Project (MADIP 2014–2018). These linked data allow for comparing an individual's self-reported conditions with their PBS prescriptions dispensed. See Appendix B 'Data sources used in this report' for more information on MADIP.

The focus of this comparison was to understand the amount of overlap between the PBS case definition and conditions self-reported in the NHS.

The PBS case definition is having 2 or more COPD-specific prescriptions dispensed in a financial year. The criteria for a prescription to be classified as COPD-specific is specified in 'Markers of COPD in PBS data' section within Chapter 2 'How are COPD cases identified in the NIHSI AA data?'.

Self-reported conditions

The 2014–15 and 2017–18 NHS asked about current conditions that have lasted or will last 6 months or more with prompts for bronchitis and emphysema. Respondents may also name other unlisted conditions such as COPD or chronic airflow limitation which are coded to emphysema for reporting, but these may be under-reported without a specific prompt.

The terms chronic bronchitis and emphysema were emphasised in historic definitions of COPD (GOLD 2021). As a result, these terms have been commonly used to describe a diagnosis of COPD to a patient and routinely reported estimates of COPD prevalence from NHS data are based on self-reported current and long-term bronchitis or emphysema. However, emphysema is only one of multiple structural abnormalities that may present in

patients with COPD and not all people with COPD will have chronic bronchitis or emphysema. Conversely, not all people with chronic bronchitis or emphysema will have COPD (Marsh et al. 2008; Soriano et al. 2003; Viegi et al. 2004).

Furthermore, chronic bronchitis is formally defined as chronic cough and sputum production for at least 3 months per year for two consecutive years, in the absence of other conditions that can explain these symptoms (GOLD 2023). Because NHS prompts people to report bronchitis that is current and has lasted or will last for 6 months or more, there may be some differences in who would meet the classic definition of chronic bronchitis.

These limitations to how well self-reported bronchitis and emphysema may capture COPD need to be considered when comparing an individual's self-reported conditions in NHS to their COPD-specific prescription dispensing captured in PBS data.

It is also common among people with COPD to have asthma or bronchiectasis without chronic bronchitis or emphysema, or even none of these lower respiratory conditions. Self-reported asthma is captured through a detailed module in the NHS so it is possible to examine people with asthma using NHS data as well. However, it is not possible to identify people with bronchiectasis using NHS data.

In this analysis asthma, bronchitis and emphysema are collectively referred to as chronic lower respiratory conditions.

A cohort of 22,300 people from the 2014–15 NHS and 2017–18 NHS were linked to the Medicare Consumer Directory with a linkage rate of 95% within MADIP. This analysis combined two NHS cycles together to use a larger sample of linked individuals with their dispensed PBS prescriptions. Unweighted counts and proportions are reported due to combining multiple survey years of data.

How many people had a chronic lower respiratory condition?

Of people aged 35 and over in the combined 2014–15 and 2017–18 linked cohort:

- 2.0% self-reported emphysema
- 2.8% self-reported bronchitis
- 4.5% self-reported bronchitis or emphysema, and this is the combination of conditions that is used for population monitoring of COPD
- 11.9% self-reported asthma (Table 7.1).

Table 7.1: People self-reporting conditions and those who met the PBS case definition, people aged 35 and over in 2014–15 and 2017–18 NHS

NHS condition	N with condition	% of total cohort	N met PBS case definition	% met PBS case definition
Emphysema	454	2.0	230	50.7
Bronchitis	624	2.8	107	17.1
Bronchitis or emphysema	*1,008*	*4.5*	*295*	*29.3*
Asthma	2,644	11.9	297	11.2
Any chronic lower respiratory condition (asthma, bronchitis, or emphysema)	*3,223*	*14.4*	*445*	*13.8*
No respiratory condition	19,082	85.5	187	1.0
Total cohort aged 35 and over	**22,305**	**100.0**	**632**	**2.8**

Note: The sum of each condition may not equal the total for the conditions when combined as people can report more than one condition.

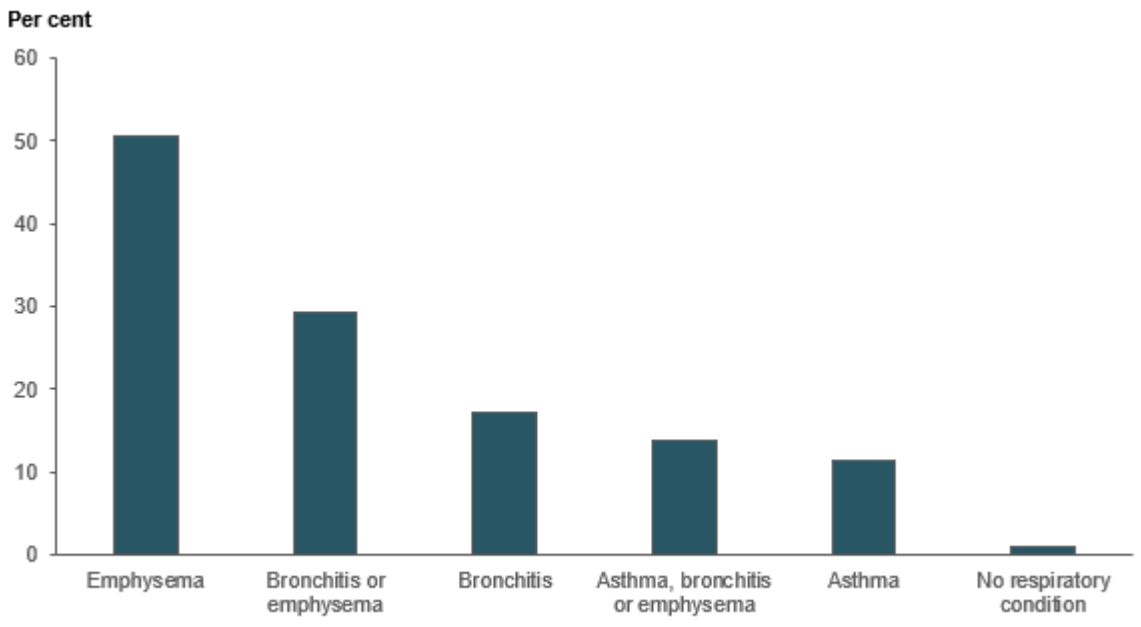
Source: 2014–15 and 2017–18 NHS linked with PBS (MADIP 2014-2018).

Who met the PBS case definition?

Of the 1,000 people aged 35 and over in the cohort who self-reported bronchitis or emphysema, 29% met the PBS case definition (Table 7.1, Figure 7.1).

Those who self-reported emphysema were 3 times as likely to meet the PBS case definition (51%) compared with those who self-reported bronchitis (17%). And people with either bronchitis or emphysema were more likely to meet the PBS case definition (29%) than people with asthma (11%).

Figure 7.1: Proportion who met the PBS case definition, among each self-reported condition group



Source: 2014-15 and 2017-18 NHS linked with PBS (MADIP 2014-2018; Table 7.1).

