MedicineInsight

General practice insights report

July 2016 – June 2017

A working paper

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FOREWORD

In 2011, NPS MedicineWise received funding from the Commonwealth Department of Health to establish MedicineInsight, a national, longitudinal primary care dataset delivering one of the most comprehensive pictures of general practice at local, regional and national levels.

With an ethos of public good, robust and rigorous governance and the willingness of hundreds of general practices to contribute data, MedicineInsight at its core supports general practice to make better decisions about patient care. Through data-driven quality improvement programs, post-market surveillance of medicine use, and research, MedicineInsight underpins both the implementation of best practice patient care and the development of evidence-based health policy. It shines a light on primary care in Australia, and this report is an exciting, albeit early, milestone on our journey towards realising the potential of MedicineInsight.

MedicineInsight is relatively new in comparison to similar international datasets, and we are still learning about this very rich, granular and complex data. As the program evolves and matures against the backdrop of the fast-moving Australian digital health environment, we expect future reports to reflect what may be seismic shifts in knowledge and understanding of the data. Therefore, this report is a preliminary exploration of how MedicineInsight data can describe general practice in Australia, and an exciting starting point for us to build on in the future.

To the MedicineInsight team, you demonstrated tenacity, patience and courage to venture into the unknown, even when it felt uncomfortable. I thank you for your efforts in producing this report.

Steve Morris
CEO, NPS MedicineWise

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The data presented and the views expressed in this report are from NPS MedicineWise and do not necessarily represent the views of the organisations represented on the Advisory Group or the reviewers.

CONTENTS

SUMMARY

MedicineInsight is a unique and valuable resource for Australian longitudinal general practice data. With 2.1 million patients, and over 10 million encounters in the 2016–17 financial year, it has the potential to support a wide range of public health and health services research, as well as providing evidence to support the development of health systems policy and practice. The large volume of data provides an opportunity to analyse, in detail, the activities that occur in general practice. In addition, because the data are longitudinal, the impact of changes in government health policy or clinical guidelines can be monitored from a general practice perspective.

This report aims to provide an overview of MedicineInsight data, including details of encounters, the conditions patients present with, how they are managed and outcomes over time. We have also provided three real-world examples of how MedicineInsight data have been used in distinct research projects to support evidence-based quality improvement in general practice.

The results in the report are based on a MedicineInsight data extract from July 2017, and include encounters from 1 July 2016 to 30 June 2017. A working group from NPS MedicineWise, the Department of Health (DoH) and the Australian Bureau of Statistics (ABS) collaborated to establish the report's scope, definitions and weighting procedure to produce nationally representative findings about people who attended an Australian general practice in 2016–17.

Practices, providers and patients

We used established inclusion and exclusion criteria and a multi-step, iterative selection process to derive a cohort of general practices, general practitioners (GPs), patients and encounters with high-quality data. The cohort consisted of 475 general practices, representing 5.9% of all general practices in Australia, and 2682 GPs, or 7.5% of GPs practising in Australia.

The dataset included 2.1 million patients, comprising 10.2% of general practice patients in Australia, and our population was representative of national data. MedicineInsight patients in this cohort were more likely to be female (54% vs 52% in national data), and to reside in major cities and in areas of socioeconomic advantage (27% in both national and MedicineInsight data).

Encounters

There were 10.4 million encounters included in the dataset, or 7.0% of GP encounters in Australia, with an average of 4.6 encounters per patient. The average number of encounters increased with age in both sexes, and females had more encounters in almost all age groups compared with males. Reasons for encounter (RFE) were available for 73% of encounters, with 80% using coded terms. The five most frequent reasons recorded were to obtain a prescription, for review/follow-up purposes, upper respiratory tract infection (URTI), immunisation, and to discuss results. However, the data in the RFE field do not equate to the conditions for which patients consult a GP.

