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Vaccination uptake among people with chronic respiratory disease

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*Authoritative information and statistics
to promote better health and wellbeing*

Vaccination uptake among people with chronic respiratory disease

Australian Institute of Health and Welfare
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Abbreviations

ACAM	Australian Centre for Asthma Monitoring
ACIR	Australian Childhood Immunisation Register
AIFS	Australian Institute of Family Studies
AIHW	Australian Institute of Health and Welfare
BDR	bronchodilator responsiveness
BEACH	Bettering the Evaluation and Care of Health
CATI	Computer Assisted Telephone Interview
COPD	chronic obstructive pulmonary disease
CI	confidence interval
DoHA	Department of Health and Ageing
FaHCSIA	Department of Families, Housing, Community Services and Indigenous Affairs
FVC	forced vital capacity (the volume of air that can forcibly be blown out after full inspiration, measured in litres).
FEV	forced expiratory volume (the maximal amount of air you can forcefully exhale within a certain time)
FEV1	forced expiratory volume in 1 second
FMRC	Family Medicine Research Centre
GOLD	Global Initiative for Chronic Obstructive Lung Disease
GP	General practitioner
GPII	General Practice Immunisation Incentive
HICID	Health Insurance Commission identification number
LSAC	Longitudinal Study of Australian Children
MBS	Medicare Benefits Schedule
NAC	National Asthma Council Australia Ltd
NATSIHS	National Aboriginal and Torres Strait Islander Health Survey
NCIRS	National Centre for Immunisation Research and Surveillance
NHS	National Health Survey
OR	odds ratio

PBS	Pharmaceutical Benefits Scheme
PCEHR	Personally Controlled Electronic Health Record
PCV	Pneumococcal conjugate vaccine
PPV	pneumococcal polysaccharides vaccine
p (value)	The probability that the observed difference or association could have occurred by chance. If that probability is less than 5% (0.05), it is conventionally held that it did not occur by chance and is a true difference or association.
RPBS	Repatriation Pharmaceutical Benefits Scheme
SAND	Supplementary Analysis of Nominated Data

Symbols

n.a.	not available
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Summary

Research has shown that vaccinations against influenza and pneumococcal infection are beneficial for people with obstructive airways disease such as asthma and chronic obstructive pulmonary disease (COPD). Improving vaccination uptake requires action to identify and immunise at-risk populations. Therefore, it is important to know the proportion of people with obstructive airways disease currently vaccinated. Further, information about the distribution of vaccination uptake within this population would assist in targeting interventions to improve vaccination uptake in under-served populations and in monitoring adverse events related to vaccination.

This report reviewed data sources that provide information on the uptake of influenza and pneumococcal vaccinations among people with obstructive airways disease and found that there is very limited information on this subject. As there are no comprehensive prescription or vaccination records or registers for influenza or pneumococcal vaccines, it is not possible to use routine data sources or data linkage for monitoring the use of these vaccinations in people with obstructive airways disease or other similar at-risk population sub-groups.

Available information shows that, for the overall population aged 50 and over, self-reported uptake of influenza and pneumococcal vaccination is higher in those with asthma or COPD than for others. The best influenza vaccination coverage is among people with asthma or COPD aged 65 or older.

Aboriginal and Torres Strait Islander peoples have similar or higher influenza and pneumococcal vaccination rates than other Australians in this age group. Among Aboriginal and Torres Strait Islander people, uptake of both influenza and pneumococcal vaccination is more common among those with asthma than those without asthma and uptake of pneumococcal vaccination, but not influenza vaccination, is higher among those with COPD than those without COPD.

In all groups, uptake of influenza and pneumococcal vaccination is sub-optimal.

The availability of systematic information about the use of vaccines in the community would support the assessment of:

- the coverage of these vaccines in the general population and in people with COPD and asthma
- the impact of vaccinations on the target populations and the health-care system including adverse events
- the effectiveness and cost-effectiveness of government-funded immunisation programs.

The report presents a range of options for interventions to improve data for monitoring vaccination uptake, impact among people with asthma and COPD, and vaccine-related adverse events.

1 Introduction

1.1 Background

Obstructive airways disease refers to a group of chronic conditions characterised by limitation of expiratory airflow. The most common such conditions are asthma and chronic obstructive pulmonary disease (COPD). Asthma is characterised by variable airflow limitation and symptoms of wheeze, shortness of breath and cough, which are usually reversible either spontaneously or with treatment. COPD is usually acquired after a long period of exposure to inhaled noxious agents, such as cigarette smoke, and is characterised by airflow limitation that is not fully reversible and associated exertional breathlessness. It is usually progressive over time.

People with obstructive airways disease may be affected by a wide range of respiratory viruses and bacteria. Amongst these are *Streptococcus pneumoniae* and influenza viruses, which can cause pneumonia and influenza. Pneumococcal and influenza infection cause substantial morbidity and mortality, particularly among people who have underlying medical conditions.

People with obstructive airways disease are at a higher risk of invasive pneumococcal disease (Juhn et al. 2008; Klemets et al. 2010; Talbot et al. 2005). While those with obstructive airways disease are no more likely than others to experience influenza infection, they are more likely to have complications following influenza infection. These infections contribute to acute exacerbations in people with asthma and COPD (Griffin et al. 2002; Groenewegen & Wouters 2003; Rothbart et al. 1995), leading to increased risk of hospitalisations and mortality.

Although *Streptococcus pneumoniae* and influenza are not the most common respiratory pathogens, they are important as they are potentially preventable by vaccination.

Therefore, this report focuses on the use of influenza and pneumococcal vaccination among people with asthma and COPD although the findings may be relevant to people with other respiratory conditions and people with other chronic diseases.

Influenza vaccination

Influenza vaccines

All influenza vaccines are purified from inactivated virus. These vaccines confer protection for one year and protect against two influenza A subtypes and one influenza B subtype that are predicted to be circulating over the following winter.

The formulations of influenza vaccine currently available in Australia are:

- | | | |
|-----------|------------|--------------------|
| • Flud | • Fluvirin | • Vaxigrip |
| • Fluarix | • Influvac | • Vaxigrip Junior. |
| • Fluvax | • Intanza | |

Influenza vaccination in obstructive airways disease

Influenza, like other respiratory viral infections, may cause exacerbations of asthma. It may be prevented by vaccination, although the extent of protection against exacerbations of asthma is

not certain (Cates et al. 2009). It has been shown that vaccination against influenza improves health-related quality of life among children with asthma (Bueving et al. 2004), but there are few good quality studies in adults. To be effective, influenza vaccination needs to be administered annually, before the influenza season, because the strains of the virus in circulation change from year to year.

In people with COPD, administration of influenza vaccine is associated with a significant reduction in the risk of disease exacerbations, particularly those occurring 3 to 4 weeks after the influenzal illness (Poole et al. 2010). There are insufficient data to draw conclusions about the effect of influenza vaccination on risk of hospitalisation or death in patients with COPD.

Despite the limitations of the existing data, influenza vaccines have been regarded as an important component of preventative strategies for managing both asthma and COPD and are recommended in the *National Asthma Handbook* (NAC 2006) and *The COPD-X Plan: Australian and New Zealand Guidelines for the management of Chronic Obstructive Pulmonary Disease* (McKenzie et al. 2011) (see Box 1.1). However, only 66% of people with asthma were vaccinated for the 2009 winter season, a season in which the H1N1 epidemic may have inflated the usual uptake of vaccination (NAC 2010).

Box 1.1 Current Australian recommendations for influenza vaccination

The Australian Immunisation Handbook 9th Edition 2008 (DoHA 2008), updated December 2011 (DoHA December 2011)

These guidelines strongly recommend active promotion of influenza vaccination for:

- Aboriginal and Torres Strait Islander Australians aged 15 and over
- people aged 65 and over
- people aged 6 months and over with conditions predisposing to severe influenza, including COPD and severe asthma
- pregnant women
- other groups at risk: residents and staff of nursing homes, health-care workers, homeless people, people involved in industries that are at-risk or providing essential services and travellers.

Asthma Management Handbook (NAC 2006)

Annual influenza vaccination recommended for people with severe persistent asthma (including those who require frequent hospitalisation).

The COPD-X Plan: Australian and New Zealand Guidelines for the management of Chronic Obstructive Pulmonary Disease (McKenzie et al. 2011)

Influenza vaccination is a recommended treatment for people with moderate to severe COPD. The vaccination should be given in early autumn while a second vaccination during the winter months will increase antibody levels.

The Australian Government funds a free seasonal influenza vaccination program for the following subgroups of Australians at risk:

- adults aged 65 and over
- Aboriginal and Torres Strait Islander people aged 15 and over
- pregnant women
- individuals aged 6 months and over with at least one underlying medical condition predisposing to severe influenza or its complications.

Pneumococcal vaccinations

Pneumococcal vaccines

The types of pneumococcal vaccines currently available in Australia are listed in Table 1.1.

Table 1.1: Vaccines against pneumococcal disease available in Australia

Vaccination name	Description
Pneumovax 23 (23vPPV)	Provides protection against the 23 most common types of pneumococcal bacteria. Not recommended for children under the age of 2. Overall protective efficacy of 60–70%.
Prevenar (7vPCV)	A 7-valent conjugate vaccine. (i.e. provides protection against 7 strains of pneumococcal bacteria). Well tolerated with good safety profile.
Prevenar 13 (13vPCV)	A 13-valent conjugate vaccine (i.e. provides protection against a further 6 serotypes of pneumococcal bacteria than Prevenar, including the strain of pneumococcal bacteria that causes the majority of invasive pneumococcal disease in children under age 3). Has replaced Prevenar as routine pneumococcal vaccine in children.
Synflorix (10vPCV)	A 10-valent conjugate vaccine (i.e. provides protection against 10 strains of pneumococcal bacteria). An alternative vaccine to Prevenar 13, available for use in children.

Source: The Australian Immunisation Handbook 9th Edition 2008 (DoHA 2008), updated December 2011 (DoHA December 2011)

Pneumococcal vaccination in obstructive airways disease

Clinical practice guidelines recommend vaccination against pneumococcal infection as an important component of the management of COPD (GOLD 2011; McKenzie et al. 2011). In a number of studies, pneumococcal vaccine has been shown to reduce the risk of pneumococcal infection among patients with COPD aged 65 and over (Jackson et al. 2003) and to reduce the incidence of community-acquired pneumonia in patients with COPD younger than the age of 65 who have severe airflow limitation (FEV1<40% predicted) (Alfageme et al. 2006). Furthermore, subset analysis of a randomised controlled trial showed that combination pneumococcal and influenza vaccine, when compared to influenza vaccine alone, reduces infectious acute exacerbations among people with COPD; however, numbers were small (Furumoto et al. 2008).

Evidence of a reduction in asthma exacerbations with pneumococcal vaccination is less clear. However a retrospective study found an association between pneumococcal vaccine and a reduction in the number and duration of hospitalisations for asthma among the elderly (Ansaldi et al. 2005).

The Australian Immunisation Handbook (DoHA 2008) states that, among healthy adults, only one dose of pneumococcal vaccine is usually required to provide protection against pneumococcal disease. In Australia, revaccination is no longer recommended in non-smokers with normal immune systems. However, a second dose, and in some cases a third dose, is currently recommended for people with chronic medical conditions such as COPD (see Box 1.2).

Box 1.2: Current Australian recommendations for pneumococcal vaccination

The Australian Immunisation Handbook 9th Edition 2008 (DoHA 2008), updated December 2011 (DoHA December 2011)

These guidelines recommend pneumococcal vaccination for:

- all infants and children from 2 months of age (vaccines 7, 10 or 13vPCV only for healthy infants, and 7, 10 or 13vPCV and 23vPPV for children with underlying medical conditions and Aboriginal and Torres Strait Islander children residing in Northern Territory, Queensland, South Australia and Western Australia)
- people aged 10 and over who have underlying chronic illnesses (including chronic pulmonary disease) predisposing them to invasive pneumococcal disease (23vPPV)
- Aboriginal and Torres Strait Islander people aged 50 and over, or aged <50 with underlying chronic illnesses including chronic pulmonary disease (23vPPV)
- all people aged 65 and over (23vPPV)
- all tobacco smokers (23vPPV).

Revaccination is currently recommended for some populations, as follows:

- Infants and children [details provided in the Australian Immunisation Handbook (DoHA 2008) and recent changes to recommendations (DoHA January 2012)].
- Non-Indigenous people aged less than 65 with an underlying chronic medical condition or who are tobacco smokers, provided that at least 5 years have passed since the previous vaccination (DoHA December 2011). For these populations, a third dose (second revaccination) is recommended to be given at age 65 or 5 years after the first revaccination (second dose), whichever is later.
- Non-Indigenous people aged 65 and over with an underlying chronic medical condition or who are tobacco smokers, provided that at least 5 years have passed since the previous vaccination (DoHA December 2011).
- Indigenous Australians aged 50 and over, and Indigenous adults aged less than 50 with an underlying chronic medical condition (DoHA December 2011). For Indigenous adults aged less than 50 with an underlying chronic medical condition or who are tobacco smokers, a third dose (second revaccination) is recommended to be given either 5 years after first revaccination (second dose) or at age 50, whichever is later.

Asthma Management Handbook (NAC 2006)

Pneumococcal vaccination is recommended for all patients with asthma who also have chronic bronchitis, emphysema, or require long-term systemic corticosteroid use (in addition to other indications).

The COPD-X Plan: Australian and New Zealand Guidelines for the Management of Chronic Obstructive Pulmonary Disease (McKenzie et al. 2011)

Pneumococcal vaccine (23vPPV) is recommended for COPD patients to prevent pneumonia.

The Australian Government funds free pneumococcal vaccination for:

- adults aged 65 and over
- Aboriginal and Torres Strait Islander people aged 50 and over
- Aboriginal and Torres Strait Islander people aged 15 and over who have underlying medical conditions placing them at risk of invasive pneumococcal disease
- children aged 2, 4 and 6 months (also at 12 months to children medically at risk of invasive pneumococcal disease).

There is recent evidence that treatment of patients with COPD with the inhaled corticosteroid fluticasone may be associated with an increased risk of reported pneumonia (Crim et al. 2009) or hospitalisation due to pneumonia (Ernst et al. 2007). It is not known whether people with COPD who are treated with inhaled corticosteroids would benefit from receiving a pneumococcal vaccine.

1.2 This report

Influenza and pneumococcal vaccination are recommended in clinical guidelines for treatment of asthma and COPD. Empirical studies cited above also suggest that people with asthma or COPD may benefit from receiving vaccinations to protect against influenza and pneumococcal infection. Improving vaccination uptake requires work to identify and immunise at-risk populations. Therefore, it is important to know what proportion of people with asthma and COPD are currently vaccinated. Information about the distribution of vaccination uptake would assist in targeting interventions to improve vaccination uptake in those populations with low vaccination rates at present.

The objectives of this report are to:

- identify and review existing data sources and published reports that provide information on influenza and pneumococcal vaccination uptake among people with obstructive airways disease
- compare influenza and pneumococcal vaccination rates in those with and without asthma or COPD.

Chapter 2 focuses on the first objective, and summarises the findings under four categories of information: child immunisation registers (Section 2.2), general practice and other medical data sources (Section 2.3), survey data (Section 2.4), and published reports (Section 2.5).

Based on the assessment of the data and information sources, Chapter 3 outlines available evidence on the comparison between the vaccination rates in those with and without asthma or COPD. The relevant sources of information selected are:

- the Longitudinal Study of Australian Children (LSAC), which is linked to the Australian Childhood Immunisation Register (ACIR), to investigate rates of pneumococcal vaccination among children with and without diagnosed asthma or asthma symptoms (Section 3.1)
- the National Health Survey (NHS), to investigate rates of influenza and pneumococcal vaccination among people with self-reported asthma or COPD aged 50 and over (Section 3.2)
- the National Aboriginal and Torres Strait Islander Health Survey (NATSIHS), to investigate rates of influenza and pneumococcal vaccination among Aboriginal and Torres Strait Islander people and other Australians with self-reported asthma or COPD (Section 3.3)
- general practice data (Bettering the Evaluation and Care of Health (BEACH) and the Supplementary Analysis of Nominated Data (SAND)) survey data, to investigate the provision of influenza and pneumococcal vaccinations at general practitioner (GP) encounters where asthma, COPD or a related respiratory problem was managed (sections 3.4–3.5)
- state and other local studies that investigated influenza and pneumococcal vaccination status among adults with asthma or COPD (sections 3.6–3.7).