There are several factors which may contribute to people who self-report one of these chronic lower respiratory conditions not meeting the PBS case definition for COPD:

- There may be some people with COPD who have milder symptoms and could be taking SABA medications such as salbutamol (for example, sold as Ventolin). These medications cannot be used in the case definition for COPD as they are commonly used for the treatment of other respiratory conditions, particularly asthma.
- Not everyone who has bronchitis or emphysema would necessarily meet the airflow limitation diagnostic criteria for COPD. Though young adults aged 20–44 with chronic bronchitis (and without asthma) have been found to have a higher risk of developing COPD as measured through chronic airflow limitation (de Marco et al. 2007).
- Data from Marsh et al. (2008) show that those who only had chronic bronchitis were less likely to have COPD diagnosed than those who had emphysema or at least 2 of the chronic lower respiratory conditions (out of asthma, bronchitis or emphysema).

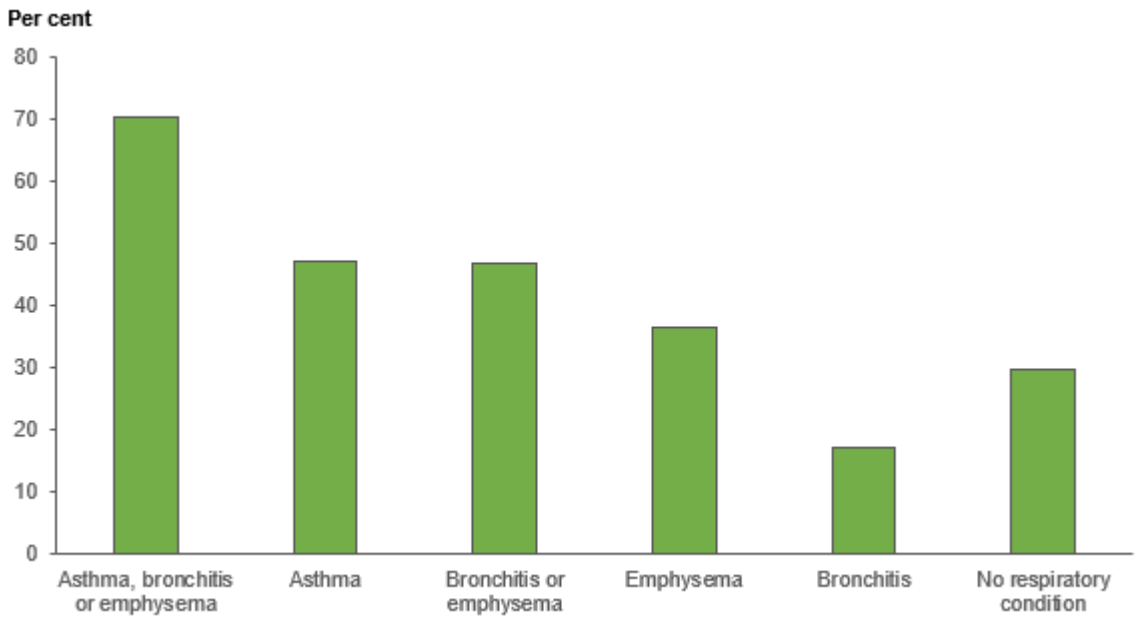
Conditions self-reported by PBS cases

Of the 630 people aged 35 and over in the cohort who met the PBS case definition:

- 70% self-reported at least one of asthma, bronchitis or emphysema
- 47% self-reported asthma
- 36% self-reported emphysema
- 17% self-reported bronchitis (Figure 7.2).

This shows that most people who met the PBS case definition self-reported at least one of these chronic lower respiratory conditions (70%), but fewer than half (47%) self-reported bronchitis or emphysema.

Figure 7.2: Proportion of PBS cases who self-reported each respiratory condition



Source: 2014-15 and 2017-18 NHS linked with PBS (MADIP 2014-2018; Appendix Table A12).

Data from Marsh et al. (2008) show that of the people diagnosed with COPD, 74% were also diagnosed with at least one of asthma, bronchitis or emphysema. This is similar to the 70% of PBS cases who self-reported having at least one of these chronic lower respiratory conditions in NHS.

By age

Of people who self-reported bronchitis or emphysema, the proportion who met the PBS case definition increased with age before plateauing at ages 65 and over (age groups 65–74, 75–84, 85 and over; Figure 7.3). This ranged from 8.2% for people aged 35–54 up to between 39% and 41% for people aged 65 and over.

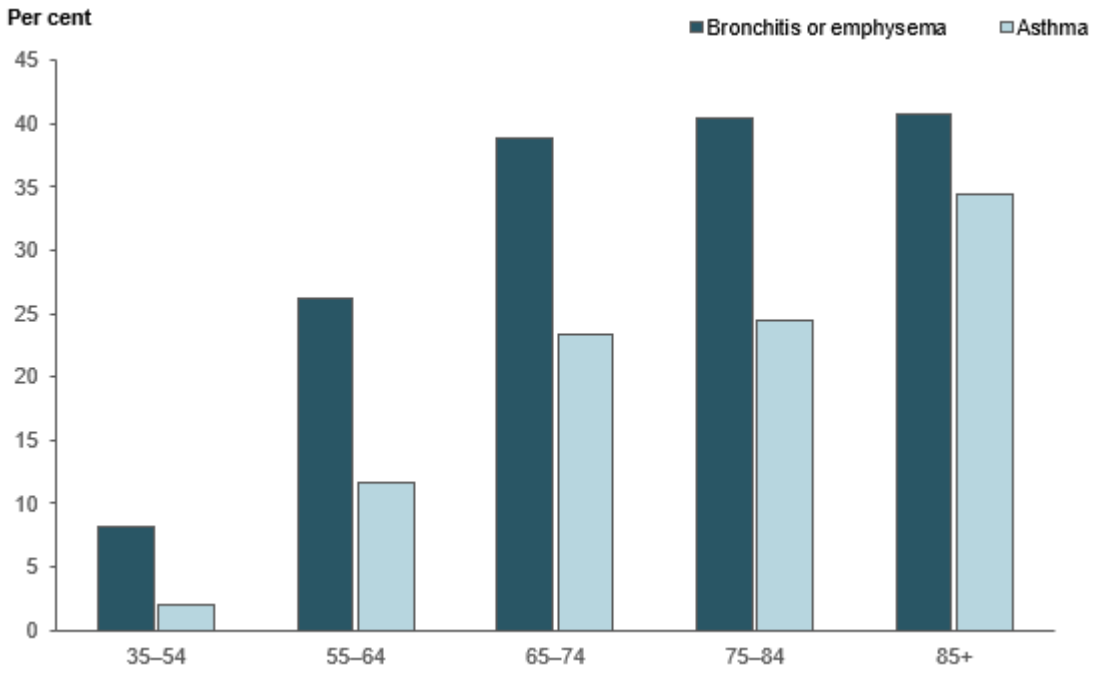
Of people who self-reported asthma, a lower proportion met the PBS case definition across each age group compared with those who self-reported bronchitis or emphysema. This ranged from 2.1% for people aged 35–54 up to 34% for people aged 85 and over.

These lower proportions of people (with asthma, bronchitis or emphysema) meeting the PBS case definition among adults aged 35–64 may be due to people with asthma, bronchitis or emphysema at these ages being less likely to have developed chronic airflow limitation

consistent with COPD. However, these people would be at a higher risk of developing COPD as they get older, as found for young adults aged 20–44 with chronic bronchitis by de Marco et al. (2007).

Similarly, it could be because our PBS case definition is not picking up a number of people with mild COPD who are most likely to be people in younger ages.