Chronic conditions

A selection of 14 common chronic conditions were identified using coded and free-text data from multiple fields. Of these conditions, the top five recorded in 2016–17 were hypertension, depression, dyslipidaemia, anxiety and asthma. While recognising differences in data collection and classification between MedicineInsight and other datasets, we have used the 2015–16 Bettering the Evaluation and Care of Health (BEACH) report[1] and the ABS National Health Survey (NHS)[2] to compare rates of recording of conditions in MedicineInsight data.

Risk factors

We have also examined recording of three important risk factors for ill health: smoking, overweight and obesity, and alcohol use. Smoking status was well-recorded in MedicineInsight (82% of patients aged over 16 had information on smoking status ever recorded in their medical record). Compared with data from the ABS National Health Survey, there was an equivalent proportion of patients who reported smoking (16%) although fewer were recorded as ex-smokers (22% vs 30%).

Body mass index (BMI), as a measure of overweight and obesity, was recorded within the previous 2 years for only 29% of patients aged 18 years or over. Recording of BMI increased with increasing age and was more common in more disadvantaged areas, suggesting that patients at higher risk of obesity may be more likely to have this recorded.

Only 14% of patients aged 16 years and older had data on alcohol use recorded within the 2016–17 financial year. Of these patients, 42% were recorded as non-drinkers. One in 10 of the patients with alcohol status recorded drank on average more than two standard drinks per day.

Prescriptions

If GPs use their clinical information systems to print prescriptions for patients, this information is available in MedicineInsight. There were over 8 million original prescriptions and 25 million total prescriptions (including originals and repeats) with ATC codes available in the dataset. More than one-third of patients (34.9%) had one or two prescriptions recorded during the study period, 31.1% had no prescriptions recorded, and 34.0% had three or more prescriptions recorded. Private prescriptions accounted for 14.5% of all original prescriptions. The average number of original prescriptions recorded throughout the year for patients in the cohort was 3.4 and the average number of total prescriptions was 10.5. The average number of prescriptions was higher for females, increased with age and was highest among patients aged 80 years and older.

The four Anatomical Therapeutic Chemical (ATC) Classification System level 3 subgroups with the highest volume of original prescriptions were: beta-lactam antibacterials – penicillins, antidepressants, opioids, and drugs for peptic ulcer and gastro-oesophageal reflux disease (GORD). Similar to the volume of prescriptions dispensed on the Pharmaceutical Benefits Scheme (PBS), the three most common ATC level 1 groups were anti-infectives for systemic use, and medicines for the nervous system and the cardiovascular system.

Pathology tests

MedicineInsight contains detailed information on pathology test results available in general practice. There were over 60 million individual pathology test results included in the dataset. However, each component of a standard suite of pathology test results is recorded separately, and a full blood count may constitute over a dozen separate test result records. On average there were 25 pathology test results per patient, and 42% of patients had at least one pathology test result recorded. Females had a higher rate of testing results recorded than males, and testing result rates increased with age in both sexes. Patients who had more than 80 pathology test results recorded in the 12-month study period had a significantly higher relative risk than other patients of having one (or more) of one of the 14 chronic conditions analysed. Chronic kidney disease was almost 18 times more frequently recorded in these patients, and cardiovascular diseases, including heart failure and atrial fibrillation, were also significantly more common.

1 INTRODUCTION

This report has been prepared to better understand how MedicineInsight data can provide information on activities that occur in general practice settings across Australia, including details of encounters, the conditions patients present with, how they are managed and outcomes over time. In the financial year 2016–17, Australian Government total recurrent expenditure on general practice and community health was $9.1 billion, or $371 per person.[3] MedicineInsight, as a large national general practice dataset, is well positioned to provide a better understanding of general practice activity in Australia and to identify opportunities to improve primary healthcare and health outcomes for all Australians.