2 Review of vaccination information sources

2.1 How this review was conducted

Currently, there are no data sources specifically designed for the purpose of assessing vaccination uptake among people with obstructive airway diseases in Australia. Therefore, the project team systematically assessed a range of potentially relevant data sources and other information to identify information on the proportion of people with asthma or COPD who were vaccinated against influenza annually and/or within the last 5 years (Appendix, Table A.1)

Identification of potentially relevant data sources and information was carried out using:

- national and state health department websites
- bibliographic databases indexing academic journals.

To ensure comprehensive review of information, the project team also liaised with the Vaccination Research Group based at Children's Hospital Westmead and vaccine manufacturers.

This chapter describes each of the identified information sources in detail before presenting a summary of the information in Table 2.2 in Section 2.6.

2.2 Registers

The Australian Childhood Immunisation Register (ACIR)

About the ACIR

The Australian Childhood Immunisation Register (ACIR) was established on 1 January 1996 and is administered by the Department of Human Services (formerly Medicare Australia). It includes information about vaccinations provided to children under the age of 7 who reside in Australia. Data on children who are vaccinated are routinely included in the ACIR unless their parents actively opt out of participation in the Register. Therefore, it constitutes a nearly complete population register. Approximately 99% of children are registered with Medicare by 12 months of age (Hull et al. 1999).

GPs are provided with financial incentives through the General Practice Immunisation Incentive (GPII) scheme for monitoring, promoting and providing appropriate immunisation services to children under the age of 7. The ACIR facilitates the recording of information on these vaccinations.

The ACIR can be used to monitor immunisation coverage levels. Data from the ACIR are analysed and reported by a number of research groups and government departments.

Limitations

The ACIR is a valuable source of data on vaccination status among children, but it does not include data on associated medical conditions, including asthma. In addition, the register is limited to children aged 0–7. All vaccination records for a child remain on the register indefinitely but no new immunisation encounter records are added after the child turns 7. There is currently no register that records information on vaccinations administered to people aged 7 and over.

Furthermore, recording of influenza vaccination details is voluntary in the ACIR as it is not included as funded immunisation for children on the National Immunisation Program Schedule. Information on influenza uptake among children in the ACIR may therefore be an under-estimate.

ACIR data linked to Longitudinal Study of Australian Children

While the ACIR does not include data about health conditions, it can be linked to other data sources to provide information on eligible vaccination status among children with asthma. For instance, information from the ACIR, Pharmaceutical Benefits Scheme (PBS) and Medicare Benefits Schedule (MBS) can be linked to the Longitudinal Study of Australian Children (LSAC) data set using the individual child's Health Insurance Commission identification number (HICID). The value of linking the LSAC data set with the ACIR is that it makes it possible to compare vaccination status among children with and without a parent-reported diagnosis of asthma or recent asthma symptoms or treatment.

The Longitudinal Study of Australian Children (LSAC) was initiated and is funded by the Australian Government Department of Families, Housing, Community Services and Indigenous Affairs (Australian Institute of Family Studies 2012). The survey aims to explore a range of research questions about children's development and wellbeing. The study commenced in 2004 with a sample of approximately 10,000 children recruited from the Medicare enrolments database. The sample is broadly representative of Australian children in each of two selected age cohorts:

- Children born between March 2003 and February 2004 (Infant cohort).
- Children born between March 1999 and February 2000 (Kindergarten cohort).

Both cohorts are followed up by parent-completed questionnaire every 2 years.

Limitations

The LSAC relies on self-reported doctor diagnosis of asthma. Other limitations such as representativeness have been described previously (AIHW: Australian Centre for Asthma Monitoring 2009).

The linked LSAC-ACIR data are also affected by the under-estimation of influenza vaccination status among children with asthma inherent in the ACIR data.

State/territory immunisation registers

Queensland and the Northern Territory have their own childhood immunisation registers. These are:

- Queensland Health's Vaccination Information and Vaccination Administration System (VIVAS)
- Northern Territory Immunisation Register (NTIR).

Vaccination records from these registers are routinely sent for inclusion in the ACIR.

Limitations

Only two state and territory-based registries identified are linked with the ACIR. Data from these registries may not be nationally representative.

Furthermore, immunisation data from these registers are restricted to only those vaccines that are on the National Immunisation Program Schedule.

2.3 General Practice and other medical encounters

Bettering the Evaluation and Care of Health (BEACH) and Supplementary Analysis of Nominated Data (SAND) surveys

About BEACH and SAND

BEACH survey data are collected through a continuous survey of general practice activity in Australia, which began in April 1998 conducted by the University of Sydney in collaboration with the Australian Institute of Health and Welfare. The BEACH survey is now conducted solely by the Family Research Centre (FMRC) of the University of Sydney. A rolling random sample of GPs is drawn from the Medicare database by the Australian Government Department of Health and Ageing (AIHW: Britt et al. 2007). To be eligible to participate, GPs must have claimed at least 375 general practice Medicare items in the previous 3 months. Approximately 1,000 GPs participate annually, with about 20 different GPs recording each week. Data are collected for 50 weeks each year. Each GP collects information on 100 consecutive encounters using a recording pack containing 100 forms.

Each form is divided into two main sections: BEACH and SAND. The BEACH section collects information about the current encounter. The data items in this section remain constant in all surveys. The SAND data are collected as a supplementary data set of the BEACH program (AIHW: Britt et al. 2001). Organisations collaborating on SAND blocks nominate questions on topics of their choice and have access to the detailed reports. GPs participating in SAND ask and record responses to specific questions of consenting patients.

Information about vaccinations and obstructive airways disease

The BEACH survey includes information on medications prescribed or dispensed by GPs at the recorded encounter. As GPs administer a large number of immunisations in Australia, BEACH is an important source of data on influenza and pneumococcal vaccinations (Britt et al 2011).

The BEACH survey also collects data on the patient's reasons for encounters and problems managed by the GP at each encounter. Therefore, it is possible to identify vaccinations prescribed at asthma or COPD related encounters.

Three SAND modules have collected data on vaccination status concurrently with information about the presence of various underlying diseases including asthma, COPD or chronic lung disease (FMRC (Family Medicine Research Centre) 2011a; FMRC 2011b; FMRC 2011c).

Limitations

When an influenza or pneumococcal vaccination is recorded for a patient at a BEACH encounter, the only way of identifying if that patient has asthma or COPD is if asthma or COPD is recorded as a 'problem managed' at the same visit. For many people with asthma or COPD, these conditions are not recorded as problems managed at the time of the influenza or pneumococcal vaccination. In fact, a GP may be less likely to administer these vaccines if the patient's asthma or COPD is unstable or causing problems at that time. BEACH data are cross-sectional in nature. There is no way of identifying whether a vaccinated individual had previous or subsequent GP visits at which asthma or COPD was managed. Hence, the BEACH data may underestimate the proportion of people receiving a vaccination who have asthma or COPD.

Medicare Benefits Schedule (MBS) data

About the data

The Department of Human Services collates statistics on claims submitted to, and subsidised by, Medicare Australia according to the Medicare Benefits Schedule. These include items claimed by general practitioners, doctors and specialists in the community. Item reports can be accessed online through the Medicare Australia website <www.medicareaustralia.gov.au>.

Information about vaccinations in the Medicare Benefits Schedule database

Several items in the Medical Benefits Schedule relate to vaccination (see Table 2.1). However, these items are not specific to vaccination as they are also used for other preventive interventions. Hence these item numbers cannot be used to ascertain rates of vaccination.

MBS item number 10988, labelled 'immunisation services provided by a Registered Aboriginal Health Worker' is specific to vaccinations listed in the Australian Standard Vaccination Schedule and vaccines covered in the current edition of the Australian Immunisation Handbook (see Table 2.1). However, the item number does not distinguish among types of vaccination. Therefore, it cannot be used to identify pneumococcal or influenza vaccination administered by Aboriginal Health Workers.

Table 2.1: Pharmaceutical Benefits Scheme items numbers relevant to vaccination included in the Medical Benefits Schedule

MBS Item number	Description	No of claims in 2010–11
410	Attendances by public health physicians will attract Medicare benefits under the new items only where the attendance relates to one or more of the following: (i) management of a patient's vaccination requirements for accepted immunisation programs; or (ii) prevention or management of sexually transmitted disease; or (iii) prevention or management of disease due to environmental hazards or poisons; or (iv) prevention or management of exotic diseases; or (v) prevention or management of infection during outbreaks of infectious disease.	410
411	Professional attendance by a general practitioner (not being a service to which any other item in this table applies) lasting less than 20 minutes, including any of the following that are clinically relevant: a) taking a patient history; b) performing a clinical examination; c) arranging any necessary investigation; d) implementing a management plan; e) providing appropriate preventive health care; in relation to 1 or more health-related issues, with appropriate documentation.	5,191
412	As above except lasting at least 20 minutes and (a) taking a detailed patient history	1,662
413	As above except last at least 40 minutes and (a) taking an extensive patient history	156
414	Attendance for an obvious problem characterised by the straightforward nature of the task that requires a short patient history and, if required, limited examination and management.	0
415	As for 411, but other than at consulting rooms	0
416	As for 412, but other than at consulting rooms	7
417	As for 413, but other than at consulting rooms	1
10988	Immunisation services provided by a Registered Aboriginal Health Worker	4,959

Note: Item 10988 can be claimed only once per patient visit, even if more than one vaccine is administered during the same patient visit. Immunisation means the administration of a registered vaccine to a patient for any purpose other than as part of a mass immunisation of persons. A registered vaccine means a vaccine that is included on the Australian Register of Therapeutic Goods. This includes all vaccines on the Australian Standard Vaccination Schedule and vaccines covered in the current edition of the Australian Immunisation Handbook. The following substances cannot be claimed under this item: vaccines used experimentally; homeopathic substances; immunotherapy for allergies (e.g. de-sensitisation preparations); and other substances that are not vaccines. There may also be territory limitations on the administration of some vaccines, such as those for tuberculosis, yellow fever and Q-fever.

Limitations

Using the MBS item numbers, it is not possible to identify which GP visits included specific types of vaccination, that is pneumococcal or influenza. In addition, there is no diagnosis attached to the MBS record, so it is not possible to determine if the patient had COPD or severe asthma.

Due to these limitations, further investigation and analysis of this data set was not pursued.

Pharmaceutical Benefits Scheme data

About the PBS

Information on reimbursements for the purchase of prescription medications is available from the Pharmaceutical Benefits Scheme (PBS) database and similar data are available from the

Repatriation Pharmaceutical Benefits Scheme (RPBS) database for eligible people. The PBS currently subsidises the cost of approximately 80% of prescription medications dispensed in Australia (DoHA 2010). However, even for these items that are covered by the PBS or RPBS, subsidies are only paid, and hence recorded in the database, where the cost of the medication is more than the co-payment amount (the patient contribution). Approximately 65% of people receiving medications used for asthma or COPD through the PBS hold a card which entitles them to the concessional rate.

Information about vaccines and obstructive airways disease

The PBS data set contains limited information on certain vaccines where these are reimbursed by Medicare Australia. As described in the next section, there are several circumstances where this is not the case.

The PBS data set does not contain information about diagnoses. However, it does contain reimbursement information on medications used for the treatment of obstructive airways disease (including asthma and COPD). Use of these medications supports the inference that the individual is being treated for obstructive airway disease. The Australian Centre for Asthma Monitoring (ACAM) has previously used the PBS data set to investigate use of these medications in Australians.

Medication reimbursement data for individuals can be tracked longitudinally to examine patterns of patient medication use by record linkage using an anonymised form of the individual's Medicare number. As with all PBS/RPBS analysis, such linked analysis is limited to medications listed in the PBS where the cost of the medication is above the co-payment threshold.

Limitations

Some groups of people, in particular, people aged 65 and over, are eligible to receive influenza vaccination free of charge. These free-of-charge vaccinations are not recorded in the PBS. Furthermore, influenza vaccines have not been continuously listed on the PBS (for example, for part of 2010 they did not appear on the list, and are not currently listed). In 2010, a study of general practice patients reported that 81.4% of patients were supplied the influenza vaccine free of charge while only 5.7% were PBS subsidised (FMRC 2011b).

Some vaccines were previously included under the PBS schedule but have since been removed, presumably when they became funded under other government programs. For example, in 2010, the free influenza program was extended to include all those aged 6 months and older who are in the medical at-risk group.

Similarly, pneumococcal vaccines are not recorded in the PBS for children and adults aged 65 and over as these vaccines are also supplied free of charge for these populations. In 2010, 93.0% of pneumococcal vaccines were supplied free of charge and 4.6% were PBS subsidised (FMRC 2011b).

Due to the limitations described above, it is not appropriate to estimate the use of vaccinations in Australia from the PBS data at the current time.

2.4 Survey data

Vaccination-specific surveys

Adult Vaccination Survey

About the survey

The 2009 Adult Vaccination Survey was a telephone survey of 10,231 Australians aged 18 or older, conducted during November–December 2009 by the Australian Institute of Health and Welfare on behalf of the Australian Government Department of Health and Ageing (AIHW 2011).

Information about vaccinations and obstructive airways disease

Participants in the survey were asked about their recent experience of influenza and pneumococcal vaccinations.

Content areas in the 2009 survey related to vaccination:

- Whether respondent had 'flu injection' last year (that is, in 2008).
- Reasons why respondent did not have 'flu injection'.
- Month of 'flu injection'.
- Whether had 'flu injection' since 1st January this year (that is, in 2009).
- Whether a payment was required for consultation for the 'flu injection'.
- Whether a payment was required for the 'flu vaccine'.
- Whether a doctor recommended the 'flu injection'.
- If respondent intends to have 'flu injection' in 2010.
- Whether respondent ever had 'pneumonia vaccination'.
- Main reason if no vaccination for pneumonia.

The main findings from the survey were that nearly 75% of those aged 65 and over were vaccinated against seasonal influenza in 2009. Among those aged 18–64, 23% were vaccinated against influenza.

Some of the main reasons cited for not being vaccinated against influenza included: 'I don't get the flu/rarely get the flu', 'I'm not at risk/don't need it' and 'It brings on the flu/I may get the flu'.

In the same year, an estimated 54% of Australians aged 65 and over were vaccinated against pneumococcal disease while only 5% of those aged 18–64 were vaccinated.

The survey also estimated that 51% of people aged 65 and over were vaccinated against both influenza and pneumococcal disease in 2009, while 22% were not vaccinated for either.

The survey results showed that 96% of the vaccines were fully subsidised by the Australian Government for those 65 and over.

The survey also included the following questions on asthma and COPD status:

- Do you have severe asthma that required hospitalisation in the last 12 months?
- Do you have chronic lung disease such as chronic bronchitis or emphysema?

Limitations

The 2009 Adult Vaccination Survey was not designed to assess vaccination status among people with asthma requiring hospitalisation or COPD. In the survey, some participants were asked questions regarding their asthma and COPD status, but not others. The findings from this survey therefore cannot be used to estimate the proportion of people with asthma and COPD who are vaccinated against influenza or pneumococcal disease.

In addition, the 2009 Adult Vaccination Survey used the Computer Assisted Telephone Interview (CATI) method, and as a result, people without landlines were excluded from the study. This may limit the generalisability of the findings to some extent.

2010 Pandemic Vaccination Survey

About the survey

The 2010 Pandemic Vaccination Survey was a national telephone survey of 6,226 adults, conducted by the AIHW in January and February 2010. Adult respondents were also asked to report information on all household members, including children (17,102 people in total). The survey provides estimates of the uptake of pandemic influenza (H1N1 virus or 'swine flu') vaccination by Australians in 2009, along with the motivation for, and barriers to, vaccination (AIHW 2010).

Information about vaccinations and obstructive airway disease

The Pandemic Vaccination Survey contains information about pandemic influenza vaccination status using the following questions:

- Have you had the swine flu vaccine?
- Have (other people who usually live in your household) had the swine flu vaccine?