Figure 7.3: Proportion who met the PBS case definition, by condition group and age group



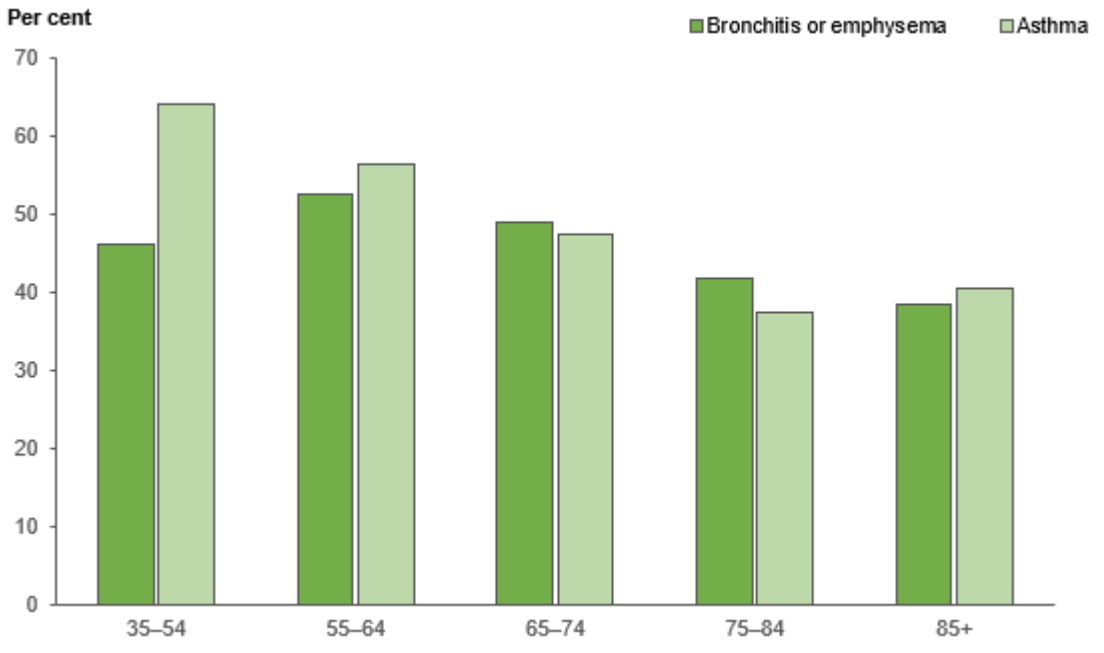
Source: 2014-15 and 2017-18 NHS linked with PBS (MADIP 2014-2018; Appendix Table A13).

Of people who met the PBS case definition, the proportion who self-reported that they had asthma decreased with age before plateauing at ages 75 and over (Figure 7.4). This ranged from 64% of people aged 35–54 down to between 37% and 40% for people aged 75–84 and 85 and over respectively.

The proportion of PBS cases who self-reported that they had bronchitis or emphysema was more similar across all ages, ranging between 38% for people aged 85 and over up to 52% for people aged 55–64.

These slightly lower proportions of PBS cases who self-reported a respiratory condition at ages 75 and over may be due to there being more people with COPD at older ages and therefore proportionally less people also self-reporting asthma, bronchitis or emphysema.

Figure 7.4: Proportion of PBS cases who self-reported each respiratory condition, by age group



Source: 2014-15 and 2017-18 NHS linked with PBS (MADIP 2014-2018; Appendix Table A14).

Who is not captured by the PBS case definition?

The COPD-specific medications used in the PBS case definition are a subset of the Drugs for obstructive airways diseases (R03) Anatomical Therapeutic Classification (ATC) group. This group of medications is used to treat chronic lower respiratory conditions such as asthma and COPD.

Of the 1,000 people who self-reported either bronchitis or emphysema, 71% did not meet the PBS case definition and this comprised of:

- 40% who didn't have any prescriptions of drugs for obstructive airways diseases dispensed in their survey reference year
- 31% who had at least one respiratory prescription dispensed but didn't meet the PBS case definition.

By condition, 46% of people with bronchitis did not have any drugs for obstructive airways diseases dispensed in their survey reference year, compared with 28% of people with emphysema.

Mild COPD symptoms can be managed with SABAs, which are not considered COPD-specific medications in this analysis and can be purchased without a prescription. It is therefore difficult to determine if they are receiving any treatment that could indicate COPD.

8 What does this work add?

Data linkage is being increasingly used to fill knowledge gaps. Large scale linked data assets such as the NIHSI AA can be used to answer complex cross-sector health questions and improve the ongoing monitoring of chronic conditions such as COPD.

Reliable and robust estimates of the prevalence of COPD in Australia are important to calculate the burden of the disease and to plan for the treatment of patients. Researchers, clinicians, health care providers and policymakers each require robust estimates on the number of people with COPD to guide decisions and policy making.

Developing a linked data approach to estimating COPD prevalence is cost-efficient and expands the use of routinely collected administrative data. As well as having the potential to be updated regularly, the use of population-level linked data has the added benefit of allowing for much more granular estimates of COPD than survey data can often provide, such as estimates for specific populations of interest and across small areas.

By identifying a cohort of people with COPD, this work also enables the analysis of outcomes such as hospitalisation and death for people with COPD. Different medication and treatment routines can be explored as well as patient care pathways including general practitioner follow-up after hospitalisation and health service use over the life course.

Due to a lack of a regularly updated diagnostic survey to monitor COPD prevalence in Australia, COPD prevalence is currently monitored based on self-reported bronchitis or emphysema (with self-reported COPD included in the emphysema category).

Comparisons of self-reported conditions and COPD-specific medication dispensing for individuals found different groups of people are classified as having COPD across these 2 sources, with fair overlap between them. This may be related to how the self-reported conditions are prompted for within the survey: COPD is not specifically prompted for while bronchitis and emphysema are. Differences may also be due to not all people with bronchitis or emphysema having COPD and therefore not requiring COPD-specific prescriptions. These results could be used to improve the way in which COPD is prompted for and categorised in self-reported surveys.

Comparisons with survey-based estimates show how this work adds a vital perspective on the prevalence of COPD in Australia that is being treated with specific medications and health services. The results also reinforce the fact that COPD is a progressive disease with patients needing different treatment and management strategies at different times throughout their disease trajectory. This affects which COPD patients are identified in different data sources, and when.

While undiagnosed COPD and mild COPD that is not managed with COPD-specific treatment cannot be captured, NIHSI AA estimates are a valuable source of information to monitor the prevalence of diagnosed COPD that is managed with specific prescriptions or requires emergency or hospital care. People with diagnosed COPD accessing these health services are an important group for population monitoring to inform health service planning.

Findings from this work add to the suite of evidence about COPD in Australia and contributes to work under the National Strategic Framework for Chronic Conditions by producing estimates of the prevalence of COPD that can be regularly updated to monitor the disease over time.

9 Factors to consider and future improvements

Factors to consider

NIHSI AA estimates are a valuable source of information to monitor the prevalence of diagnosed COPD that is managed with specific prescriptions or requires emergency or hospital care. However, there are several factors that need to be considered when interpreting NIHSI AA COPD estimates. These include source data, linkage and environmental considerations.