MedicineInsight provides monthly longitudinal, de-identified, whole-of-practice data extracted from the clinical information systems (CIS) of 649 consenting general practices across Australia. As participation in MedicineInsight increases, and as the data are continuously improved, this will become an increasingly valuable source of information to inform primary healthcare, policy and planning in Australia. The potential of MedicineInsight data for research, and to inform policy development and healthcare decision making at local, regional and national levels, is being realised as the program evolves and matures. Further information on population health and health service research projects using MedicineInsight data can be found at https://www.nps.org.au/approved-projects-using-medicineinsight-data.

This report is a preliminary exploration of how data from the MedicineInsight program can be used to describe general practice activity. The results in the report are based on a MedicineInsight data extract from July 2017 including encounters from 1 July 2016 to 30 June 2017. The report also includes vignettes from other recent reports and research projects using MedicineInsight data. These vignettes demonstrate the versatility and utility of the dataset and they include data for different cohorts and time periods from those included in this report.

1.1 The MedicineInsight program

NPS MedicineWise is an independent, not-for-profit and evidence-based organisation that works to improve the way health technologies, medicines and medical tests are used. MedicineInsight was initially established by NPS MedicineWise in 2011, with core funding from the Australian Government DoH, to collect general practice data to support quality improvement in Australian primary care and post-market surveillance of medicines. Regular aggregate-level reports are provided to the DoH to support quality use of health technologies for Australia, including medicines, vaccines and medical tests. MedicineInsight data are also available to support research that aligns with the NPS MedicineWise mission and the ethos of the MedicineInsight program. Further details about MedicineInsight are available at https://www.nps.org.au/medicine-insight.

1.2 Recruitment and consent

General practices from all states and territories are recruited into the MedicineInsight program and consent to the collection of de-identified patient information. Practices included in the cohort used for this report all use one of two CISs, Best Practice (BP) or Medical Director 3 (MD), which together account for over 80% of general practice software systems.

Initial recruitment focused on practices with more than three GPs as it was considered that these practices were more likely to have electronic health records. Later, solo general practitioners and corporate organisations were included in the cohort. More recently, there has been targeted recruitment of practices into MedicineInsight to support local Primary Health Network (PHN) quality improvement programs and research. By July 2017, 649 general practices had been recruited to participate in MedicineInsight.

The general practice owner or authorised person for a general practice must provide a signed agreement to participate in MedicineInsight. Consistent with National Health and Medical Research Council (NHMRC) ethical guidelines for the use of health-related data, patients are not required to give written consent due to the non-identifiable nature of the data collected. This process has been approved by the Royal Australian College of General Practitioners (RACGP) ethics committee (see section 1.5). However, general practices are required to inform patients of the practice's participation in the MedicineInsight program through poster displays and information leaflets. The posters and information leaflets contain MedicineInsight contact information (email and phone line) in case there are any patient concerns. Patients can opt out of the program through a process handled independently at the practice if they do not wish their de-identified data to be shared via MedicineInsight.

1.3 Data collection

MedicineInsight uses third-party data extraction tools to de-identify, extract and securely transmit whole-of-practice data from within each general practice's CIS. An all-of-practice data collection, containing all available historic and current de-identified electronic health records, is conducted when a practice joins MedicineInsight. The extraction tool collects incremental data regularly, allowing the development of a longitudinal database in which patients within practices can be tracked over time.

The data that MedicineInsight collects from general practice sites include:

- general practice and GP information for the administration of quality improvement activities by NPS MedicineWise
- patient demographic and clinical data entered by GPs and practice staff directly into the system, or collected in the CIS from external sources (eg, pathology test results)
- system-generated data such as start time and date of a patient encounter.

The CIS uses coding systems such as 'Docle' in MD or 'Pyefinch' in BP to code conditions entered into the system. However, it is not mandatory to use a code and clinicians can also enter terms as

free text. Both coded and free-text data are extracted from the CIS. However, data are not extracted from fields such as the progress notes that may contain identifying information.

The data held in the MedicineInsight database are de-identified. However, each patient, practice and provider has a unique number, enabling patient data to be matched across multiple data tables within each practice. Rigorous confidentiality controls are in place to prevent re-identification of patient data.