The adult pandemic influenza vaccination rate in this survey was 21% among respondents only, and 18% when the vaccination status of all household members was collected from the respondent. The survey also showed that nearly 45% of people aged 65 and over were vaccinated against pandemic influenza compared with only 16% of people aged 18–64.

The survey also included the following questions about asthma and COPD:

- Do you have asthma that required regular medical treatment or preventative medication in the last 12 months?
- Do you have chronic lung disease (chronic bronchitis, emphysema, cystic fibrosis, chronic pulmonary disease or bronchiectasis)?

While the survey collected information about asthma and COPD for some participants (see limitations below), the published report did not include data on pandemic influenza vaccination uptake among people with asthma or COPD.

Limitations

Limitations of this survey are similar to those of the Adult Vaccination Survey. The Pandemic Vaccination Survey was not designed to assess the proportion of specific target populations who had received the pandemic influenza vaccine. As with the Adult Vaccination Survey, not all participants were asked questions regarding their asthma or COPD status, making it not possible to obtain estimates of proportion of people with asthma or COPD vaccinated against influenza or pneumococcus.

The survey used the CATI method and people without landlines were excluded. In 2010, the response rate was 53%.

General surveys which include information about vaccinations

Australian Bureau of Statistics National Health Survey 2004–05 and Australian Bureau of Statistics National Aboriginal and Torres Strait Islander Health Survey 2004–05

The 2004–05 National Health Survey (NHS) and National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) provide information on influenza and pneumococcal vaccination status among people with asthma or COPD. The 2007–08 NHS did not collect information about vaccination status.

About the surveys

The NHS, conducted by the Australian Bureau of Statistics (ABS) periodically since 1977, is designed to collect information on the health status, use of health services and facilities, and health and lifestyle characteristics of Australians. It aims to obtain nationally-representative information on a range of health issues, provide information on health indicators for National Health Priority Areas and for important population subgroups and, where possible, enable trends to be monitored over time.

Households in all states and territories were sampled randomly using a stratified multi-stage area sample to ensure that all eligible members of the population within a given state and territory had an equal chance of selection. Residents from non-private dwellings such as hotels and motels, hostels and boarding houses were excluded. Also excluded were those who reside in hospitals, residential aged-care facilities, prisons, reformatories and single quarters of military establishment (ABS 2006a).

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

In 2004–05, the National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) (ABS 2006b) was conducted in parallel with the NHS. This was the most extensive survey to date of the health of Indigenous Australians conducted by the ABS. While the NHS and NATSIHS were separate surveys, they in part shared a common survey instrument, and were designed to produce a common core data set, to enable comparison of Indigenous and non-Indigenous key health indicators.

The 2004–05 NATSIHS collected data from 4,904 Aboriginal and Torres Strait Islander people in remote communities. The response rates for the NATSIHS non-remote and remote samples were 83.4% and 85.5%, respectively.

Information about vaccinations and obstructive airways disease

The 2004–05 NHS and NATSIHS contain information on influenza and pneumococcal vaccinations. The following questions were asked among people aged 50 and over in the NHS and among people aged 15 and over in the NATSIHS:

- Have you ever had a flu injection (or flu shot)? If 'yes', did you have this (injection/shot) in the last 12 months?
- Have you ever had pneumococcus (pneumonia) or pneumovax (vaccination/injection/shot)? If 'yes', did you have this injection in the last 5 years?

In addition to the above questions, the 2004–05 NHS and NATSIHS asked about asthma and COPD status:

- Have you ever been told you have asthma? If 'yes', do you still get asthma?
- Which of these do you have? ...Bronchitis? ...Emphysema?

Limitations

The survey questions relating to influenza and pneumococcal vaccination are only asked in relation to people aged over 50 in the NHS, not about younger adults and children.

State/territory computer assisted telephone interview (CATI) surveys

NSW Population Health Survey 2010

About the survey

The NSW Population Health Survey collects information on the health of the people of New South Wales to support the planning, implementation and evaluation of health services and programs in New South Wales.

Information about vaccinations and obstructive airways disease

The NSW Population Health Survey collects information about influenza and pneumococcal vaccinations among people aged over 50 using the questions:

- Were you vaccinated or immunised against flu in the past 12 months?
- When were you last vaccinated or immunised against pneumonia?

The survey estimated that, in 2010, nearly 73% of adults aged 65 and over had been immunised against influenza in the last 12 months while 55% had been immunised against pneumococcal infection in the last 5 years.

The survey also collected information about asthma status using the questions:

- Have you ever been told by a doctor or hospital you have asthma?
- Have you had symptoms of asthma or treatment for asthma in the last 12 months?

These data could be analysed to provide an estimate of the proportion of older adults with current asthma who had received influenza or pneumococcal vaccinations. There are currently no published data reporting this combined information.

Unfortunately, no information about COPD, emphysema or chronic bronchitis is collected in the NSW Population Health Survey.

Limitations

The survey questions related to influenza and pneumococcal vaccinations are only asked to people aged over 50. It is important to also identify vaccination status among younger adults and children.

The survey used the CATI method and people without landlines were excluded. In 2010, the response rate was 57.2%.

Health and Wellbeing of Adults in Western Australia 2010

About the survey

The WA Health and Wellbeing Surveillance System (HWSS) is a continuous data collection system which monitors the health and wellbeing of Western Australians. Each month, at least 550 people throughout WA are interviewed. Topics include chronic health conditions, lifestyle risk factors, protective factors and socio-demographics. Information from the survey is used to inform and support health policy development, to identify and monitor emerging trends and to inform and support health service planning and development.

Information about vaccinations and obstructive airways disease

The Health and Wellbeing of Adults in Western Australia Survey collects information about annual influenza and 5-yearly pneumonia vaccinations among people aged 65 and over using the following questions:

- Did you have any flu vaccination since the 1st of March [2009]?
- Have you had a pneumonia vaccination anytime within the past 5 years? Was this pneumonia vaccination within the past 12 months?

The 2010 survey found that in the 12 months prior to 1 March 2010, 52% of people aged 65 and over received the seasonal flu vaccine, 37% received the H1N1 vaccine and 32% received both the H1N1 and the seasonal flu vaccine.

Over this same period, pneumococcal vaccine uptake among people aged 65 and over was reported at 48%.

In addition, the survey collected information about asthma and COPD status using the questions:

- Has a doctor ever told you that you have asthma? Have you had symptoms of asthma or taken treatment for asthma in the last 12 months?
- Other than asthma, has a doctor ever told you that you had a respiratory problem such as chronic bronchitis, emphysema, or chronic lung disease that has lasted 6 months or more?

These data could be analysed to provide an estimate of the proportion of older adults with current asthma who had received an influenza vaccination in the last year and a pneumococcal vaccination in the last 1 or 5 years. There are currently no published data reporting this combined information.

Limitations

The survey questions relating to influenza and pneumococcal vaccinations are only administered to people aged 65 and over, not younger adults and children.

The survey used the CATI method and people without landlines were excluded. In 2010, the response rate was 74.9%.

Influenza and pneumococcal immunisation among adults with chronic disease living in Queensland (2008)

About the study

This study examined influenza and pneumococcal vaccination coverage and predictors of immunisation in 2,203 adults with asthma, diabetes or a cardiovascular condition (Dower et al. 2011). Data were taken from the 2008 Queensland CATI survey that was conducted among people with chronic disease in Queensland. The survey collected information on lifestyle and health risk factors, access to and satisfaction with health care, utilisation of health-care services and physical and psychological wellbeing among adults aged 18 and over.

Information about vaccinations and obstructive airways disease

This study provides information on influenza and pneumococcal vaccination status among people with asthma, obtained from the 2008 Queensland CATI survey. The following questions were asked to survey participants:

- Have you had the flu injection since the 1st of January this year? In how many of the last five years have you been vaccinated against influenza?
- Have you ever been vaccinated against pneumonia? Have you been vaccinated against pneumonia within the last five years?
- Ever been told by a doctor or nurse or at a hospital that you have asthma and have had symptoms of asthma or taken medication for asthma in the last 12 months?

This study can provide information on influenza and pneumococcal vaccination status among people with asthma (see Chapter 3 Section 3.6).

Limitations

The survey used the CATI method and people without landlines were excluded. The survey would have also included people with asthma of any severity. Therefore, it is not possible to determine the proportion of people with severe asthma who were vaccinated against influenza or pneumococcus. The response rate to this survey in 2008 was 22.7%.

Trends in influenza immunisation amongst an elderly Australian community (1993–2004)

About the study

This study compared the trend in influenza vaccine coverage among people aged 65 and over living in South Australia, 1993–2004 with national survey vaccination coverage (Gill et al. 2007). Data from the South Australian Health Omnibus Surveys and state CATI surveys were used to examine trends in vaccination.

Information about vaccinations and obstructive airways disease

This study determined the prevalence of vaccination by asking the following questions:

- Did you have a flu injection this year? or In the last 12 months have you had a flu injection?

Results showed an increasing prevalence of influenza vaccination between 1993 and 2000, followed by a plateau until 2004. In 2004, 82.4% of people aged 65 and over living in SA reported having received an influenza vaccination in the last year. In comparison, the national survey (2004 Influenza Vaccine Survey) reported that 79.1% of people in this age group had received influenza vaccination in 2004.

While this study did not investigate vaccination uptake among people with asthma or COPD, the data sources used (SA Health Omnibus Surveys and state CATI surveys) also include a question on asthma status:

- Ever told by a doctor they have asthma and do they still have asthma?

Therefore, the original data sources could be used to investigate influenza vaccination status among people with asthma.

Limitations

The publication reported data from state surveys related to influenza vaccine uptake. Data about influenza vaccinations among people with asthma or COPD were not examined, but would be available for asthma from the original data sources.

2.5 Published reports

Immunisation coverage annual report, 2009

About the report

The immunisation coverage annual reports are prepared by the National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases (NCIRS), and the most recent annual report was published in 2009. The *Immunisation coverage annual report 2009* (Hull et al. 2011b) based on analysis of the Australian Childhood Immunisation Register (ACIR) contains national data on childhood immunisation.

Information about vaccinations and obstructive airways disease

This report includes vaccination coverage at standard milestone ages, trends over time, coverage for vaccines not included in standard coverage assessments, timeliness of vaccination, coverage for Aboriginal and Torres Strait Islander children, data for small geographic areas on vaccination coverage, and the prevalence of conscientious objectors.

In 2009, approximately 91.8% of non-Indigenous children aged 12 months listed on the ACIR were vaccinated against pneumococcal disease (7-valent conjugate polysaccharide vaccine). Pneumococcal vaccination coverage was slightly lower for Aboriginal and Torres Strait Islander children aged 12 months (85%).

Limitations

Because the ACIR does not include disease data, it is not possible to describe the uptake of vaccinations among people with asthma or COPD using these data.

In addition, the *Immunisation coverage annual report* presents data on vaccines that were listed on the National Immunisation Program Schedule and therefore information about influenza vaccination (which is not listed on the Schedule) was not reported.

NSW annual immunisation coverage report, 2010

About the report

This report provides information on trends and issues in immunisation coverage among children, adolescents and the elderly in New South Wales. Its purpose is to facilitate monitoring of New South Wales immunisation programs (Hull et al. 2011a). Data presented in the report were obtained from the Australian Childhood Immunisation Register (ACIR), the NSW School Immunisation Program and the NSW Population Health Survey.

Information about vaccinations and obstructive airways disease

Pneumococcal and influenza vaccination data among children and the elderly are presented in this report, obtained from the ACIR and the NSW Population Health Survey.

In 2010, it was estimated that the percentage of children immunised against pneumococcal infection at 12 months of age was above 90% across local districts in New South Wales, except in the Mid North Coast (88.2%) and Northern New South Wales (86.0%). Across Australia the coverage was at 91.5% among this same age group. Coverage for pneumococcal vaccination increased from 87.4% in March 2006 to 91.6% in December 2010.

The proportion of people aged 65 and over who were vaccinated against influenza in the previous 12 months remained stable and above 70% between 2003 and 2010. Uptake of pneumococcal vaccination within the previous 5 years steadily increased over this period, although the prevalence remains lower than influenza coverage estimates. The highest coverage rate for pneumococcal vaccination in this older age group was observed in 2006, the year after its inclusion on the National Immunisation Program. In 2010, the coverage of pneumococcal vaccination among people aged 65 and over was below 60%.

Limitations

This report provides pneumococcal vaccination coverage estimates among children aged 12 months only. Children of other ages were not included in the vaccination coverage calculation. Furthermore, the report only provided coverage data for vaccines that are listed on the National Immunisation Program Schedule. Therefore, data for influenza vaccination are not reported.

Coverage for vaccines given to adolescents was collected using the NSW School Immunisation Program. However this did not include vaccines against influenza or pneumococcal infection.

Vaccine preventable disease and vaccination coverage in Aboriginal and Torres Strait Islander people, Australia, 2003 to 2006

About the report

This report includes vaccination coverage data among Aboriginal and Torres Strait Islander people from the ACIR, National Aboriginal and Torres Strait Islander Health Survey and the National Health Survey 2004–05 (Menzies et al. 2008).

Information about vaccinations and obstructive airways disease

The report estimated pneumococcal vaccination coverage among children 12 months of age for 2002 to 2005, using data from the ACIR. Over this period, the coverage of pneumococcal vaccination among Indigenous and non-Indigenous children increased. In 2005, 82.9% of

Indigenous children aged 12 months and 90.2% of non-Indigenous children of the same age were reported as being vaccinated against pneumococcal infection.

Influenza vaccinations among children were not reported as influenza data is not routinely recorded in the ACIR.

Among adults, data from the National Aboriginal and Torres Strait Islander Health Survey estimated that 23% of the Aboriginal and Torres Strait Islander people aged 18–49 reported having influenza vaccination in the last 12 months prior to the survey in 2004–05. This proportion increased to 29% among those of this age group who reported one or more chronic diseases, including asthma. Among the whole population aged 50–64, 52% reported having an influenza vaccination and 84% were among those aged 65 and over. In comparison, estimates from the National Health Survey show that 27% of non-Indigenous people aged 50–64 reported having been vaccinated against influenza and 73% amongst those aged 65 or more.

Pneumococcal vaccination coverage was markedly lower than that reported for influenza vaccinations. Among Aboriginal and Torres Strait Islander people aged 18–49, 12% were estimated as having had a pneumococcal vaccination in the last 5 years prior to the survey in 2004–05. Among Aboriginal and Torres Strait Islander people, 30% of those aged 50–64 and 48% of those aged 65 or more reported having pneumococcal vaccination in the last years prior to the survey in 2004–05.

Compared with the non-Indigenous population, pneumococcal vaccination coverage was significantly lower among those aged 50–64 (4%) but was similar among those aged 65 and over (43%). During the five year period prior to the survey, pneumococcal vaccination was funded for the Aboriginal and Torres Strait Islander people aged 50 and over but not for the non-Indigenous population. Only part of the period included funding for non-Indigenous people aged 65 and over.

Limitations

This report did not present data for vaccination coverage among Aboriginal and Torres Strait Islander people with asthma or COPD. However, the original sources of data used in the report (the National Health Survey and the Aboriginal and Torres Strait Islander Health Survey) do contain questions on asthma and COPD status.

Managing chronic obstructive pulmonary disease

About the study

This cross-sectional study investigated the management of COPD among 1,232 adults aged 45 to 70 living in Melbourne (Matheson et al. 2006). Study participants completed a respiratory questionnaire on history of COPD and asthma, medication use, health-care service utilisation, immunisation and management measures. Lung function tests were also performed on all participants. People were classified as either COPD-only, asthma-only or both asthma and COPD.

Information about vaccinations and obstructive airways disease

Participants in the study were asked about influenza and pneumococcal vaccinations using the following questions:

- Have you ever had an influenza vaccination? If 'Yes' Have you been vaccinated for influenza in the last 12 months?

- Have you ever had a pneumonia vaccination? If 'Yes' Have you been vaccinated for pneumonia in the last 5 years?