Data considerations

The data collections included in the NIHSI AA version 1.0 used in analysis for this report and their coverage influence what can be captured in the current estimates:

- NIHSI AA data capture information on individuals who use MBS, PBS, ED, hospital and residential aged care services or die in Australia. This includes usual residents of Australia and overseas visitors. At the same time, the NIHSI AA does not include information for people who were not eligible for, or did not use, in-scope services or who died outside of Australia during the observation period.
- General practice data are not available within the NISHI AA and MBS data do not include diagnosis information. People with mild COPD diagnosed by a GP may be less likely to be identified in NIHSI AA estimates as they are less likely to be taking COPD-specific prescription medication or require ED treatment or hospitalisation.
- Medicines dispensed to prisoners are not captured in PBS data and dispensing of medication through remote Aboriginal health services cannot be associated with an individual and so cannot be attributed to a person to identify someone with COPD.
- Hospitalisations and ED data for Western Australia and the Northern Territory are not available in NIHSI AA version 1.0.
- Information on private hospitalisations is limited but included where available.

Importantly, gaps in the coverage of PBS, ED and hospitalisations data will limit the identification of Aboriginal people and prisoners with COPD and may affect estimates by remoteness area. ED and hospitalisations data within the NIHSI AA version 1.0 include an Indigenous Australian identifier. However, hospitalisations data from Western Australia and the Northern Territory are not included in the NIHSI AA version 1.0. In addition, it is not possible to analyse COPD cases identified in the PBS data by Indigenous status unless the individual has a linked record in the hospitalisations data. Analysis of COPD prevalence by Indigenous status has not been performed due to the inconsistent capture of Indigenous status across cases. Future versions of the NIHSI AA data may include more complete Indigenous status identification.

The identification of people whose COPD was managed in a private hospital may also be limited, particularly where the individual was not taking COPD medication and did not also require emergency care or receive care in a public hospital. Based on analysis of the National Hospital Morbidity Database (NHMD), 13% of hospital separations with a COPD diagnosis were managed in private hospitals. National NIHSI AA version 1.0 estimates of COPD did not change substantially with the inclusion of the private hospital information in the algorithm. COPD prevalence was estimated at 2.7% at 30 June 2019 whether private hospitalisations data was included in the calculation or not.

The completeness of information in the NIHSI AA also influences what can be measured. In mid-2015, 29 supplementary codes for chronic conditions and a new Australian Coding Standard were implemented in the ICD-10-AM 9th edition and Australian Coding Standards. Supplementary diagnosis codes represent a selection of clinically important chronic conditions, which are part of the patient's current health status on admission, but do not meet criteria for inclusion as a principal or additional diagnosis on the patient's hospital record. The supplementary code U83.2: Chronic obstructive pulmonary disease maps directly to *J44.9: Chronic obstructive pulmonary disease, unspecified*. The broad mapping additionally includes *J44.8: Other specified chronic obstructive pulmonary disease.*

Supplementary codes are not available in NIHSI AA version 1.0 so they cannot be used as an additional and more complete means of capturing people who have COPD. A recent study used the National Dementia Linked Dataset to show the increase in the number of people with COPD that can be identified when the supplementary diagnosis codes are available alongside principal and additional diagnosis codes for identification. The report found that in 2015–16 and 2016–17 (combined) there was a 6.5-fold increase from 31,000 to 203,000 in the number of people identified with COPD when the supplementary code (U83.2) was used in addition to J44.8 and J44.9 as a principal and/or additional diagnosis for identification (AIHW 2023b). The absence of these codes will limit the identification of people with COPD in hospitalisations data although it is not possible to know how many of these people would not already be identified using the PBS data.

Linkage considerations

Data linkage is the process of identifying, matching, and merging records that correspond to the same person or entity from several datasets or even within one data set.

This provides a rich person-level source of information. Records that are linked for an individual across one or more of the NIHSI AA data sets can be analysed at the person-level to identify COPD cases.

Missed or incorrect links can lead to information bias through potential misclassification (as a disease case or not) although link accuracy was a priority for the development of NIHSI AA data and a high cut-off for matching records was used to achieve the estimated link accuracy of 98.5% or higher.

Furthermore, analysis of more common conditions like COPD is likely to be less sensitive to linkage error than analysis of rare conditions (Doidge and Harron 2019) and so the effect of missed and incorrect links on population-level COPD estimates is expected to be negligible.

Further details of the NIHSI AA version 1.0 linkage can be found in the data quality statement at: https://meteor.aihw.gov.au/content/766334.

Environmental considerations

Health service use by people with COPD can be affected by environmental and other factors including thunderstorms, bushfires and the level of communicable respiratory conditions, such as influenza, circulating in the population. These can require changes in medication use and lead to COPD exacerbations that may require ED and hospital care. Changes in the prevalence of COPD estimated from health services data need to be interpreted with these factors in mind.

Improvements with future NIHSI AA versions

Current estimates of COPD over time are likely to be influenced by differences in the information available to identify COPD cases at different times and also by any change to the definition of clinical COPD. For example, new treatment options listed on the PBS over time that require a streamline authority code for COPD to be recorded at the time of dispensing enable more cases to be identified with greater certainty in later years of the NIHSI AA data.

The capture of COPD and consistency of coding in the NIHSI AA collections is expected to improve in the future. This is expected to improve the amount and consistency of information available within future versions of the NIHSI AA data to identify people with COPD over time.

Subsequent versions of the NIHSI AA data include supplementary diagnosis codes in hospitalisations data. This code allows COPD to be coded as part of the patient's current health status, where it does not meet the criteria for inclusion as a principal or additional diagnosis on the patient's hospital record, but where it may impact on clinical care. This will provide an additional means of identifying people with COPD in future work.

The identification of people with COPD in ED and PBS data are expected to be more consistent from mid-2018. ED and PBS case definitions used to identify cases are complicated by different classifications used to capture diagnoses in ED data and by changes in the restriction status of COPD medication on the PBS over time.

In July 2018 the Emergency Department ICD-10-AM 11th edition principal diagnosis short list was used by all states and territories to code diagnoses. Diagnosis information in ED data is expected to be more consistent across states and territories from 2018-19 onwards with the introduction of these codes.

The restriction status was changed for several items listed on the PBS used in COPD treatment in August 2018. Before this date, the items were listed as restricted for the treatment of asthma and COPD and it was not possible to differentiate whether dispensing was for someone with asthma or COPD. In August 2018, the restriction status for most of these items was changed to require a streamlined authority code which can be used to identify dispensing of these items where they were prescribed to treat COPD.

It is also likely that the hospitalisations and ED data from more jurisdictions and more private hospitals will be included in future versions of the NIHSI AA.

These improvements are likely to improve the identification of people with COPD in the NIHSI AA data.

10 Next steps

The next step for this work is to incorporate NIHSI AA prevalence estimates into AIHW's routine monitoring of COPD. The multi-source algorithm will be updated and applied to future versions of the NIHSI AA data. This will allow diagnosis information from hospital supplementary codes to be incorporated into the case-finding algorithm and for the timeseries to be extended for monitoring purposes.

Opportunities to further enhance the COPD case-finding algorithm will be monitored. New COPD medications listed on the PBS and changes to the restriction status of COPD medications may enhance the capture of COPD cases. Similarly, the introduction of MBS items specifically for the treatment of COPD will be monitored.

Future analysis may explore additional ways to improve case-finding. This could include further analysis of PBS cases not identified in self-reported data, cases that are not consistently identified over time and of COPD deaths that aren't identified as cases in prior reference periods.