The data are held by NPS MedicineWise in an external, secure data warehouse. General practices are provided with transformed data via practice reports. These insights support general practices in monitoring quality improvement activities and best practice patient management over time. Subject to Data Governance Committee approval, data extracts are also available to external parties, including researchers and government agencies. Figure 1.1 summarises this process.

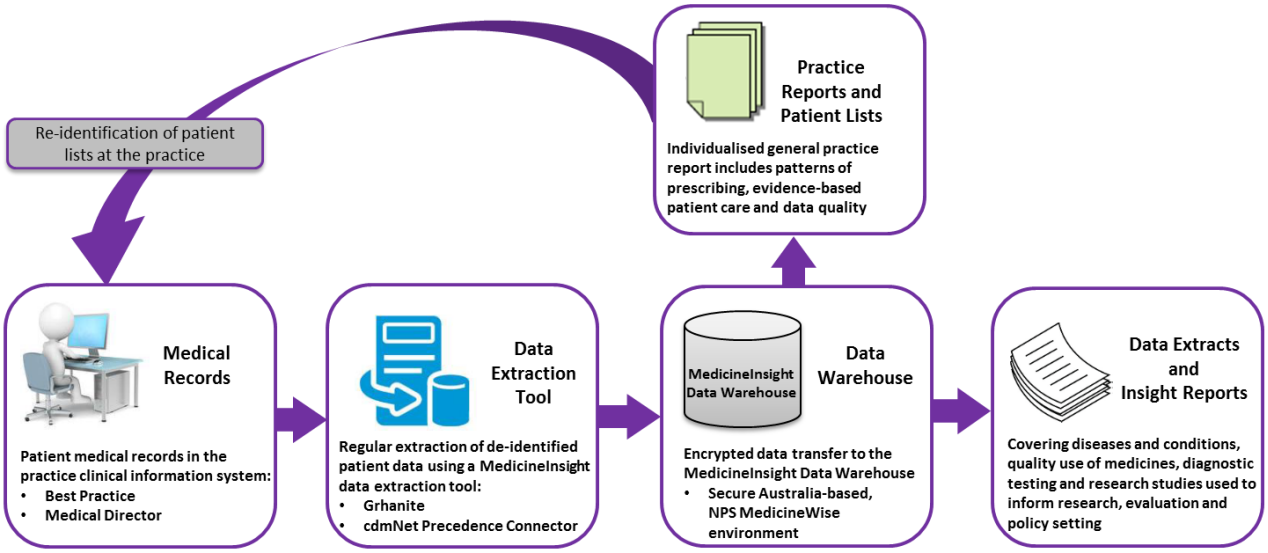


Figure 1.1 MedicineInsight data collection and extraction procedure

1.4 Data elements

Detailed granular data are extracted from MedicineInsight, including both coded and free-text fields. These are fully described in Appendix 2 and the data dictionary.[4] A list of the commonly used data elements appears in Table 1.1.

Table 1.1 Summary of MedicineInsight data elements

Practice information	Location, multi-practice	
Provider information	Clinical user type	
Patient information	Demographics	Birth year, sex, Aboriginal or Torres Strait Islander status, location, concession card, death year
	Risk factors	Alcohol, smoking, BMI
	Encounters	Reason for encounter
	Medical history	Diagnosis, date of onset, active
	Prescriptions	Reason for prescription, medicine, repeats, dose, strength, frequency, instructions
	Observations	Type, value
	Allergy/adverse events	Allergy, date, reaction, severity and type
	Immunisation	Vaccine name, batch, administered by
	Pathology	Result date, LOINC code, result name, value, units, normal/abnormal result flag

1.5 Data governance and ethics

The MedicineInsight program has rigorous governance processes in place to mitigate any risk to participants and to ensure that the program is run lawfully, ethically and for the public good. Sharing of MedicineInsight data is subject to a robust data governance framework, including approval by an independent Data Governance Committee. The committee comprises consumer advocates, data privacy and security experts, general practitioners and researchers. The committee approved the use of data for this report.