The study identified people as having asthma-only, COPD-only or both asthma and COPD using a combination of objective and self-report measures. COPD was defined using the Global Initiative on Obstructive Lung Disease (GOLD) criteria stage 2 or worse ($FEV_1/FVC < 0.70$ and $FEV_1 < 80\%$ predicted) (GOLD 2011). Asthma was defined as wheeze during the last 12 months together with bronchial hyper-responsiveness to methacholine or bronchodilator reversibility.

This study provides information on influenza and pneumococcal vaccination status among people with asthma, COPD or both.

Limitations

This study recruited participants from the electoral roll and was limited to people aged 45 to 70. While this age group is relevant for those with COPD, data on people less than 45 of age are also required to identify vaccination status among those with asthma.

2.6 Summary of information sources

The following table summarises the nature of information available from existing data sets about immunisation rates, and the nature of information about asthma or COPD.

Table 2.2: Summary of information contained within each data set

Data set	Asthma status	COPD status	Influenza vac. status	Pneumococcal vac. status	Data presented in Chapter 3
Registers					
Australian Childhood Immunisation Register (ACIR)	X	X	✓ (some) Influenza vaccines not routinely collected Only age 0–7	✓ Only age 0–7	Linked data from LSAC (on parent-reported asthma status) and ACIR (vaccination status) presented in this report (see Section 3.1)
Longitudinal Study of Australian Children (LSAC) (not a register but can be linked to a register such as ACIR)	✓	n.a. for children	X (when linked to ACIR, influenza vaccines not routinely collected)	X (only when LSAC is linked to the ACIR)	Linked data from LSAC (on parent-reported asthma status) and ACIR (vaccination status) presented in this report (see Section 3.1)
General Practice and other medical data sources					
Bettering the Evaluation and care of Health (BEACH) and Supplementary Analysis of Nominated Data (SAND)	✓ (Only if asthma managed on same day of vaccination)	✓ (Only if COPD is managed on same day of vaccination)	✓ All ages	✓ All ages	BEACH data and SAND data are analysed and presented in this report (see sections 3.4 –3.5). Rates are underestimates since asthma/COPD status is only recorded if managed on the same day as the vaccination was administered
Medicare Benefits Schedule data	X	X	X Not able to be singled out from general vaccination	X Not able to be singled out from general vaccination	No relevant data available
Pharmaceutical Benefits Schedule (PBS) data	X (But can identify people taking medications used for the treatment of asthma)	X (But can identify people taking medications used for the treatment of chronic lung disease)	X Not routinely collected if vaccine is given free of charge	X Not routinely collected if vaccine is given free of charge	No relevant data available

(continued)

Table 2.2: Summary of information contained within each data set (continued)

Data set	Asthma status	COPD status	Influenza vac. status	Pneumococcal vac. status	Data presented in Chapter 3
Data from vaccination-specific surveys					
Adult vaccination survey	X Self-report Data only captured if respondent did not have high blood pressure or heart disease/attack	X Self-report Data only captured if respondent did not have high blood pressure or heart disease/attack	✓	✓	No relevant data available
Pandemic Vaccination Survey 2010	✓ Self-report	X Self-report Data only captured if respondent did not have other chronic disease status	✓ (only for pandemic influenza)	✓ (only for pandemic influenza)	No relevant data available
Data from general surveys which include information about vaccinations					
National Health Survey (NHS)	✓ Self-report	✓ Self-report	✓ Only in 2004–05 Self-report Age 50 and over	✓ Only in 2004–05 Self-report Age 50 and over	Data on vaccination status versus asthma/COPD status analysed and presented in this report (see Section 3.2).
National Aboriginal and Torres Strait Islander Health Survey (NATSIHS)	✓ Self-report	✓ Self-report	✓ Only in 2004–05 Self-report Age 15 and over	✓ Only in 2004–05 Self-report Age 15 and over	Data on vaccination status versus asthma/COPD status analysed and presented in this report (see Section 3.3).
NSW Population Health Survey	✓	✓	✓	✓	Raw data not available for this report
Health and Wellbeing of Adults in WA	✓	✓	✓	✓	Raw data not available for this report
Qld CATI (Dower et al. 2011)	✓	X	✓	✓	Data on vaccination status among people with asthma presented in this report (see Section 3.6).
SA Omnibus and CATI surveys (Gill et al. 2007)	✓	✓	✓	✓	Raw data not available for this report

(continued)

Table 2.2: Summary of information contained within each data set (continued)

Data set	Asthma status	COPD status	Influenza vac. status	Pneumococcal vac. status	Data presented in Chapter 3
Published reports					
<i>Immunisation coverage annual report</i> (reports ACIR data)	X	X	X	✓	No relevant data available However, original data source (ACIR linked to LSAC) analysed and presented in Section 3.1.
<i>NSW annual immunisation coverage report 2010</i> (reports ACIR and NSW Population Health Survey data)	X	X	X	✓	No relevant data available However, original data source (ACIR linked to LSAC) analysed and presented in Section 3.1.
<i>Vaccine preventable disease and vaccination coverage in ATSI people, 2003–06</i>	X	X	✓	✓	No relevant data available However, original data sources (ACIR linked to LSAC, NHS, NATSIHS) analysed and presented in Sections 3.1–3.3.
Matheson et al. 2006	✓	✓	✓	✓	Data on vaccination status versus asthma/COPD status analysed and presented in this report (see Section 3.7).
✓ information contained in data set X information not contained in data set					

3 Vaccination status in people with obstructive airways disease

This chapter reviews the data sets identified in Chapter 2 which allow for the comparison between the vaccination rates in those with and without asthma or COPD. The findings are summarised in tables 3.10 and 3.11 in Section 3.8.

3.1 Longitudinal Study of Australian Children linked with Australian Childhood Immunisation Register

Data from the Longitudinal Study of Australian Children (LSAC) linked to the Australian Childhood Immunisation Register (ACIR) were used to:

- identify the proportion of children that had received influenza and/or pneumococcal vaccination
- compare the rate of pneumococcal vaccination among children with and without parent-reported asthma.

Data from LSAC were for the period 2004 (Wave 1) to 2010 (Wave 4).

In this analysis, 'asthma' was defined as positive responses to both 'Ever told by a doctor they have asthma' AND 'In the last 12 months, has child had an illness with wheezing in the chest which lasted for a week or more or taken any medication for asthma?' at any one of three interviews over the four year observation period. Children in the infant cohort whose parents reported the presence of wheeze at the first interview (0 to 1 year) were also included among those with asthma, because there was no question about asthma diagnosis at this interview.

Children were considered to have had pneumococcal vaccination if the ACIR recorded that they had ever received a pneumococcal vaccination (including before the Wave 1 (baseline interview)). The vaccinations included in the analysis were Prevenar, Prevenar 13, Pneumovax 23 and generic pneumococcal vaccine. There were no records for the vaccine Synflorix in the ACIR for the LSAC cohorts.

The pneumococcal vaccination program was introduced in 2001 for Aboriginal and Torres Strait Islander people and non-Indigenous children with high-risk conditions. In January 2005, the universal pneumococcal vaccination program was funded for all Australian infants and children (Brotherton et al. 2007). For this reason, data are presented separately for the infant and kindergarten cohorts.

Influenza vaccination

As described in the previous chapter, details on influenza vaccination are under-reported in the ACIR as the influenza vaccine is not included on the National Immunisation Program Schedule and there is no requirement for it to be recorded in the ACIR. Therefore, linked LSAC and ACIR data are not used to explore influenza vaccinations in this report.

Pneumococcal vaccination

In the infant cohort, 70.6% (n = 3,322) of children had ever had a pneumococcal vaccination between 2004 and 2010. There was no significant difference in pneumococcal vaccine coverage between those with (69.4%) and without asthma (72.0%, $p = 0.2$). Only 1.8% of children in the kindergarten cohort ever had a pneumococcal vaccination between 2004 and 2010. There was no statistical difference in the rate of pneumococcal vaccination between children with and without asthma.

Although the National Immunisation Program Schedule now recommends pneumococcal vaccination in infancy for all children, this was not introduced until January 2005, at which time members of the Infant cohort in LSAC were already aged 1–2 years and members of the Kindergarten cohort were aged 5–6. Hence, it is anticipated that vaccination uptake will increase in future years.

3.2 National Health Survey 2004–05

Data from the 2004–05 National Health Survey (NHS) were used to identify the proportion of people aged 50 and over, with and without self-reported asthma or COPD, who reported having received an influenza vaccination in the last 12 months or a pneumococcal vaccination in the last 5 years.

For the analysis, self-reported current asthma was defined as the interviewer responses '[respondent was] ever told [he/she] has condition and still current and long term' combined with '[respondent was] ever told [he/she] has condition and still current but not long term'. Influenza vaccination status was investigated by describing those who reported having an influenza vaccination in the last 12 months and those who did not report having an influenza vaccination in the last 12 months (defined as 'never had influenza vaccination' or 'had influenza vaccination but not in last 12 months' or 'had influenza vaccination but not known if in last 12 months').

Pneumococcal vaccination status was investigated by identifying those who 'had a pneumococcus vaccination in the last 5 years' and those who had not had a pneumococcal vaccination in the last 5 years (defined as 'never had pneumococcus vaccination' or 'had pneumococcus vaccination but not the last 5 years' or 'had pneumococcus vaccination but not known if in the last 5 years').

Influenza vaccination

In the 2004–05 NHS, 47.4% of people aged 50 and over were vaccinated against influenza in the previous 12 months. Males were less likely to have received influenza vaccination in the previous 12 months compared to females (odds ratio (OR) 0.80 [95% confidence interval (CI) 0.73–0.89]).

Influenza vaccination among adults with asthma

A higher proportion of adults aged 50 and over with current asthma were vaccinated against influenza in the previous 12 months (60.8%) than people without current asthma (46.0%) ($p < 0.0001$) (Table 3.1; Figure 3.1). This pattern was observed among:

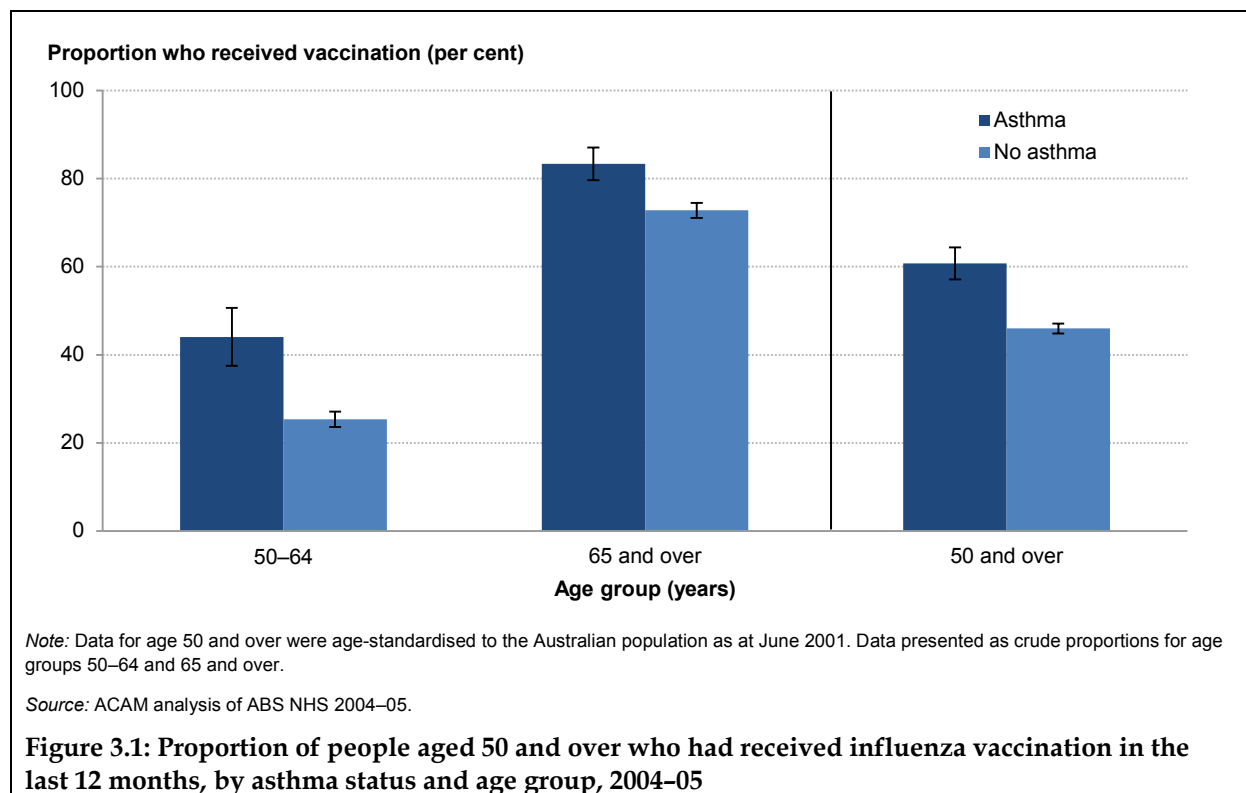
- people aged 50–64 (who would not receive the vaccine free of charge unless they had severe asthma; 44.1% [95% CI: 37.5–50.7] versus 25.3% [95% CI: 23.6–27.1])

- people aged 65 and over (who would all receive the vaccine free of charge; 83.4% [95% CI: 79.6–87.1] versus 72.8% [95% CI: 71.1–74.5]) (Figure 3.1).

Table 3.1: Influenza vaccination status among people with and without current asthma, people aged 50 and over

Vaccination status	Current asthma (95% CI)	No current asthma (95% CI)
Never had influenza vaccination	23.3% (19.6–27.0)	39.4% (38.3–40.6)
Had influenza vaccination but not in last 12 months	15.8% (12.7–18.8)	14.1% (13.1–15.1)
Had influenza vaccination in last 12 months	60.8% (57.1–64.4)	46.0% (44.8–47.1)
Had influenza vaccination but not known if in last 12 months	0.1% (0–0.3)	0.1% (0–0.2)
Not known if ever had influenza vaccination	0% (0–0)	0.4% (0.2–0.6)

Note: Age-standardised to the Australian Population as at June 2001.



Influenza vaccination among people with COPD

A higher proportion of people with self-reported COPD were vaccinated against influenza (60.3%) than people without self-reported COPD (46.6%) ($p < 0.0001$) (Table 3.2; Figure 3.2).

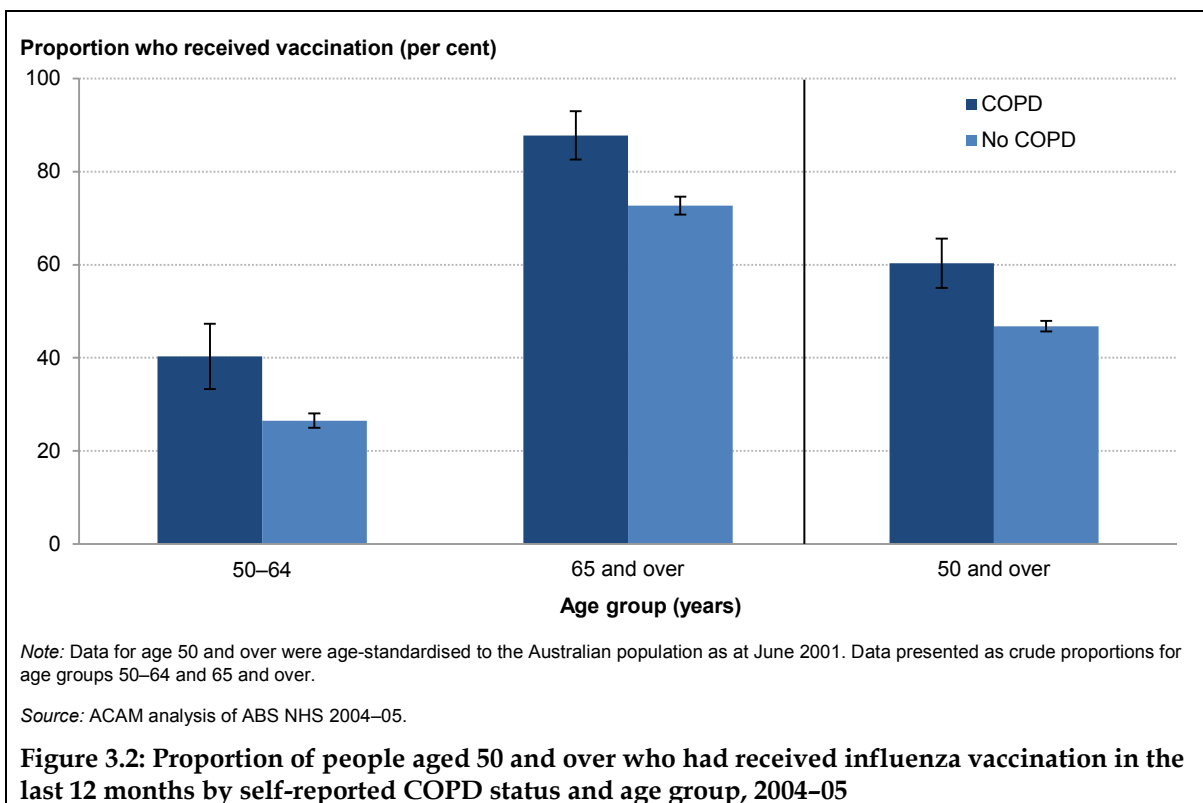
This pattern was observed among:

- people aged 50–64 (who would not receive the vaccine free of charge unless they had COPD; 40.3% [95% CI: 33.3–47.3] versus 26.5% [95% CI: 24.9–28.0]) (Figure 3.2)
- people aged 65 and over (who would receive the vaccine free of charge regardless of their COPD status; 87.8% [95% CI: 82.6–93.0] versus 72.7% [95% CI: 70.8–74.7]) (Figure 3.2).