There are a wide range of analysis opportunities presented by being able to identify a cohort of people with COPD including examining of the types of medication they use, and how this changes over time, as well as before and after hospitalisation. Similarly, the use of other health services and health outcomes including hospitalisation, use of aged care services and death can be explored using NIHSI AA data.

Appendix A Data tables

Table A1: Changes in case classification 30 June 2018 and 30 June 2019, by age group at 30 June 2018

	Case to case		Case to non-case		Case to death		Non-case to case	
Age group	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
35–44	4,799	69.2	2,066	29.8	69	1.0	3678	0.1
45–54	16,529	72.2	5,962	26.1	389	1.7	10250	0.3
55–64	46,365	77.1	12,013	20.0	1,739	2.9	20,922	0.7
65–74	88,522	80.6	16,686	15.2	4,684	4.3	28,636	1.4
75–84	79,710	78.2	13,942	13.7	8,215	8.1	22,157	2.1
85 and over	33,155	68.2	6,685	13.7	8,810	18.1	9,967	2.2
35 and over	**269,080**	**76.8**	**57,354**	**16.4**	**23,906**	**6.8**	**95,610**	**0.7**

Notes:

1. Percentages are of COPD cases classified at 30 June 2018 in each age group.
2. 'Non-case to case' excludes people aged 35 at 30 June 2019 as they were not eligible to be classified as a case at 30 June 2018

Source: AIHW NIHSI AA version 1.0.

Table A2: Distribution of PBS and multi-source cases at 30 June 2019 by sex and age group

Characteristic	Multi-source cases (N)	Multi-source cases (%)	PBS cases (N)	PBS cases (%)	Ratio PBS/ multi-source cases
Age 35–44	7,567	2.1	6,901	2.0	0.91
Age 45–54	23,990	6.6	21,706	6.4	0.90
Age 55–64	62,712	17.2	58,093	17.1	0.93
Age 65–74	113,134	31.0	106,742	31.4	0.94
Age 75–84	107,026	29.3	100,285	29.5	0.94
Age 85 and over	50,681	13.9	45,946	13.5	0.91
Men 35 and over	181,470	49.7	168,609	49.6	0.93
Women 35 and over	183,640	50.3	171,064	50.4	0.93
Persons 35 and over	365,110	100.0	339,673	100.0	0.93

Source: AIHW NIHSI AA version 1.0.

Table A3: Comparison of cases and prevalence using different case definitions, people aged 35 and over at the reference date, 30 June 2011 to 30 June 2019

	COPD (PBS without ICS/LABA adjustment)		COPD (PBS)		COPD (multi-source)	
Reference year (30 June)	Number	Prevalence (%)	Number	Prevalence (%)	Number	Prevalence (%)
2011	204,882	1.7	226,992	1.9	245,367	2.1
2012	218,847	1.8	242,650	2.0	261,669	2.2
2013	232,314	1.9	258,003	2.1	277,316	2.3
2014	243,742	2.0	271,167	2.2	292,549	2.4
2015	260,058	2.1	289,130	2.3	311,263	2.5
2016	275,503	2.1	306,037	2.4	329,003	2.6
2017	288,840	2.2	321,834	2.5	347,440	2.7
2018	282,781	2.1	323,670	2.4	350,340	2.6
2019	287,632	2.1	339,673	2.5	365,110	2.7

Source: AIHW NIHSI AA version 1.0.

Table A4: Comparison of COPD prevalence, selected states and national, 30 June 2019

		Selected states			National			Difference
Sex	Age group	Cases (N)	Population (N)	Prevalence (%)	Cases (N)	Population (N)	Prevalence (%)	% higher for selected states
Men	35–39	1,157	778,387	0.1	1,274	887,660	0.1	3.6
Men	40–44	2,015	696,438	0.3	2,197	792,771	0.3	4.4
Men	45–49	3,594	729,823	0.5	3,910	830,452	0.5	4.6
Men	50–54	6,297	665,645	0.9	6,893	757,792	0.9	4.0
Men	55–59	10,863	673,472	1.6	11,940	762,161	1.6	3.0
Men	60–64	16,366	600,779	2.7	17,995	677,498	2.7	2.6
Men	65–69	22,420	531,359	4.2	24,588	596,909	4.1	2.4
Men	70–74	29,761	464,138	6.4	32,546	518,390	6.3	2.1
Men	75–79	28,543	313,434	9.1	31,227	349,136	8.9	1.8
Men	80–84	22,715	205,090	11.1	24,759	227,771	10.9	1.9
Men	85–89	14,304	116,366	12.3	15,534	128,489	12.1	1.7
Men	90–94	6,413	48,225	13.3	6,931	53,097	13.1	1.9
Men	95+	1,569	11,158	14.1	1,676	12,228	13.7	2.6
Men	*35+*	*166,017*	*5,834,314*	*2.8*	*181,470*	*6,594,354*	*2.8*	*3.4*
Women	35–39	1,391	790,530	0.2	1,523	898,179	0.2	3.8
Women	40–44	2,351	711,228	0.3	2,573	806,600	0.3	3.6
Women	45–49	4,754	754,447	0.6	5,180	853,197	0.6	3.8
Women	50–54	7,314	691,430	1.1	8,007	782,977	1.0	3.4
Women	55–59	12,477	702,247	1.8	13,634	791,358	1.7	3.1
Women	60–64	17,481	636,951	2.7	19,143	716,138	2.7	2.7
Women	65–69	22,531	565,842	4.0	24,651	633,668	3.9	2.4
Women	70–74	28,726	487,549	5.9	31,349	542,525	5.8	2.0
Women	75–79	26,261	341,834	7.7	28,623	379,804	7.5	1.9
Women	80–84	20,536	248,855	8.3	22,417	276,012	8.1	1.6
Women	85–89	14,435	165,820	8.7	15,682	183,229	8.6	1.7
Women	90–94	7,778	89,342	8.7	8,382	98,110	8.5	1.9
Women	95+	2,270	29,117	7.8	2,476	31,999	7.7	0.8
Women	*35+*	*168,305*	*6,215,192*	*2.7*	*183,640*	*6,993,796*	*2.6*	*3.1*
Persons	**35+**	**334,322**	**12,049,506**	**2.8**	**365,110**	**13,588,150**	**2.7**	**3.3**

Notes

1. COPD cases are identified in PBS, hospitalisation and ED data using the multi-source algorithm.
2. Case and population data for ‘selected states’ exclude data for Western Australia, Northern Territory and ‘Other Territories’.
3. Difference (%) is the ratio of prevalence estimates for the selected states (excluding Northern Territory, Western Australia and 'Other Territories') to national estimates. It shows by what percentage prevalence estimates for the selected states are higher than National estimates.

Source: AIHW NIHSI AA version 1.0.

Table A5: Prevalence of COPD by age group and sex, 30 June 2019

	Men		Women		Persons	
Age group	**N**	**%**	**N**	**%**	**N**	**%**
35–44	3,471	0.2	4,096	0.2	7,567	0.2
45–54	10,803	0.7	13,187	0.8	23,990	0.7
55–64	29,935	2.1	32,777	2.2	62,712	2.1
65–74	57,134	5.1	56,000	4.8	113,134	4.9
75–84	55,986	9.7	51,040	7.8	107,026	8.7
85 and over	24,141	12.5	26,540	8.5	50,681	10.0
35 and over	**181,470**	**2.8**	**183,640**	**2.6**	**365,110**	**2.7**

Source: AIHW NIHSI AA version 1.0.