Data are always encrypted during transit and storage, following government and industry best practice standards. MedicineInsight data are collected, used and stored strictly in line with Australian privacy laws (including mandatory data breach notification laws).

The pilot MedicineInsight program was approved by the RACGP National Research and Evaluation Ethics Committee in January 2013. In December 2017, the same committee granted NPS MedicineWise ethics approval for the MedicineInsight program. This approval covers the standard operations and uses of the MedicineInsight database. The use of MedicineInsight data for this report was considered by the Department of Health Human Research Ethics Committee. It was considered to be of negligible risk and an ethics waiver was approved.

1.6 Other Australian general practice data

MedicineInsight data can be used to supplement other sources of general practice data in Australia. Where appropriate, this report compares MedicineInsight data to these other sources. All data sources have different methods of data collection and different strengths and limitations. The following data sources are referred to in this report.

Bettering the Evaluation and Care of Health (BEACH)

The BEACH program provided a continuous study of general practice activity in Australia from 1998 to 2016 with a random sample of 1000 practising GPs recording details of 100 patient encounters on a structured paper-based record over one week. This was collated into an annual report providing details on GPs and patients, including: problems managed; risk factors; medications and other treatments; referrals and admissions; tests ordered; and additional sub-studies on different topics.[5] The BEACH program provided detailed cross-sectional data for the types of problems and the ways they were managed at individual encounters within a general practice. Individual patients could not be followed over time and longitudinal analysis was therefore limited.

Pharmaceutical Benefits Scheme (PBS) data

Data from the PBS are available for all medicines dispensed in the community and to patients who are discharged from public hospitals in five states and one territory meeting PBS requirements. Data are also available for the Repatriation Pharmaceutical Benefits Scheme (RPBS) prescriptions for eligible war veterans and their families. PBS data do not include medicines prescribed for hospital inpatients or private prescriptions. Data from the PBS are limited, with only sociodemographic data routinely available for individual patients. PBS data do not include information on relevant diagnoses, test results, risk factors and service use, which are important to the interpretation of medicines data.

Medicare Benefits Schedule (MBS) data

The MBS claims data are an administrative by-product of the administration of the Medicare fee-for-service payment system. MBS data are available on eligible general practice attendances. Data are also available on pathology tests, but generally only for the three most expensive items undertaken (called ‘coning’). The MBS data do not cover all services, for example those qualifying for a benefit under the Department of Veterans’ Affairs (DVA) National Treatment Account or some services conducted through state and territory community-controlled health centres.

ABS National Health Survey (NHS), 2014–15

The most recent ABS NHS collected a range of information about the health of Australians, including the prevalence of long-term health conditions, risk factors, use of health services and actions people have recently taken for their health. Trained ABS interviewers conducted interviews with selected residents in the sampled dwellings. This survey was conducted in all states/territories and across urban, rural and remote areas of Australia from July 2014 to June 2015 and included approximately 19,000 people. The survey asks about conditions in two ways: if they have been told by a doctor or nurse that they have a condition, and whether the condition is current and long-term; and if they have any other long-term health conditions that have lasted or are expected to last for 6 months or more.

Further information about the NHS is accessible from http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4364.0.55.001Main+Features12014-15.

Linked general practice data

Currently there are limited linked datasets available that include national general practice data in Australia. There is a proof of concept data linkage project for MedicineInsight underway in Victoria, linking hospital, administrative and costing data with the Victorian Cancer Registry data (https://www.nps.org.au/approved-projects-using-medicineinsight-data).

2 METHODS

This report is based on MedicineInsight data extracted in July 2017 and includes encounters from 1 July 2016 to 30 June 2017. This chapter focuses on the scope and rationale for the main definitions used in this report, summarises the processes used to select and weight the MedicineInsight data and outlines the statistical methods used. Appendices 3 and 5 contain more detailed information about the cohort selection and weighting process.