Table 3.2: Influenza vaccination status among people with and without self-reported COPD, people aged 50 and over

Vaccination status	COPD (95% CI)	No COPD (95% CI)
Never had influenza vaccination	24.8% (19.3–30.3)	38.6% (37.4–39.8)
Had influenza vaccination but not in last 12 months	14.9% (11.2–18.6)	14.3% (13.4–15.3)
Had influenza vaccination in last 12 months	60.3% (55.0–65.6)	46.6% (45.5–47.7)
Had influenza vaccination but not known if in last 12 months	0% (0–0)	0.1% (0–0.2)
Not known if ever had influenza vaccination	0% (0–0)	0.3% (0.1–0.5)

Note: Age-standardised to the Australian Population as at June 2001.



Pneumococcal vaccination

In the 2004–05 NHS, 21.4% of people aged 50 and over reported having been vaccinated against *Pneumococcus* in the previous 5 years. Males were less likely than females to have been vaccinated against pneumococcus (OR 0.80 [95% CI 0.7–0.9]).

Pneumococcal vaccination among people with asthma

A higher proportion of people with current asthma were vaccinated against pneumococcus (35.6%) than people without current asthma (19.9%) ($p<0.0001$) (Table 3.3; Figure 3.3).

This pattern was observed among:

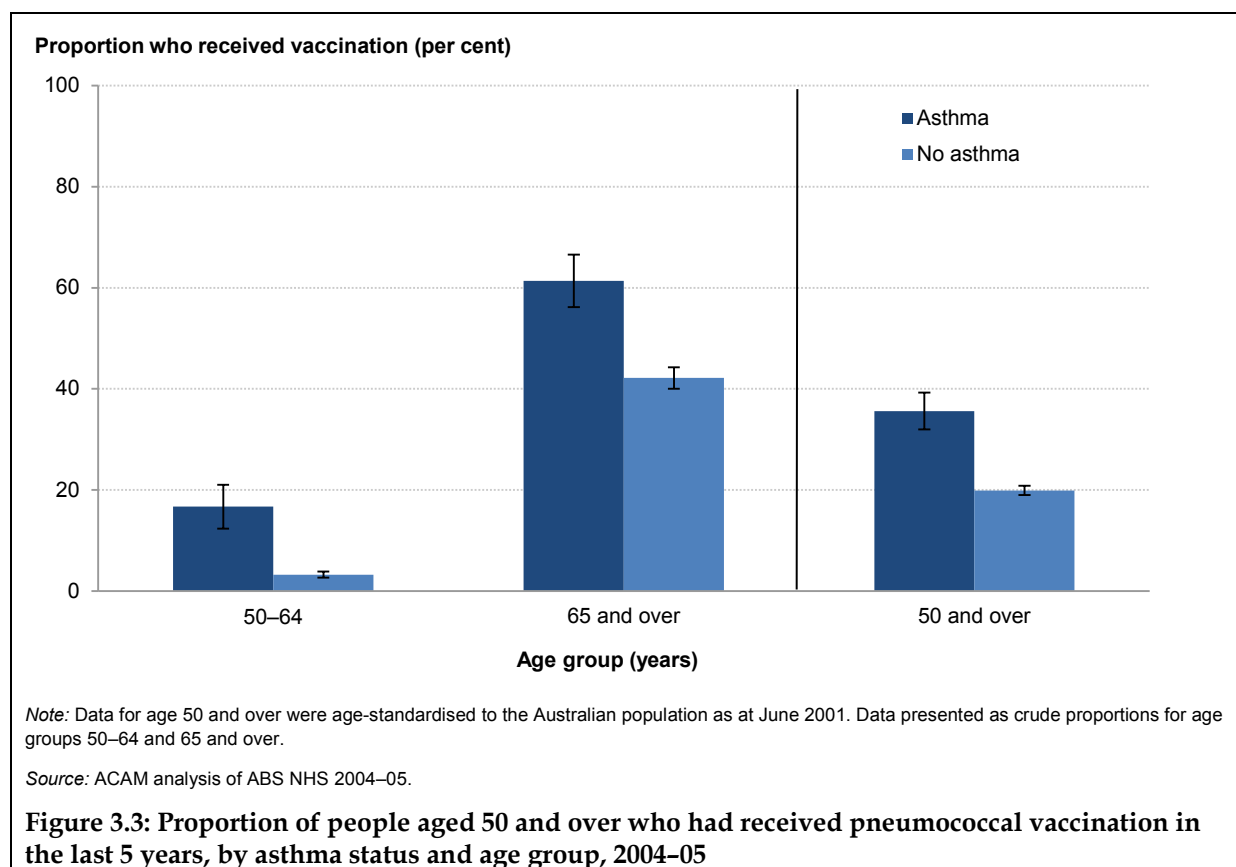
- people aged 50–64 (who would not receive the vaccine free of charge unless they had severe asthma or were smokers; 16.7% [CI: 12.3–21.0] versus 3.2% [CI: 2.6–3.9])
- people aged 65 and over (who would receive the vaccine free of charge; 61.4% [CI: 56.2–66.6] versus 42.2% [CI: 40.0–44.3]) (Figure 3.3).

Among people with asthma, those aged 50–64 were less likely to receive the vaccination than people aged 65 and over ($p<0.0001$).

Table 3.3: Pneumococcal vaccination status among people with and without current asthma, people aged 50 and over

Vaccination status	Current asthma (95% CI)	No current asthma (95% CI)
Never had pneumococcal vaccination	61.5% (57.9–65.0)	77.4% (76.4–78.3)
Had pneumococcal vaccination but not in last 5 years	1.0% (0.3–1.7)	1.0% (0.6–1.3)
Had pneumococcal vaccination in last 5 years	35.6% (32.0–39.2)	19.9% (19.0–20.9)
Had pneumococcal vaccination but not known if it was in last 5 years	0.3% (0.3–0.8)	0.1% (0–0.1)
Not known if ever had pneumococcal vaccination	1.6% (0.5–2.6)	1.7% (1.3–2.1)

Note: Age-standardised to the Australian Population as at June 2001.



Pneumococcal vaccination among people with COPD

A higher proportion of people with self-reported COPD were vaccinated against pneumococcus in the previous 5 years (36.9%) than people without self-reported COPD (20.5%) ($p < 0.0001$) (Table 3.4; Figure 3.4).

This pattern was observed among:

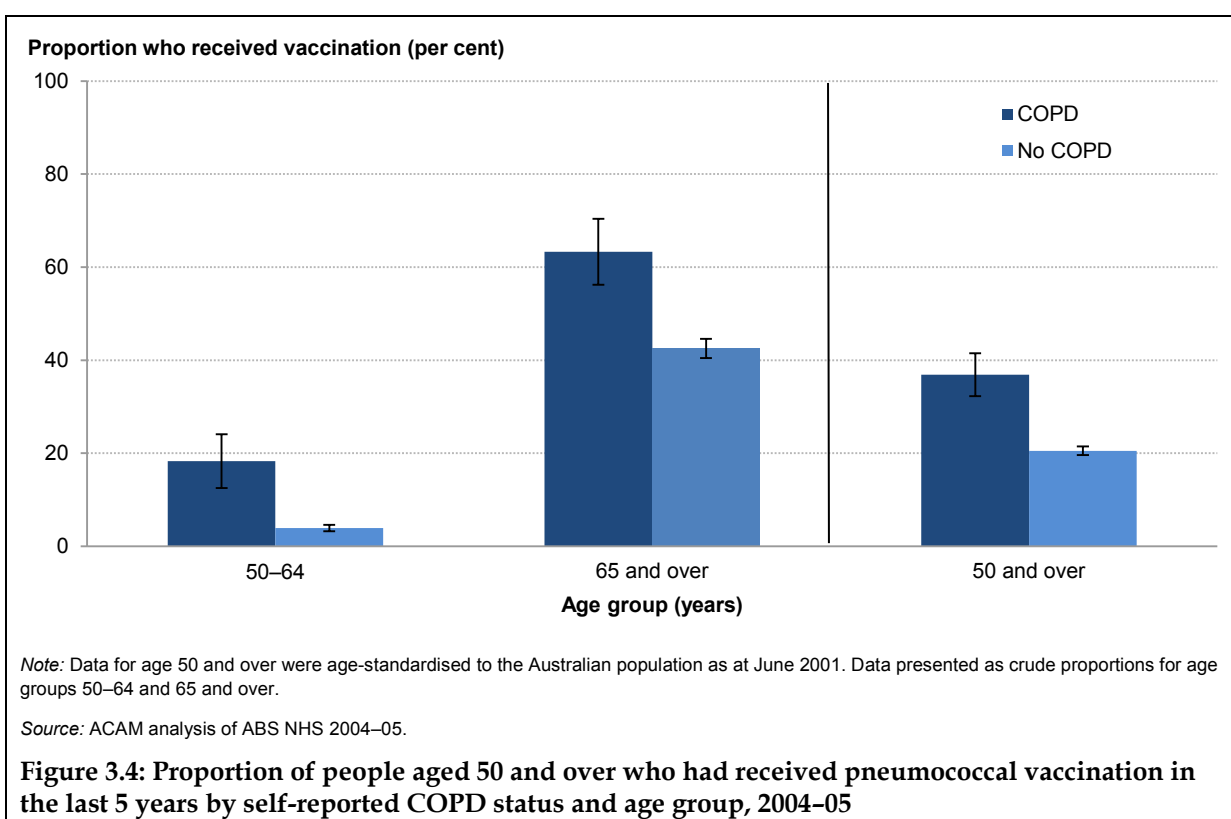
- people aged 50-64 (who would not receive the vaccine free of charge unless they had COPD or were smokers; 18.3% [CI: 12.5-24.1] versus 3.9% [CI: 3.2-4.6])
- people aged 65 and over (who would receive the vaccine free of charge; 63.3% [CI: 56.2-70.4] versus 42.5% [CI: 40.4-44.5]) (Figure 3.4).

Among people with COPD, those aged 50-64 were less likely to receive the vaccination than people aged 65 and over ($p < 0.0001$).

Table 3.4: Pneumococcal vaccination status among people with and without self-reported COPD, people aged 50 and over

Vaccination status	COPD (95% CI)	No COPD (95% CI)
Never had pneumococcal vaccination	58.7% (54.5–63.0)	77.0% (76.0–77.9)
Had pneumococcal vaccination but not in last 5 years	2.2% (0.4–3.9)	0.9% (0.6–1.2)
Had pneumococcal vaccination in last 5 years	36.9% (32.3–41.5)	20.5% (19.6–21.4)
Had pneumococcal vaccination but not known if in last 5 years	0.5% (0–1.2)	0.04% (0–0.1)
Not known if ever had pneumococcal vaccination	1.7% (0.5–2.8)	1.6% (1.2–2.0)

Note: Age-standardised to the Australian Population as at June 2001.



3.3 National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) 2004–05

Data from the NATSIHS were used to identify the proportion of Aboriginal and Torres Strait Islander people aged 15 and over with self-reported asthma, and the proportion of Aboriginal and Torres Strait Islander people aged 50 and over with self-reported COPD, who had received an influenza vaccination in the last 12 months or a pneumococcal vaccination in the last 5 years. Comparisons between Indigenous and non-Indigenous Australians are presented for people aged 50 and over with or without COPD.

Influenza vaccination

Among people with asthma

Among Aboriginal and Torres Strait Islander people aged 15 and over, the proportion of those who had received vaccination against influenza in the last 12 months was higher among people with current asthma (33.5%) compared to those without current asthma (26.6%) ($p < 0.0001$) (Table 3.5).

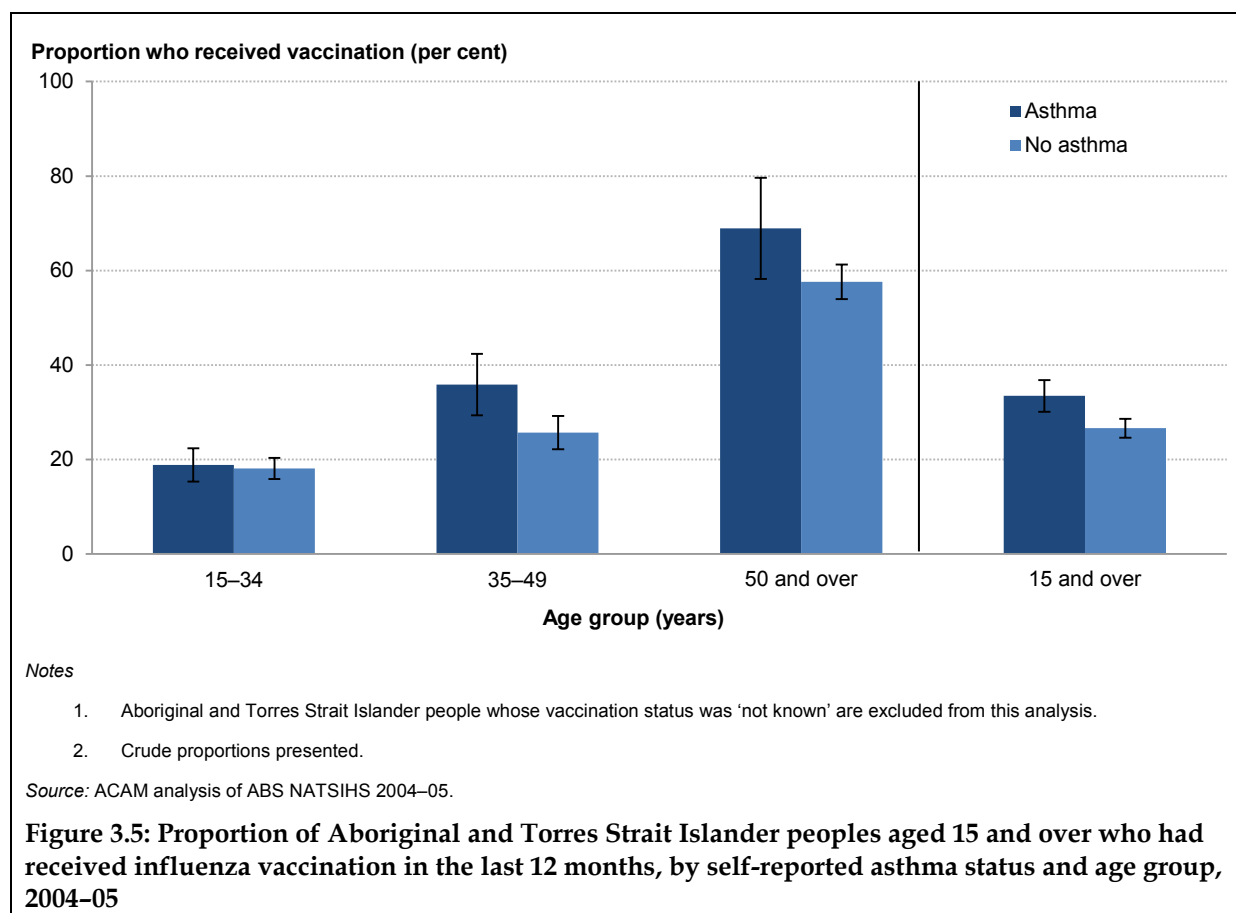
Table 3.5: Influenza vaccination status among Aboriginal and Torres Strait Islander people with and without current asthma, people aged 15 and over, 2004–05

Vaccination status	Current asthma (95% CI)	No current asthma (95% CI)
Never had influenza vaccination	49.7% (44.2–55.1)	55.4% (53.2–57.5)
Had influenza vaccination but not in last 12 months	14.8% (11.8–17.8)	15.8% (14.1–17.4)
Had influenza vaccination in last 12 months	33.5% (30.1–36.8)	26.6% (24.6–28.6)
Had influenza vaccination but not known if in last 12 months	0.2% (0–0.5)	0.3% (0–0.4)
Not known if ever had influenza vaccination	1.9% (0.7–3.0)	2.0% (1.2–2.7)

Note: Crude data presented.