Table A6: Prevalence of COPD by age group and sex, 30 June 2017 to 2019

	Number			Prevalence (%)		
Characteristic	**2017**	**2018**	**2019**	**2017**	**2018**	**2019**
35–44	6,748	6,934	7,567	0.2	0.2	0.2
45–54	23,397	22,880	23,990	0.7	0.7	0.7
55–64	59,732	60,117	62,712	2.1	2.1	2.1
65–74	110,171	109,892	113,134	5.1	4.9	4.9
75–84	99,140	101,867	107,026	8.7	8.6	8.7
85 and over	48,252	48,650	50,681	9.8	9.8	10.0
		Number		**Age-standardised prevalence (%)**		
Men 35 and over	174,817	174,781	181,470	2.5	2.5	2.5
Women 35 and over	172,623	175,559	183,640	2.2	2.2	2.2
Persons 35 and over	**347,440**	**350,340**	**365,110**	**2.3**	**2.3**	**2.3**

Note: age-standardised estimates are age-standardised to the 2001 Australian population.

Source: AIHW NIHSI AA version 1.0.

Table A7: Prevalence of COPD at 30 June 2019, by socioeconomic and remoteness areas

Group	COPD cases (N)	Population (N)	Prevalence (%)	Age-standardised prevalence (%)
SEIFA quintile				
1 (lowest)	91,253	2,417,843	3.8	3.1
2	98,066	2,666,951	3.7	2.9
3	77,045	2,875,626	2.7	2.4
4	51,632	2,782,548	1.9	1.8
5 (highest)	45,743	2,842,916	1.6	1.5
Remoteness area				
Major city	222,925	9,513,942	2.3	2.1
Inner regional	93,505	2,629,747	3.6	2.8
Outer regional, remote and very remote	47,375	1,444,461	3.3	2.8

Notes

1. Age-standardised to the 2001 Australian population.
2. Socioeconomic areas are classified according to population-based quintiles using the Index of Relative Socio-Economic Disadvantage (IRSD) based on Statistical Area Level 2 (SA2) of usual residence.
3. Remoteness areas are classified according to the Australian Statistical Geography Standard 2016 Remoteness Areas structure based on Statistical Area Level 2 (SA2) of usual residence.

Source: AIHW NIHSI version 1.0.

Table A8: Newly identified NIHSI AA cases of COPD at 30 June 2019, by age group and sex

	Number			Proportion of total case (%)		
Age group	Men	Women	Persons	Men	Women	Persons
35–44	1,374	1,593	2,967	39.6	38.9	39.2
45–54	3,294	3,559	6,853	30.5	27.0	28.6
55–64	7,038	7,191	14,229	23.5	21.9	22.7
65–74	9,887	9,216	19,103	17.3	16.5	16.9
75–84	7,987	7,371	15,358	14.3	14.4	14.3
85 and over	3,628	4,023	7,651	15.0	15.2	15.1
35 and over	**33,208**	**32,953**	**66,161**	**18.3**	**17.9**	**18.1**

Note: An 8-year look-back was used to identify new cases. This counts COPD case at 30 June 2019 that were not identified as cases between July 2010 and June 2018.

Source: AIHW NIHSI AA version 1.0.

Table A9: Deaths and COPD deaths of cases and non-cases, deaths in 2011–12 to 2017–18

Reference date	Year of death	Category	N	%	Denominator (N)	Denominator (description)
30-Jun-11	2011–12	Deaths of cases	17,593	7.2	245,367	COPD cases
30-Jun-12	2012–13	Deaths of cases	18,789	7.2	261,669	COPD cases
30-Jun-13	2013–14	Deaths of cases	19,912	7.2	277,316	COPD cases
30-Jun-14	2014–15	Deaths of cases	21,163	7.2	292,549	COPD cases
30-Jun-15	2015–16	Deaths of cases	21,833	7.0	311,263	COPD cases
30-Jun-16	2016–17	Deaths of cases	23,077	7.0	329,003	COPD cases
30-Jun-17	2017–18	Deaths of cases	24,313	7.0	347,440	COPD cases
30-Jun-18	2018–19	Deaths of cases	23,906	6.8	350,340	COPD cases
30-Jun-11	2011–12	COPD deaths of cases	8,514	48.4	17,593	Deaths of cases
30-Jun-12	2012–13	COPD deaths of cases	9,081	48.3	18,789	Deaths of cases
30-Jun-13	2013–14	COPD deaths of cases	9,486	47.6	19,912	Deaths of cases
30-Jun-14	2014–15	COPD deaths of cases	10,067	47.6	21,163	Deaths of cases
30-Jun-15	2015–16	COPD deaths of cases	10,196	46.7	21,833	Deaths of cases
30-Jun-16	2016–17	COPD deaths of cases	10,904	47.3	23,077	Deaths of cases
30-Jun-17	2017–18	COPD deaths of cases	11,305	46.5	24,313	Deaths of cases
30-Jun-18	2018–19	COPD deaths of cases	n.a.	n.a.	23,906	Deaths of cases
30-Jun-11	2011–12	Deaths of non-cases	123,391	1.1	11,601,591	ERP minus cases
30-Jun-12	2012–13	Deaths of non-cases	126,021	1.1	11,790,058	ERP minus cases
30-Jun-13	2013–14	Deaths of non-cases	126,432	1.1	11,976,284	ERP minus cases
30-Jun-14	2014–15	Deaths of non-cases	130,467	1.1	12,150,339	ERP minus cases
30-Jun-15	2015–16	Deaths of non-cases	131,403	1.1	12,320,763	ERP minus cases
30-Jun-16	2016–17	Deaths of non-cases	133,455	1.1	12,511,698	ERP minus cases
30-Jun-17	2017–18	Deaths of non-cases	134,998	1.1	12,735,408	ERP minus cases
30-Jun-18	2018–19	Deaths of non-cases	134,541	1.0	12,978,193	ERP minus cases
30-Jun-11	2011–12	COPD deaths of non-cases	5,686	4.6	123,391	Non-case deaths
30-Jun-12	2012–13	COPD deaths of non-cases	5,512	4.4	126,021	Non-case deaths
30-Jun-13	2013–14	COPD deaths of non-cases	5,378	4.3	126,432	Non-case deaths
30-Jun-14	2014–15	COPD deaths of non-cases	5,581	4.3	130,467	Non-case deaths
30-Jun-15	2015–16	COPD deaths of non-cases	5,452	4.1	131,403	Non-case deaths
30-Jun-16	2016–17	COPD deaths of non-cases	5,365	4.0	133,455	Non-case deaths
30-Jun-17	2017–18	COPD deaths of non-cases	5,231	3.9	134,998	Non-case deaths
30-Jun-18	2018–19	COPD deaths of non-cases	n.a.	n.a.	134,541	Non-case deaths
30-Jun-11	2011–12	COPD death: non-case met criteria	2,051	36.1	5,686	COPD non-case death
30-Jun-12	2012–13	COPD death: non-case met criteria	1,994	36.2	5,512	COPD non-case death
30-Jun-13	2013–14	COPD death: non-case met criteria	1,923	35.8	5,378	COPD non-case death
30-Jun-14	2014–15	COPD death: non-case met criteria	1,999	35.8	5,581	COPD non-case death
30-Jun-15	2015–16	COPD death: non-case met criteria	2,095	38.4	5,452	COPD non-case death
30-Jun-16	2016–17	COPD death: non-case met criteria	2,110	39.3	5,365	COPD non-case death
30-Jun-17	2017–18	COPD death: non-case met criteria	1,988	38.0	5,231	COPD non-case death
30-Jun-18	2018–19	COPD death: non-case met criteria	n.a.	n.a.	n.a.	COPD non-case death

Note: Cause of death information is not available (n.a.) for the full 2018-19 period. Source: AIHW NIHSI AA version 1.0.