Decisions on cohort selection and scope were guided by the following objectives:

- a single set of assumptions and quality criteria to ensure data included were from a consistent cohort of practices, providers, patients and encounters
- including as much data as possible and excluding only data that did not meet data selection and quality criteria.

2.1 Cohort selection

To obtain a high-quality dataset and to ensure a consistent cohort of general practices, GPs, patients and encounters, we have used a multi-stage approach for sample selection. We have applied appropriate definitions and established MedicineInsight quality inclusion and exclusion criteria at each step of the process, as outlined in Table 2.1.

Table 2.1 Summary of MedicineInsight cohort selection criteria and volumes, 2016–17

	Inclusion criteria	Number included
General practices	• Had successful data extract in July 2017	475 General practices (5.9% of general practices in Australia[6])
	• Met the general practice data quality criteria	
	• Identified as general (not specialised) practice	
	• Had any included GPs, patients, encounters	
GPs	• Working at an included practice	2682 GPs (7.5% of GPs in Australia[7])
	• Without an administrative provider name	
	• With a minimum volume of activity (> 3 encounters, diagnoses or prescriptions in total in the year)	
	• Identified with a complete prescriber number	
	• With included patient encounters	
Patients	• With an encounter at an included practice with an included GP	2,168,084 Patients within practices (Estimated 10.2% of general practice patients in Australia[8])
	• Identified as a patient in the CIS (eg, not a next of kin, emergency contact)	
	• With included encounters	
Encounters	• At an included practice with an included GP and patient	10,429,217 Encounters (Estimated 7.0% of GP encounters in Australia[8])
	• Did not have an administrative reason for encounter	

General practices and data quality

In Australia, the most commonly applied definition of a general practice is from the RACGP, which defines a general practice as an organisation that provides 'person centred, continuing, comprehensive and coordinated whole person health care to individuals and families in their communities'.[9] We have used this definition of a general practice to select practices for inclusion in this report.

MedicineInsight collects data at a general practice 'site' level rather than at the level of a general practice. A general practice site is used to describe one or more practices that share the same general practice database, either because they are operating within a common administrative system (eg, the same corporate entity) or in the same geographical area. However, for most general practices participating in MedicineInsight, each general practice maintains its own separate CIS and is consequently defined as a single site. MedicineInsight is currently unable to assign patient records within the database of a multi-practice site to the individual practices.

At the time of data extraction, 555 practice sites representing 649 general practices were recruited to MedicineInsight and were potentially eligible for inclusion in this report.

Table 2.1 shows the detailed inclusion criteria used to select the practices for the sample, including having a successful data extract from the practice site, meeting the data quality criteria, meeting the RACGP definition of a 'general' rather than a 'specialised' practice and with encounters during the study period.

Using the inclusion criteria, the general practice cohort contains data from 475 general practices from 418 practice sites, representing 5.9% of all general practices in Australia in 2016–17.[6]

General practitioners

Practice providers are recorded in the CIS and include any staff member who logs information in the CIS, including clinical (GP, nurse, allied health) and administrative staff. GPs were included in the cohort where they were identified in the CIS as doctors and had unique prescriber numbers. We then excluded GPs with an administrative provider name and where there had been only a small volume of activity in the year.

Using the inclusion criteria, 2,682 GP providers provided a patient encounter in 2016–17, representing 7.5% of all GPs in Australia.[7]

Patients within a practice

Patient information is entered in the CIS at the practice and each patient is given a unique digital number at each general practice site visited. There were 2,850,243 unique patient records for people with any encounter in the 2016–17 study period, and 2,168,084 patients were included in the final study cohort. This represents 10.2% of all patients who saw a GP in 2016–17.[8]

If a patient visits practices that are not enrolled in MedicineInsight, this information and activity will not be captured. We are also currently unable to link patients across different practices within