The proportion of Aboriginal and Torres Strait Islander people who were vaccinated against influenza increased with age among people with and without asthma (Figure 3.5). Among those aged 35 and over, the proportion of people vaccinated against influenza was higher among Aboriginal and Torres Strait Islander people with asthma than those without current asthma. There was no difference in the proportion of Aboriginal and Torres Strait Islander people aged 15 to 34 with and without asthma who were vaccinated against influenza (Figure 3.5).

Comparison of influenza vaccination by Indigenous status was not possible for people aged 15–49 with and without asthma. The National Health Survey 2004–05 only asked questions on vaccination for people aged 50 and over, so no data are available for non-Indigenous Australians aged 15–49.



Among people with COPD

In 2004-05, the proportion of people aged 50 and over vaccinated against influenza in the previous 12 months was similar among Indigenous Australians with COPD (62.5%) and non-Indigenous Australians with COPD (60.3%) (Table 3.6).

Among Aboriginal and Torres Strait Islander people, the proportion of people vaccinated against influenza in the last 12 months was similar among people with self-reported COPD (62.5%) and those without COPD (65.7%) (Table 3.6). Among non-Indigenous Australians, the proportion vaccinated against influenza in the last 12 months was higher among those with COPD (60.3%) compared with those without the condition (46.5%) ($p < 0.0001$).

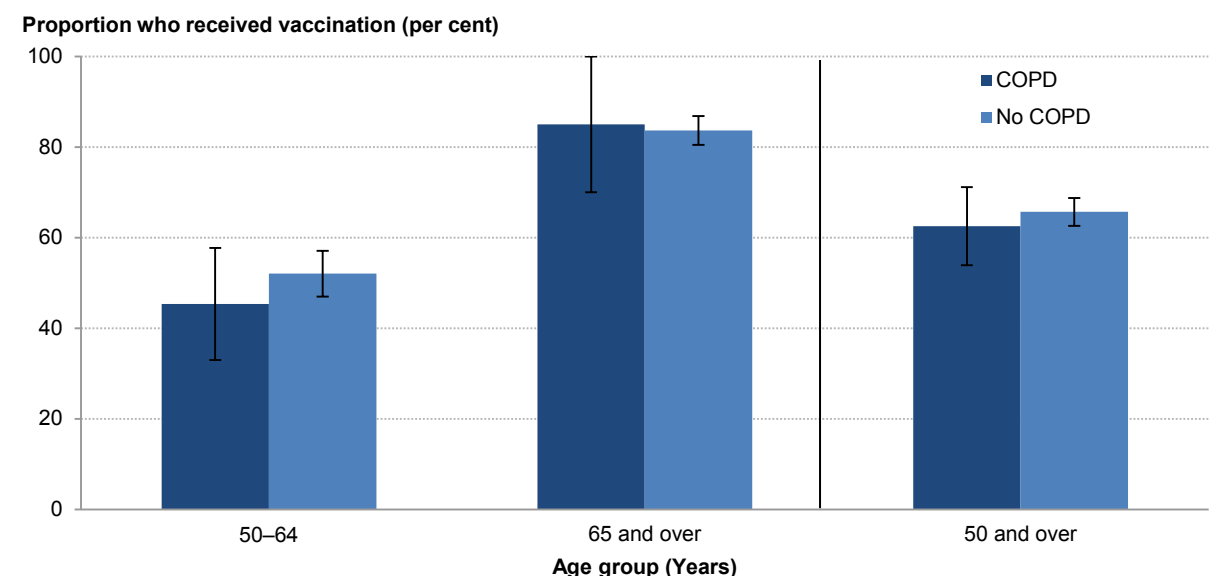
Table 3.6: Influenza vaccination status among people with and without self-reported COPD, by Indigenous status, people aged 50 and over, 2004–05

Vaccination status	Indigenous		Non-Indigenous	
	COPD (95% CIs)	No COPD (95% CIs)	COPD (95% CIs)	No COPD (95% CIs)
Never had influenza vaccination	23.7% (11.3–36.1)	20.2% (16.5–23.9)	24.8% (19.2–30.3)	38.8% (37.6–40.0)
Had influenza vaccination but not in last 12 months	11.4% (4.8–18.1)	13.6% (10.1–17.1)	14.9% (11.2–18.6)	14.3% (13.3–15.2)
Had influenza vaccination in last 12 months	62.5% (53.9–71.2)	65.7% (62.6–68.8)	60.3% (54.8–65.9)	46.5% (45.3–47.7)
Had influenza vaccination but not known if in last 12 months	0% (0–0)	0.1% (0–0.3)	0% (0–0)	0.1% (0–0.2)
Not known if ever had influenza vaccination	0.6% (0–1.8)	0.4% (0–0.9)	0% (0–0)	0.3% (0.1–0.6)

Notes

1. age-standardised to the Australian Population as at June 2001.
2. CIs = Confidence intervals.

The proportion of Aboriginal and Torres Strait Islander people vaccinated against influenza increased with age, but there was no difference in the proportion of people vaccinated amongst those with COPD compared to those without COPD at age 50–64, 65 and over or those aged 50 and over (Figure 3.6).



Notes

1. Aboriginal and Torres Strait Islander people whose vaccination status was 'not known' are excluded from this analysis.
2. Data for 50 and over are age-standardised to the Australian population as at June 2001. Data for age groups (50–64 and 65 and over) are crude proportions.

Source: ACAM analysis of ABS NATSIHS 2004–05.

Figure 3.6: Proportion of Aboriginal and Torres Strait Islander people aged 50 and over who had received influenza vaccination in the last 12 months by self-reported COPD status and age group, 2004–05

Pneumococcal vaccination

The majority of Aboriginal and Torres Strait Islander people aged 15 and over had never had a pneumococcal vaccination at the time of the NATSIHS in 2004–05 (Table 3.7).

Among people with asthma

Among Aboriginal and Torres Strait Islander people aged 15 and over, the proportion of people vaccinated against pneumococcus in the previous 5 years was higher among people with current asthma (20.9%) compared to those without current asthma (13.9%) ($p < 0.0001$) (Table 3.7).

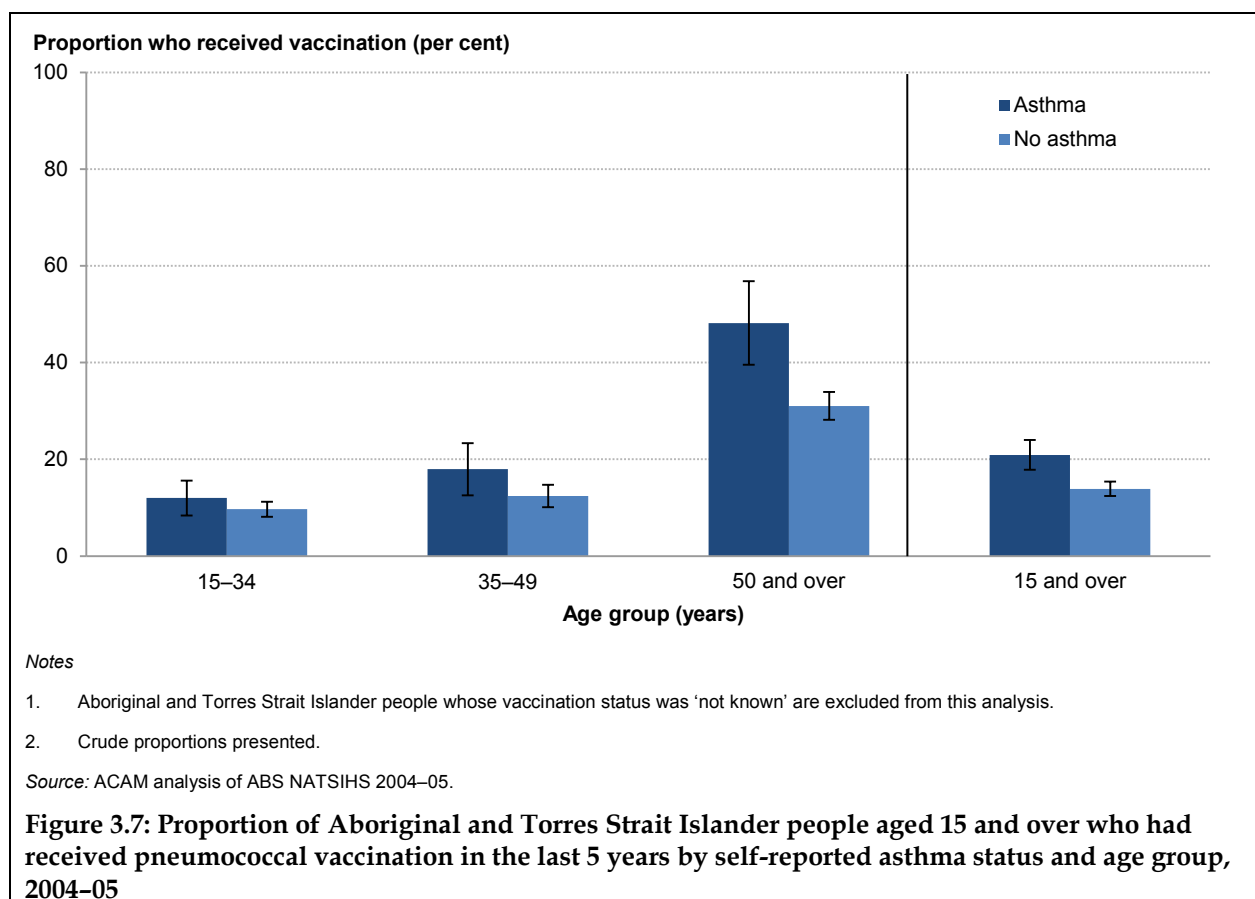
Table 3.7: Pneumococcal vaccination status among Aboriginal and Torres Strait Islander people with and without current asthma, people aged 15 and over, 2004–05

Vaccination status	Current asthma (95% CIs)	No current asthma (95% CIs)
Never had pneumococcal vaccination	73.9% (68.9–79.0)	79.8% (78.2–81.3)
Had pneumococcal vaccination but not in last 5 years	1.2% (0.4–2.0)	1.6% (0.7–2.6)
Had pneumococcal vaccination in last 5 years	20.9% (17.8–24.0)	13.9% (12.4–15.4)
Had pneumococcal vaccination but not known if in last 5 years	0.3% (0–0.7)	0.1% (0–0.2)
Not known if ever had pneumococcal vaccination	3.6% (2.2–5.0)	4.6% (3.8–5.5)

Notes

1. Crude data presented.
2. CIs = Confidence intervals.

The proportion of people vaccinated against pneumococcus increased with age among Aboriginal and Torres Strait Islander people aged 15 and over with and without asthma (Figure 3.7). Among those aged 35 and over, the proportion of Aboriginal and Torres Strait Islander people vaccinated against pneumococcus was higher among those with asthma than among those without asthma.



Among people with COPD

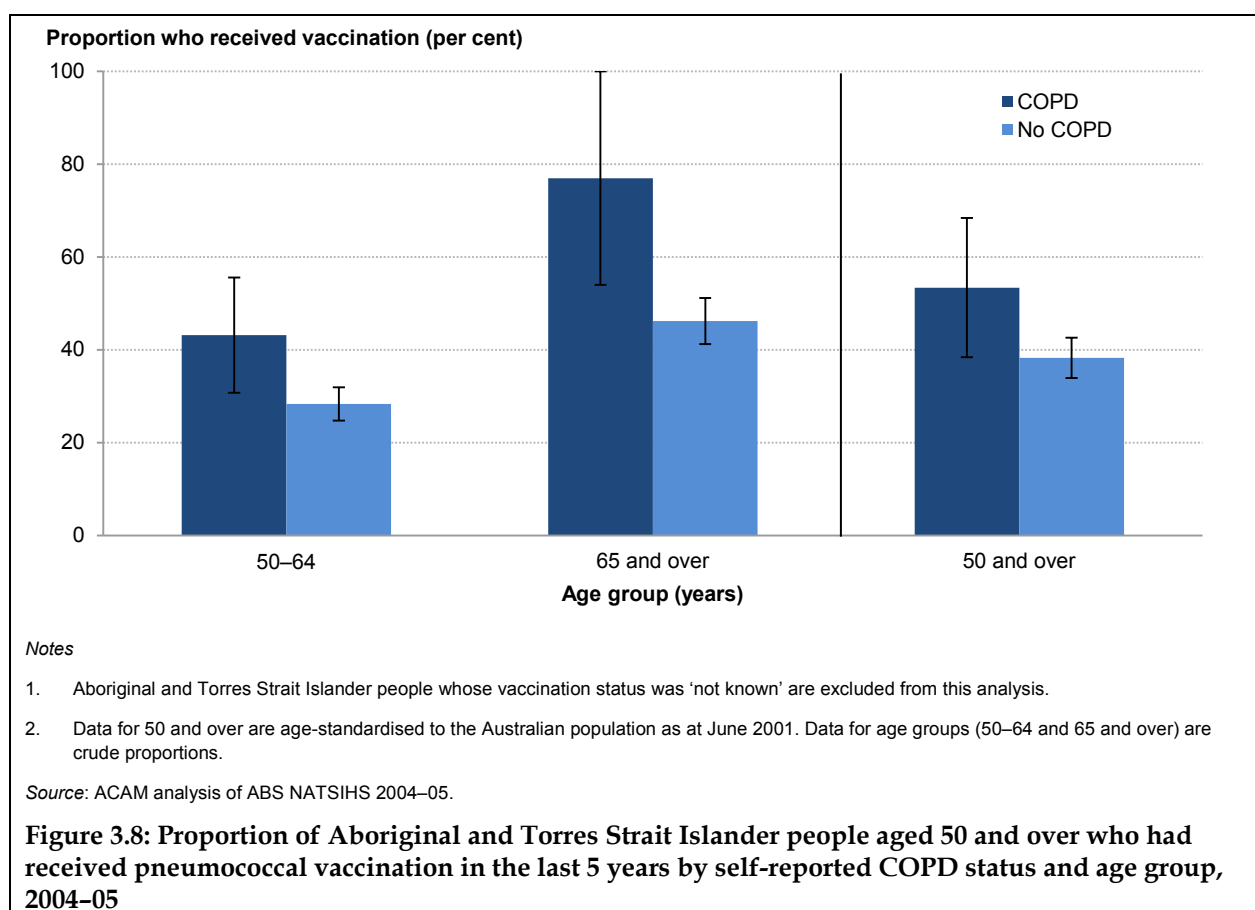
In 2004-05, 54.4% of Indigenous Australians with self-reported COPD were vaccinated against pneumococcus in the last 5 years, while 36.4% of non-Indigenous Australians with self-reported COPD were vaccinated against pneumococcus in the same time period. This difference, however, was not statistically significant ($p = 0.2$) (Table 3.8).