Table A10: Comparison of BOLD Australia (2016) and NIHSI AA (30 June 2018) COPD estimates, people aged 40 and over, by sex and age group

Sex	Age group	BOLD Australia study: COPD with breathlessness				NIHSI AA	% lower for NIHSI AA
		Mild (CI)	Moderate (CI)	Severe (CI)	Total	Total	
Men	40+	3.2 (1.8, 5.7)	0.4 (0.2, 1.0)	1.1 (0.5, 2.1)	4.7	3.1	33.6
Women	40+	1.9 (1.3, 2.7)	1.6 (0.6, 3.8)	0.8 (0.4, 1.6)	4.2	2.9	30.9
Persons	40+	2.5 (1.5, 3.5)	1.0 (0.3, 1.7)	0.9 (0.5, 1.4)	4.4	3.0	32.2
Persons	40–44	1.1 (0.3, 3.4)	0.1 (0.0, 0.6)	0.6 (0.1, 3.7)	1.8	0.3	84.6
Persons	45–54	2.0 (1.0, 3.8)	0.2 (0.1, 0.6)	0.2 (0.1, 1.2)	2.4	0.7	70.0
Persons	55–64	1.7 (1.0, 3.0)	0.9 (0.4, 2.1)	0.2 (0.1, 0.8)	2.9	2.1	27.3
Persons	65–74	3.5 (2.1, 5.7)	0.9 (0.4, 2.1)	1.7 (0.6, 4.6)	6.1	4.9	19.0
Persons	75+	5.7 (1.9, 16.2)	4.4 (1.2, 14.6)	3.1 (1.5, 6.1)	13.2	9.0	32.0

Note: CI = confidence interval.

Sources: AIHW NIHSI AA version 1.0; Toelle et al. 2021.

Table A11: Comparison of NHS and NIHSI AA COPD estimates, people aged 40 and over, by sex

Sex	NHS 2017-18			NIHSI AA 30 June 2018	
	N	(CIs)	%	N	%
Men	222,336	(3.48,4.81)	4.1	173,609	3.1
Women	262,316	(3.86,5.25)	4.6	174,205	2.9
Persons	484,653	(3.88,4.84)	4.4	347,814	3.0

Note: CI = confidence interval.

Sources: AIHW NIHSI AA version 1.0; AIHW analysis of NHS 2017–18 (ABS 2019).

Table A12: Number and proportion of PBS cases who self-reported each respiratory condition, people aged 35 and over

NHS respiratory condition	Number	% of total PBS cases
Bronchitis	107	16.9
Emphysema	230	36.4
Bronchitis or emphysema	295	46.7
Asthma	297	47.0
Asthma, bronchitis or emphysema	*445*	*70.4*
No respiratory condition	187	29.6
Total met PBS case definition	**632**	**100.0**

Source: 2014–15 and 2017–18 NHS linked with PBS (MADIP 2014–2018).

Table A13: Number and proportion who met the PBS case definition, by self-reported respiratory condition and age group, people aged 35 and over

	Bronchitis or emphysema			Asthma		
Age group	N met PBS case definition	% met PBS case definition	Total with condition	N met PBS case definition	% met PBS case definition	Total with condition
35–54	18	8.2	220	25	2.1	1,209
55–64	67	26.2	256	72	11.7	618
65–74	121	38.8	312	117	23.3	502
75–84	69	40.4	171	62	24.4	254
85 and over	20	40.8	49	21	34.4	61
Total	**295**	**29.3**	**1,008**	**297**	**11.2**	**2,644**

Source: 2014–15 and 2017–18 NHS linked with PBS (MADIP 2014–2018).

Table A14: Number and proportion of PBS cases who self-reported each respiratory condition, by age group, people aged 35 and over

	Bronchitis or emphysema		Asthma		Total PBS cases[(a)]
Age group	N with condition	% of PBS cases	N with condition	% of PBS cases	Number
35–54	18	46.2	25	64.1	39
55–64	67	52.3	72	56.3	128
65–74	121	49.0	117	47.4	247
75–84	69	41.6	62	37.3	166
85 and over	20	38.5	21	40.4	52
Total PBS cases	**295**	**46.7**	**297**	**47.0**	**632**

(a) Total PBS cases with or without a respiratory condition.

Source: 2014–15 and 2017–18 NHS linked with PBS (MADIP 2014–2018).

Appendix B Data sources used in this report

ABS National Health Survey

This web report contains results from the Australian Bureau of Statistics (ABS) National Health Survey (NHS) 2017–18, collected between July 2017 and June 2018.

The NHS was designed to collect a range of information about the health of Australians, including the prevalence of long-term health conditions; health risk factors such as tobacco smoking, overweight and obesity, alcohol consumption and exercise; demographic and socioeconomic characteristics.

The NHS is a community-based survey and does not include information from people living in nursing homes or otherwise institutionalised. Residents of *Very remote* areas and discrete Aboriginal and Torres Strait Islander communities are out of scope for the survey.

For further information, refer to the ABS National Health Survey: First Results methodology, 2017–18. https://www.abs.gov.au/methodologies/national-health-survey-first-results-methodology/2017-18

AIHW National Integrated Health Service Infrastructure Analysis Asset

The NIHSI AA, developed by the AIHW, brings together data on admitted patient care (APC) services in public hospitals and private hospitals (where available), emergency department services and outpatient services in public hospitals, for participating states and territories, along with Medicare Benefits Schedule data, Pharmaceutical Benefits Scheme and Repatriation Pharmaceutical Benefits Scheme data, Residential Aged Care data and National Death Index data.

Further information on the NIHSI AA linkage and collections included in the asset can be found in the data quality statement at: https://meteor.aihw.gov.au/content/766334.

Multi-Agency Data Integration Project

Multi-Agency Data Integration Project (MADIP) is a secure data asset combining information on health, education, government payments, income and taxation, employment, and population demographics (including the Census) over time.

The 2014-15 and 2017-18 National Health Survey and PBS data linked within the MADIP were used in this report.

For more information on MADIP see: https://www.abs.gov.au/about/data-services/data-integration/data-integration-project-register/data-assets.

For information on the structure of the data and items included see: https://www.abs.gov.au/statistics/microdata-tablebuilder/available-microdata-tablebuilder/multi-agency-data-integration-project-madip.

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Abbreviations

ABS	Australian Bureau of Statistics
AIHW	Australian Institute of Health and Welfare
BOLD	Burden of Obstructive Lung Disease
COPD	chronic obstructive pulmonary disease
ED	Emergency Department
ERP	Estimated Resident Population
FEV	Forced expiratory volume
FVC	Forced vital capacity
GLI	Global Lung Initiative
ICD-9-CM	International Classifications of Diseases, 9th Revision, Clinical Modification
ICD-10-AM	International Classifications of Disease and Related Health Problems, 10th Revision, Australian Modification
LLN	Lower Limit of Normal
MBS	Medicare Benefits Schedule
MADIP	Multi-Agency Data Integration Project
NIHSI AA	National Integrated Health Services Information Analysis Asset
NHS	National Health Survey
PBS	Pharmaceutical Benefits Scheme
RPBS	Repatriation Pharmaceutical Benefits Scheme
SNOMED CT-AU EDRS	Systematized Nomenclature of Medicine—Clinical Terms—Australian version, Emergency Department Reference Set

Glossary

additional diagnosis: A condition or complaint that either coexists with the principal diagnosis or arises during the hospitalisation. An additional diagnosis is reported if the condition affects patient management.

admitted care: A specialised mental health service that provides overnight care in a psychiatric hospital or a specialised mental health unit in an acute hospital. Psychiatric hospitals and specialised mental health units in acute hospitals are establishments devoted primarily to the treatment and care of admitted patients with psychiatric, mental or behavioural disorders. These services are staffed by health professionals with specialist mental health qualifications or training and have as their principal function the treatment and care of patients affected by mental disorder/illness.

admitted patient: A patient who undergoes a hospital's formal admission process.

age-standardisation: Method to remove the influence of age when comparing rates between population groups with different age structures. This is used as the rate of many diseases vary strongly (usually increasing) with age, and so too can service use, for example, hospitalisations – a population group with an older age structure will likely have more hospitalisations. The age structures of different populations are converted to the same 'standard' structure, and then the relevant rates, such as hospitalisations, that would have occurred within that structure are calculated and compared.

airflow obstruction: Difficulty breathing air out of the lungs that is formally measured and diagnosed by **spirometry** testing.

algorithm: A set of rules to be followed in calculations or solving problems.

associated cause(s) of death: All causes listed on the death certificate other than the underlying cause of death. They include the immediate cause, any intervening causes and conditions that contributed to the death but were not related to the disease or condition causing the death. See also **cause of death**.

asthma: an obstructive lung condition. Symptoms of asthma can range from mild to severe and are usually reversible, either with or without treatment. People with asthma experience episodes of wheezing, shortness of breath, coughing, chest tightness and fatigue due to widespread narrowing of the airways and variable airflow limitation demonstrated on lung function testing.

Authority required (streamlined): Restricted PBS benefits that do not require prior approval from Services Australia or the DVA but require the recording of a streamlined authority code

cause of death: The causes of death entered on the Medical Certificate of Cause of Death are all diseases, morbid conditions or injuries that either resulted in or contributed to death, and the circumstances of the accident or violence that produced any such injuries. Causes of death are commonly reported by the underlying cause of death. See also associated cause(s) of death.

chronic bronchitis: a symptom-based diagnosis. It is the presence of cough and sputum (mucus) production for at least 3 months in each of 2 consecutive years, in the absence of other conditions that could explain these conditions. Symptoms may also be ongoing and persist throughout the year.

chronic condition: A term applied to a diverse group of diseases, such as heart disease, cancer and arthritis that tend to be long-lasting and persistent in their symptoms or development. Although these features also apply to some communicable diseases, the term is usually confined to non-communicable diseases.

chronic obstructive pulmonary disease (COPD): A serious, progressive and disabling long-term lung disease where damage to the lungs obstructs oxygen intake and causes increasing shortness of breath.

confidence interval: A range determined by variability in data, within which there is a specified (usually 95%) chance that the true value of a calculated parameter lies.

emphysema: A diagnosis typically defined by changes seen on imaging of the lungs. It is due to over-expansion or destruction of the lung tissue, most particularly the alveoli. This limits oxygen intake and leads to shortness of breath and other problems.

Forced expiratory volume (FEV1): The maximum amount of air that an individual can breathe out in 1 second when breathing out as hard as they can.

Forced vital capacity (FVC): The maximum about of air that an individual can breathe out after a deep breathe, when breathing out as hard as they can.

incidence: The number of new cases (of an illness or event, and so on) occurring during a given period. Compare with prevalence.

data linkage/linked data: Bringing together (linking) information from 2 or more data sources believed to relate to the same entity, such as the same individual or the same institution. The resulting data set is called linked data. In this report, data linkage is used to bring together information from datasets that indicates a population of interest (such as people with dementia) with other datasets that include information on other characteristics or service usage.

look-back period: A defined pre-observation period without the illness or event to identify new cases of the disease.

Medicare: A national, government-funded scheme that subsidises the cost of personal medical services for all Australians and aims to help them afford medical care. The Medicare Benefits Schedule (MBS) is the listing of the Medicare services subsidised by the Australian Government. The schedule is part of the wider Medicare Benefits Scheme (Medicare).

over-the-counter medicines: Medicine that one can buy without a prescription from a pharmacy or retail outlet.

prevalence: The number or proportion of cases or instances of a disease or illness present in a population at a given time. The prevalence of disease is related to both the incidence of the disease and how long people live with the disease after developing it.

Pharmaceutical Benefits Scheme (PBS): A national, government-funded scheme that subsidises the cost of a wide range of pharmaceutical drugs for all Australians to help them afford standard medicines. The Schedule of Pharmaceutical Benefits (schedule) lists all the medicinal products available under the PBS and explains the uses for which they can be subsidised.

principal diagnosis: The diagnosis established after study to be chiefly responsible for occasioning an episode of patient care (hospitalisation), an episode of residential care or an attendance at the health care establishment.

private hospital: A privately owned and operated institution, catering for patients who are treated by a doctor of their own choice. Patients are charged fees for accommodation and other services provided by the hospital and by relevant medical and allied health practitioners. The term includes acute care and psychiatric hospitals as well as private free-standing day hospital facilities.

procedure: A clinical intervention that is surgical in nature, carries a procedural risk, carries an anaesthetic risk, and requires specialist training and/or special facilities or equipment available only in the acute-care setting.

Repatriation Pharmaceutical Benefits Scheme (RPBS): An Australian government scheme that provides a range of pharmaceuticals and wound dressings at a concessional rate for the treatment of eligible veterans, war widows/widowers, and their dependants.

restricted benefits: PBS benefits that can only be prescribed for specific therapeutic uses.

separation (from hospital): The formal process where a hospital records the completion of an episode of treatment and/or care for an admitted patient

spirometry: A test that measures the amount and/or speed of air that a person can breathe in and out in a specified amount of time. It is used to test for **airflow obstruction**.

respiratory condition: A chronic condition affecting the airways and characterised by symptoms such as wheezing, shortness of breath, chest tightness and cough. Conditions include asthma and chronic obstructive pulmonary disease (COPD).

underlying cause of death: The disease or injury that initiated the sequence of events leading directly to death; that is the primary or main cause. For each death, only a single underlying cause is selected from among all the conditions reported on a death certificate.

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Related publications

This report is accompanied by a report titled *Strengthening national COPD monitoring using linked health services data*, available on the AIHW website: http://www.aihw.gov.au/reports/chronic-respiratory-conditions/copd-monitoring-using-linked-health-services-data

The report uses the methods described in this technical report to estimate COPD prevalence in Australia using the NIHSI AA data. It compares the prevalence of COPD by age, sex, between population groups and over time. It also includes data on newly identified cases of COPD and deaths of COPD cases.

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