Among Aboriginal and Torres Strait Islander people, however, the proportion of those vaccinated against pneumococcus in the last 5 years was higher among people with COPD (53.4%) compared to those without COPD (38.3%) and this difference is significant ($p = 0.002$) (Table 3.8). The proportion of people vaccinated against pneumococcus increased with age among Aboriginal and Torres Strait Islander people aged 50 and over with and without COPD.

Table 3.8: Pneumococcal vaccination status among people with and without self-reported COPD, by Indigenous status, people aged 50 and over, 2004–05

Vaccination status	Indigenous		Non-Indigenous	
	COPD (95% CI)	No COPD (95% CI)	COPD (95% CI)	No COPD (95% CI)
Never had pneumococcal vaccination	41.8% (22.6–61.0)	54.9% (49.4–60.3)	59.3% (55.0–63.5)	77.1% (76.0–78.1)
Had pneumococcal vaccination but not in last 5 years	0.8% (0.3–2.0)	0.4% (0–0.8)	2.2% (0.4–4.0)	0.9% (0.6–1.2)
Had pneumococcal vaccination in last 5 years	53.4% (38.4–68.4)	38.3% (33.9–42.6)	36.4% (31.6–41.1)	20.5% (19.5–21.4)
Had pneumococcal vaccination but not known if in last 5 years	0% (0–0)	0.1% (0–0.3)	0.6% (0.3–1.6)	0.04% (0–0.1)
Not known if ever had pneumococcal vaccination	4.0% (1.8–9.7)	6.4% (4.3–8.4)	1.7% (0.4–3.1)	1.6% (1.2–2.0)

Note: Age-standardised to the Australian Population as at June 2001



3.4 Bettering the Evaluation and Care of Health (BEACH) Survey of General Practice

Data from the Bettering the Evaluation and Care of Health (BEACH) Survey of General Practice were used to identify occasions where influenza or pneumococcal vaccination was recorded at patient encounters. Occasions where asthma or COPD were related to the encounter were also investigated.

For the analysis, 'asthma-related encounters' were defined as those at which at least one of the reasons for encounter or problems managed was coded to asthma (R96001, R96002, R96003, R6005, R96007, or R96008) and 'COPD-related encounters' were defined as those at which at least one of the reasons for encounter or problems managed was coded as COPD (R79001, R79003, R95001, R95002, R95004, R95006, R95008, R95009). Influenza and pneumococcal vaccination associated with these encounters were identified using the prescription codes J314 (influenza vaccination) and J325 (pneumococcal vaccination).

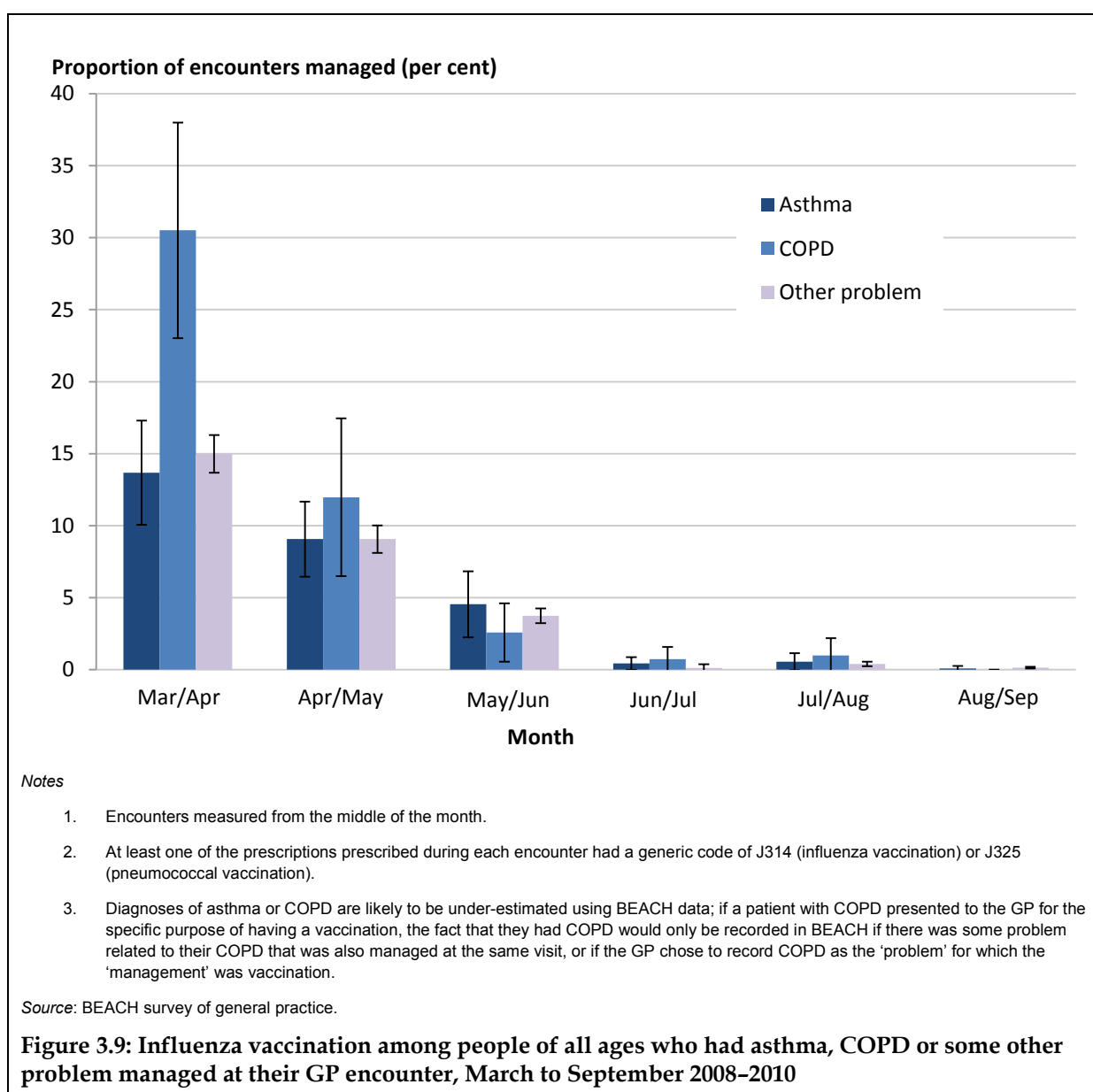
In 2010–11, vaccines accounted for 6 out of 10 supplied medications prescribed by GPs; the influenza and pneumococcal vaccines were the vaccines most frequently prescribed (Britt et al. 2011).

Influenza vaccination

Annual influenza vaccination becomes available around 15 March each year. Between 2008 and 2010, vaccinations against influenza peaked in March–April and then declined through the autumn and winter months (Figure 3.9). By August–September, very few people received influenza vaccinations. During the period mid-March to mid-September for 2008–2010, 5.2% (95% CI: 4.8–5.6) of all GP encounters included influenza vaccinations.

In each year, after mid-March, people visiting their GP for management of COPD were more likely to receive influenza vaccination than those who visited their GP for management of other problems, including asthma. For COPD related encounters, influenza vaccination was provided at 32.1% (95%CI 25.4–38.8) of these encounters in March–April, compared to 15.8% (95%CI 12.4–19.2) of asthma related encounters and 14.8% (95%CI 13.6–16.0) for all other encounters. During the remaining months, there was no difference in the proportion of people receiving influenza vaccinations according to the type of encounter.

However, among all people who received the influenza vaccine between March and September 2008–2010, only 3.7% had asthma or COPD recorded as a reason for encounter or problem managed at the time of the vaccination. This is much lower than the prevalence of asthma or COPD (9.8% for asthma, 5.3% for COPD in the community (AIHW (Australian Centre for Asthma Monitoring), 2011) implying that for many people who have asthma or COPD, these conditions are not recorded in the BEACH survey as being problems managed at the time of the influenza vaccination. For example, if a patient with COPD presented to the GP for the specific purpose of having a vaccination, the fact that they had COPD would only be recorded in BEACH if there was some problem related to their COPD that was also managed at the same visit, or if the GP chose to record COPD as the 'problem' for which the 'management' was vaccination.



Pneumococcal vaccination

According to BEACH data from April 2008–March 2010, only 0.8% (95% CI: 0.76–0.84) of all GP encounters included pneumococcal vaccinations. Of these, only 1.1% (95% CI: 0.7–1.6) had asthma or COPD recorded as a problem managed at the time of the vaccination.

3.5 Supplementary Analysis of Nominated Data (SAND)

The SAND data are collected as a supplementary data set of the BEACH program (AIHW: Britt et al. 2001). Organisations sponsoring blocks of SAND data collection ask questions on topics of their choice and have access to the detailed reports. GPs participating in SAND ask and record responses to specific questions in targeted patient groups.

SAND data report vaccine coverage for influenza at 45.8 % and pneumococcal vaccine coverage ranged from 31.5% to 43.6% (Table 3.9).

Table 3.9: SAND abstract data that include influenza and pneumococcal vaccination coverage

	SAND abstract 162 (FMRC 2011a)	SAND abstract 179 (FMRC 2011b)	SAND abstract 181 (FMRC 2012c)
Data collection period	4/5/10–7/6/10	22/2/11–28/3/11	29/3/11–2/5/11
Sample	98 GPs n = 2,920 Patients of all ages	102 GPs n = 1,618 Patients aged 50+	99 GPs n = 2,437 Patients aged 18+
Influenza vaccination			
Vaccination in past 12 months	n.a.	n.a.	Total respondents n = 2,363 45.8% were vaccinated 47.6% were not 6.6% status was unknown
Other information contained in the SAND module	n.a.	n.a.	(n=2,340) 54.2% had discussed influenza vaccination in past 12 months (n=1,266) Of the patients with at least one Influenza risk factor 79.7% had discussed influenza vaccination in past 12 months
Pneumococcal vaccination			
Vaccination in past 5 years	Yes 31.5% Total n = 2,918	Yes 43.6% Total n = 1,565	Total respondents n = 2,193 31.3% were vaccinated 59.4% were not 9.3% status was unknown
Other information contained in the SAND module	Vaccination coverage (n = 918) Age-specific rates Aged <15 57.1% Aged <1 61.8% Aged 1–4 83.3% Aged 65+ 70.2% Aged 75+ 74.6% Aged 65–74 65.3%	Main reason(s) for vaccination being given (n = 624)* Being aged 65+ 84.1% Presence of conditions 17.2% (n = 107) Type 2 diabetes 32.7% COPD 19.6% Asthma 14.0% Non-specified 7.5% Smoker 5.1% Aboriginal/Torres Strait Islander 50+ 1.8%	(n=2,265) 35.2% of patients had discussed pneumococcal vaccination in the past 5 years. (n=1,149) Of those patients with at least one pneumococcal risk factor, 64.8% had discussed pneumococcal vaccination in past 5 years. Most common risk factors Being aged 65+ 33.2% Chronic heart disease 8.9% Diabetes 8.5% Chronic lung disease 8.3%

Note: * Indicates multiple responses were allowed.

Sources: Sand abstracts 162 (FMRC 2011a), 179 (FMRC 2011b) and 181 (FMRC 2011c).

3.6 Influenza and pneumococcal immunisation among adults with chronic disease living in Queensland

This study examined influenza and pneumococcal vaccination coverage and predictors of immunisation in 2,203 adults with asthma, diabetes or a cardiovascular condition (Dower et al. 2011). Data were taken from the 2008 CATI survey conducted with people with chronic disease in Queensland.

The results of the study estimated that nearly a third (30.9%) of people aged 18 and over with asthma were vaccinated against influenza (n = 255). People aged 65 and over with asthma had a significantly higher rate of influenza vaccination (74.6%) compared to those aged 50–64 (48.8%) and 18–49 (19.3%) with asthma.

Among people aged 18 and over with asthma, 14.3% received the pneumococcal vaccine (n = 143). Similar to influenza vaccination, the rate of pneumococcal vaccination coverage increased with age: 7.3% were aged 18–49, 18.1% were aged 50–64 and 61.4% were aged 65 and over.

Overall 10.2% of people with asthma received both the influenza and pneumococcal vaccines.

The proportion of people with asthma who were vaccinated against influenza and/or pneumococcus was lower (30.9% for influenza, 14.3% for pneumococcal) than for those with diabetes (56.6% for influenza, 40.6% for pneumococcal) or a cardiovascular condition (58.4% for influenza, 42.1% for pneumococcal).

3.7 Managing chronic obstructive pulmonary disease in Australia

This cross-sectional study investigated the management of COPD among 1,232 adults aged 45 to 70 living in Melbourne (Matheson et al. 2006). Participants were classified as either asthma-only, COPD-only or both asthma and COPD.

The study showed that 43.4% (n = 43) of people with asthma and 59.0% (n = 23) of people with COPD were vaccinated against influenza in the previous 12 months. Among those classified as having both asthma and COPD, more than half (55.0% n = 22) reported having an influenza vaccination in the previous 12 months.

The proportion of people with COPD immunised against pneumococcal infection (41.0% n = 16) was greater than the proportion of those with asthma (19.2% n = 19) and those with both asthma and COPD (22.5% n = 9) who received pneumococcal vaccination.

3.8 Summary of findings

Table 3.10 summarises the nature of information that is available for existing data sources on influenza vaccination rates in the preceding 12 months for people with and without obstructive airways disease.

Table 3.11 summarises the nature of information that is available for existing data sources on pneumococcal vaccination rates in the preceding 12 months for people with and without obstructive airways disease.

Table 3.10: Summary of information on influenza vaccination status in the preceding 12 months among people with and without asthma or COPD

Information source	Year	Population	Age (years)	Asthma criterion	Proportion vaccinated		COPD criterion	Proportion vaccinated	
					Asthma	No asthma		COPD	No COPD
NHS	2004–2005	All Australians	50+	Ever diagnosed + still have asthma	60.8%*	46.0%	Has bronchitis or emphysema	60.3%*	46.6%
			50–64		44.1%*	25.3%		40.3%*	26.5%
			65+		83.4%*	72.8%		87.8%*	72.7%
NATSIHS	2004–2005	Aboriginal and Torres Strait Islander people	15+	Ever diagnosed + still have asthma	33.5%*	26.6%	n.a.	n.a.	n.a.
			15–34		18.8%	18.1%		n.a.	n.a.
			35–49		35.9%*	25.7%		n.a.	n.a.
			50+	n.a.	68.9%*	57.6%	Has bronchitis or emphysema	n.a.	n.a.
			50+		n.a.	n.a.		62.5%	65.7%
			50–64		n.a.	n.a.		45.4%	52.1%
BEACH	**March–April 2008–2010	Patients visiting a GP	65+	Asthma managed at GP visit	n.a.	n.a.	COPD managed at GP visit	85.0%	83.7%
					15.8%	n.a.		32.1%	n.a.
Dower et al. 2011	2008		18+ (n = 255)	Ever diagnosed + symptoms or medication in last 12 months	30.9%	n.a.	n.a.	n.a.	n.a.
			18–49		19.3%	n.a.		n.a.	n.a.
			56–64		48.8%	n.a.		n.a.	n.a.
			65+		74.6%	n.a.		n.a.	n.a.
Matheson et al. 2006	2000		45–70	Wheeze during last 12 months + bronchial hyperactivity or BDR	43.4% (n = 43)	n.a.	GOLD stage 2 or worse (FEV1/FVC <0.70 and FEV1 < 80% predicted)	59.0% (n = 23)	n.a.

Notes:

- * significantly different between 'with' and 'without' the condition.
- ** March–April = mid-March to mid-April.

Table 3.11: Summary of information on pneumococcal vaccination status in last 5 years among people with and without asthma or COPD

Information source	Year	Population	Age (years)	Asthma criterion	Proportion vaccinated		COPD criterion	Proportion vaccinated	
					Asthma	No asthma		COPD	No COPD
LSAC + ACIR	2004–2011	Infant cohort (children born March 2003–February 2004)	4–5	Ever diagnosed asthma + illness/wheezing which lasted a week or more or taken medication in last 12 months	69.4% (n = 441)	72.0% (n = 2,233)	n.a.	n.a.	n.a.
LSAC + ACIR	2004–2011	Kindergarten cohort (children born March 1999–February 2000)	8–9	Ever diagnosed asthma + illness/wheezing which lasted a week or more or taken medication in last 12 months	2.4% (n = 15)	1.6% (n = 48)	n.a.	n.a.	n.a.
NHS	2004–2005	All Australians	50+	Ever diagnosed + still have asthma	35.6%*	19.9%	Has bronchitis or emphysema	36.9%*	20.5%
			50–64		16.7%*	3.2%		18.3%*	3.9%
			65+		61.4%*	42.2%		63.3%*	42.5%
NATSIHS	2004–2005	Aboriginal and Torres Strait Islander people	15+	Ever diagnosed + still have asthma	20.9%*	13.9%	n.a.	n.a.	n.a.
			15–34		12.0%	9.7%		n.a.	n.a.
			35–49		18.0%*	12.4%		n.a.	n.a.
			50+	n.a.	48.2%*	31.0%	Has bronchitis or emphysema	n.a.	n.a.
			50+		n.a.	n.a.		53.4%	38.3%
			50–64		n.a.	n.a.		43.2%	28.3%
			65+		n.a.	n.a.		77.0%	46.2%
BEACH	**March–April 2008–2010	Patients visiting a GP	n.a.	Asthma managed at GP visit	n.a.	n.a.	COPD managed at GP visit	n.a.	n.a.
SAND	22 February–28 March 2011	Patients visiting a GP	n.a.	Asthma as main reason for vaccination being given	14.0%	n.a.	COPD as main reason for vaccination being given	19.6%	n.a.

(continued)

Table 3.11: Summary of information on pneumococcal vaccination status in last 5 years among people with and without asthma or COPD (continued)

Information source	Year	Population	Age (years)	Asthma criterion	Proportion vaccinated		COPD criterion	Proportion vaccinated	
					Asthma	No asthma		COPD	No COPD
Dower et al. 2011	2008		18+ (n = 255)	Ever diagnosed + symptoms or medication in last 12 months	14.3%	n.a.	n.a.	n.a.	n.a.
			18–49		7.3%	n.a.	n.a.	n.a.	n.a.
			56–64		18.1%	n.a.	n.a.	n.a.	n.a.
			65+		61.4%	n.a.	n.a.	n.a.	n.a.
Matheson et al. 2006	2000		45–70	Wheeze during last 12 months plus bronchial hyperactivity or BDR	19.2% (n = 19)	n.a.	GOLD stage 2 or worse (FEV1/FVC <0.70 and FEV1 < 80% predicted)	41.0% (n = 16)	n.a.

Notes:

1. * significantly different between 'with' and 'without' the condition.
2. ** March-April = mid-March to mid-April.

4 Discussion

Both influenza and pneumococcal vaccination are recommended in clinical guidelines for people with COPD and asthma; and these vaccinations are shown to reduce disease exacerbations and contribute to better management of these conditions. In this context, the objectives of this report were to:

- identify and review existing data sources that provide information on influenza and pneumococcal vaccination uptake among people with obstructive airways disease
- compare influenza and pneumococcal vaccination rates in those with and without asthma or COPD.

Main findings of the report

The report has shown that, at present, there is limited information on vaccination uptake among people with obstructive airways diseases such as asthma and COPD. As there are no comprehensive prescription or vaccination records or registers of influenza or pneumococcal vaccines, it is not possible to use routine data sources or data linkage for monitoring use of these vaccinations in at-risk sub-groups of the populations such as people with obstructive airways disease.

Available survey data show that, for the overall population aged 50 and over, self-reported uptake of influenza and pneumococcal vaccination is higher in those with asthma or COPD than for others. The best influenza vaccination coverage is among people with asthma or COPD aged 65 or older. Aboriginal and Torres Strait Islander peoples have similar or higher influenza and pneumococcal vaccination rates than other Australians in this age group. Among Aboriginal and Torres Strait Islander people, uptake of both influenza and pneumococcal vaccination is more common among those with asthma than those without asthma; and uptake of pneumococcal vaccination, but not influenza vaccination, is higher among those with COPD than those without COPD. In all groups, uptake of influenza and pneumococcal vaccination is sub-optimal.

Potential value of improved information on the use of vaccines

The availability of systematic information about the use of vaccines in the community would support the assessment of:

- the coverage of these vaccines in the general population and in people with COPD and asthma
- the impact of vaccinations on the target populations and the health-care system including adverse events
- the effectiveness and cost-effectiveness of government-funded immunisation programs.

Coverage

The only available data for monitoring the vaccination coverage in people with obstructive airways disease are derived from surveys of general practice (such as BEACH) and general population surveys, such as the NHS, the NATSIHS, and some surveys conducted by state and territory health authorities. However, because these surveys are conducted some years

apart, the data are often not current. Furthermore, their usefulness for examining vaccination uptake for people with obstructive airways disease is limited due wide confidence intervals around the estimates for vaccine coverage among people with asthma and COPD.

These information gaps could be addressed by establishing a national register of pneumococcal and influenza vaccination and by including information on influenza and pneumococcal vaccination within the Personally Controlled Electronic Health Record.

Impact

The absence of vaccination registers and records means that, at the present time, it is not possible to effectively monitor the positive and negative impact of influenza and pneumococcal vaccination among those with obstructive airways disease. For example, it is not possible to use available data to detect adverse events and intervene when they occur. In order to fill this information gap, a standard format for recording information of all vaccinations in all age groups could be considered. Information for inclusion in a standard format could include: type of vaccine, indication of vaccine (that is, chronic disease or risk group), date of administration, vaccine batch number and occurrence of any adverse events.

Specific vaccination surveys, like the Adult Vaccination Survey, have the potential to provide information on the impact of vaccination in at-risk populations, but at present are not configured to do so. This particular survey could be strengthened to include information on the presence of chronic disease in order to identify vaccination status by specific risk group (that is, those with obstructive airways disease).

Other existing surveys such as the NHS and NATSIHS only measure vaccination uptake intermittently. The most relevant and recent data in relation to vaccination uptake is in the NHS 2004–05. The impact of vaccinations on at-risk populations and the health-care system could be improved by routinely asking questions about vaccination status among those with obstructive airways disease.

Effectiveness and cost-effectiveness

Improved information on vaccine coverage and impact would enable assessment of the effectiveness and cost-effectiveness of government-funded immunisation programs for those who fit in the at-risk categories, including those with obstructive airways disease.

Appendix

Table A.1: List of information sources reviewed

Data source
Registers
Australian Childhood Immunisation Register (linked to Longitudinal Study of Australian Children)
General practice and other medical encounter data sources
Bettering the Evaluation and Care of Health (BEACH) and Supplementary Analysis of Nominated Data (SAND)
Medicare Benefits Schedule
Pharmaceutical Benefits Scheme
Survey data
AIHW Adult Vaccination Survey
2010 Pandemic Vaccination Survey
National Health Survey
National Aboriginal and Torres Strait Islander Health Survey
New South Wales CATI (NSW Population Health Survey)
Western Australia CATI (Health and Wellbeing of Adults in Western Australia 2010)
Queensland CATI (Dower et al. 2011)
South Australian Omnibus and South Australian CATI (Gill et al. 2007)
Published reports
Immunisation coverage annual report, 2009 (Hull et al. 2011b)
NSW annual immunisation coverage report 2010 (Hull et al. 2011a)
Vaccine preventable disease and vaccination coverage in Aboriginal and Torres Strait Islander people, 2003 to 2006 (Menzies et al. 2008).
How have we been managing chronic obstructive pulmonary disease in Australia? (Matheson et al. 2006)

Glossary

Aboriginal: A person of Aboriginal descent who identifies as an Aboriginal and is accepted as such by the community in which he or she lives.

Adult: In some data sources for this document, a person may be classified as an adult from the age 15, rather than strictly according to the legal age of 18.

Age-specific rate: A rate for a specific age group. The numerator and denominator relate to the same age group.

Age-standardisation: A method of removing the influence of age when comparing populations with different age structures. This is usually necessary because the rates of many diseases vary strongly (usually increasing) with age. The age structures of the different populations are converted to the same 'standard' structure, then the disease rates that would have occurred with that structure are calculated and compared.

Asthma: A chronic inflammatory disorder of the airways. Chronically inflamed airways are hyper-responsive; they become obstructed and airflow is limited (by bronchoconstriction, mucus plugs, and increased inflammation) when airways are exposed to various risk factors (GINA 2010).

Asthma severity: Defined by the intensity of treatment required to achieve good asthma control. Mild asthma is asthma that can be well-controlled with reliever medications alone or with low dose inhaled corticosteroids. Severe asthma is asthma which requires high intensity treatment with inhaled corticosteroids and long-acting b2-agonists to maintain good control, or which is not well controlled despite such treatment. Several different definitions of asthma severity have been used in the past (Reddel et al. 2009).

Bacteria: Microorganisms that are smaller than a blood cell but bigger than a virus. Although many bacteria are harmless, some cause diseases. Examples of bacterial infections are diphtheria, pertussis (whooping cough) and tuberculosis.

BEACH (Bettering the Evaluation and Care of Health) survey: A continuous cross-sectional paper-based data collection that collects information for individual patient visits about the reasons for seeking medical care, the type of patients seen, the types of problems managed and treatment provided in general practice across Australia.

Bronchitis: Inflammation of the main air passages (the bronchi). May be acute (because of infection) or chronic (most often because of tobacco smoking).

Chronic bronchitis: A condition with the presence of cough and sputum production for at least 3 months in each of 2 consecutive years (GOLD 2011).

Chronic obstructive pulmonary disease (COPD): A common preventable and treatable disease that is characterised by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response of the lung to noxious particles or gases. Exacerbations and comorbidities contribute to the overall severity in individual patients (GOLD 2011). It may be characterised by Emphysema and/or Chronic bronchitis. By far the greatest cause is cigarette smoking.

Confidence interval (CI): A statistical term describing a range (interval) of values within which we can be 'confident' that the true value lies. For this report, confidence intervals are

calculated using the 95% confidence level. A 95% confidence interval implies that there is 95% confidence that the true value will be included in this interval.

Current asthma: Reporting ever being diagnosed with asthma by a doctor or nurse, and reporting having any symptoms of asthma or taking treatment for asthma in the previous 12 months. Other definitions have been used in some surveys however this is the definition recommended by the Australian Centre for Asthma Monitoring. See also Asthma.

Emphysema: A chronic lung disease where over-expansion or destruction of the lung tissue limits oxygen uptake, leading to shortness of breath and other problems.

Health-related quality of life: A term used to describe the impact that a disease has on an individual's health status and everyday functioning. It is most often used when referring to chronic diseases.

Health risk factor: Any factor that represents a greater risk of a health disorder or other unwanted condition or event. Some risk factors are regarded as causes of disease, others are not necessarily so.

Health survey: A research method in which health information is collected from participants at a point in time. In population health monitoring, this typically involves selecting a representative sample of the population and administering questionnaires to the participants. This can be done in person, over the phone or by post. Some surveys have additionally included physiological measurements.

Incidence: The number of new cases (of a disease, condition or event) occurring during a given period. Compare with Prevalence.

Immunity: The ability of the body to fight off certain infections, immunity can result from natural (wild) infections or from vaccination.

Immunisation: The process of inducing immunity to an infectious agent by administering a vaccine.

Indicator: A key statistical measure selected to help describe (indicate) a situation concisely, track progress and performance, and act as a guide to decision-making. It may have an indirect meaning as well as a direct one; for example, Australia's overall mortality rate is a direct measure of mortality but is often used as a major indicator of population health.

Indigenous Australians Refers to people who identify themselves as being of Aboriginal or Torres Strait Islander origin.

International Classification of Diseases (ICD): International Statistical Classification of Diseases and Related Health Problems. The World Health Organization's internationally accepted statistical classification of death and disease. The 10th Revision (ICD-10) is currently in use. In this report, hospital separations before 1998-99 and causes of death before 1997 under previous revisions have been reclassified to ICD-10. ICD-10-AM is the Australian modification of ICD-10, used for diagnoses and procedures recorded for patients admitted to hospitals.

Medicare Benefits Scheme: A national, government-funded scheme that subsidises the cost of personal medical services for all Australians and aims to help them afford medical care (see also Medicare Benefits Schedule).

Medicare Benefits Schedule (MBS): Subsidies are paid under the Medicare Benefits Scheme as per specific item numbers detailed in the Medicare Benefits Schedule.

Morbidity: Refers to ill health in an individual and to levels of ill health in a population or group.

Mortality: Death.

Non-Indigenous: People who have declared they are not of Aboriginal or Torres Strait Islander descent.

Obstructive airway disease: Refers to a group of chronic conditions characterised by limitation of expiratory airflow. The most common such conditions are asthma and chronic obstructive pulmonary disease.

Odds ratio: The ratio of the odds of an event occurring in one group to the odds of it occurring in another group.

Outcome (health outcome): A health-related change due to a preventive or clinical intervention or service. The intervention may be single or multiple and the outcome may relate to a person, group or population or be partly or wholly due to the intervention.

Other Australians: People who have declared they are not of Aboriginal or Torres Strait Islander descent, or whose status is not known.

p value: The probability that the observed difference or association could have occurred by chance. If that probability is less than 5% (i.e. $p < 0.05$), it is conventionally held that it would be unlikely to have occurred by chance and is a true difference or association.

Percentage: A percentage is a proportion multiplied by 100. See Proportion. Compare with Rate.

Pharmaceutical Benefits Scheme (PBS): A national, government-funded scheme that subsidises the cost of a wide range of pharmaceutical drugs, and that covers all permanent residents and citizens of Australia to help them afford standard medications.

Prevalence: The number or proportion (of cases, instances, and so forth) present in a population at a given time. Compare with Incidence.

Proportion: A proportion is a fraction in which the numerator contains a subset of the individuals contained in the denominator. Its value ranges between 0 and 1. For example, the proportion of males in the population is calculated as the number of males divided by the number of persons (i.e. males + females). Compare with Rate.

Pneumococcus (Streptococcus pneumonia): A type of pathogenic bacterium which is recognized as a major cause of respiratory tract infections like pneumonia.

Pneumonia: Inflammation of one or both lungs causing them to become firm or solid. Pneumonia is frequently but not always due to infection. The infection can be bacterial, viral, fungal or parasitic. Symptoms may include fever, chills, cough, cough with sputum production, chest pain and shortness of breath.

Rate: A rate is one number (the numerator) divided by another number (the denominator). The numerator is commonly the number of events in a specified time period. The denominator is the population 'at risk' of the event. Rates (crude, age-specific and age-standardised) are generally multiplied by a number such as 100,000 to create whole numbers. Compare with Proportion and Percentage.

Risk factor: See Health risk factor.

SAND (Supplementary Analysis of Nominated Data): Additional questions asked of patients in subsamples of general practice encounters, as part of the BEACH survey.

SEIFA Index of Relative Socioeconomic Disadvantage: An index of socioeconomic status which provides a summary score for a range of key socioeconomic variables that are related to health status, including household income and resources, education, occupation, fluency in English, and Indigenous status.

Statistical significance: An indication from a statistical test that an observed difference or association may be significant, or 'real', because it is unlikely to be due just to chance. A statistical result is often said to be 'significant' if it would occur by chance only once in twenty times or less often. See also p value.

Torres Strait Islander: A person who identifies themselves as a Torres Strait Islander.

Vaccines: Microbial preparations of killed or modified microorganisms that can stimulate an immune response in the body to prevent future infection with similar microorganisms.

Vaccination: Vaccine preparation which is delivered by injection.

Virus: A tiny living organism, smaller than a bacterium, that can cause infections like measles, mumps, influenza and hepatitis.

Wheeze: Breathing difficulty accompanied by an audible whistling sound.

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Research has shown that vaccinations against influenza and pneumococcal infection can benefit people with obstructive airways disease, which includes asthma and chronic obstructive pulmonary disease (COPD). This report reviews the limited information available in Australia on how many people with asthma and COPD have the vaccination, and finds that the uptake rate is not as high as would be expected if recommendations were being followed.

It presents a range of data improvement options that would enhance our ability to monitor vaccination uptake in this and other at-risk population groups.