MedicineInsight, and consequently there is potential for duplication where patients attend multiple included practices. Data from the Practice Incentive Program for the 12 months ending 30 November 2017 shows that 53% of patients attended only 1 practice, 30% attended 2 practices, 11% attended 3 practices and 5% attended 4 or more practices. These data are referred to as patient loyalty data.[10] Assuming that patient loyalty rates in our cohort are similar to national patient loyalty rates, and using these rates to assess the probability of a patient visiting another included MedicineInsight practice, we can estimate that for every 104 patient records, we have 100 unique patients. As this is not a significant duplication rate, we have not adjusted for it in these analyses.

We have also not adjusted for relatively increased mortality rates in older patients, which has the potential to lead to underestimates of patient-specific prescription and pathology volume in these age groups. For example, if a patient dies part way through the study period, they are still considered an active patient for the full 12 months in the analysis. This will be investigated in future analyses.

Encounters

There is currently no single consistent and accurate marker of an encounter for general practice electronic health records in Australia. A clinical encounter is generally defined as an interaction between a patient and a healthcare professional. However, this is difficult to determine in MedicineInsight, as an 'encounter' occurs in the CIS whenever a patient's electronic health record is opened. This may occur for clinical reasons (such as a consultation) or for administrative purposes (such as reviewing or updating a patient record). This report includes data on all encounters at included general practices with an included GP for an included patient. We then excluded 0.7% of the included encounters that were identified as administrative only, using search terms specific for administrative activity such as 'update file'.

Using the inclusion criteria, there were 10,429,217 encounters in this cohort. If all these encounters were associated with an MBS billing item this would represent 7.0% of MBS-billed GP encounters in Australia.[8]

Summary of multi-stage process

Appendix 3 shows the details of the multi-stage cohort selection approach with the numbers excluded at each stage for general practices, GPs, patients and encounters.

2.2 Patient data

Demographics

Aboriginal and/or Torres Strait Islander patients

Information on patients' Aboriginal or Torres Strait Islander status is recorded within the CIS and extracted into MedicineInsight using the ABS standard classification.[11]

Socio-economic status

Socio-Economic Indexes for Areas (SEIFA) are assigned to patients based on their postcodes. SEIFA is determined in accordance with the ABS Index of Relative Socio-Economic Advantage and Disadvantage (IRSAD) deciles.[12]

Rurality

Rurality is assigned to both practices and patients, based on practice and patient postcodes. Rurality is determined in accordance with the ABS geographical framework 'Remoteness Areas'.[13]

Conditions

There is no consistent national classification system used within general practice to code conditions, and each CIS has its own classification system. MedicineInsight extracts Docle- and Pyefinch-coded and free-text data from fields including diagnosis and medical history, the reason for encounter (ie, reason for visit or consultation) and the reason for prescription. To maintain patient confidentiality, we are unable to access or extract information from patient progress notes.

In conjunction with medical, pharmacist and clinical coding experts, we have developed coding algorithms to identify conditions and symptoms of interest within the MedicineInsight database, using commonly accepted clinical definitions, terms and synonyms from SNOMED CT-AU.[14] Both free-text and coded data extracted from the fields listed above are used to identify conditions. We have assessed the completeness and coding of data in these fields in a subset of patients from this cohort, and this is discussed further in Appendix 4.

Risk factors

Three important risk factors for ill health were examined in this report: smoking status, body mass index (BMI) and alcohol intake. Data were extracted from specific fields, and as with the identification of conditions, we were unable to access data from patient progress notes.

The most recent smoking status ever recorded in the CIS was used in this report. Smoking status for a patient may be recorded in the CIS by the GP, nurse or other practice staff. For both clinical systems (MD and BP), the smoking status options include: non-smoker, smoker, ex-smoker, not known or not recorded. In the data extraction for this report, smoking status was not associated with a date of data entry, so we have been unable to quantify how recently or how often this information is recorded. However, this data will be available in future, and we will be able to analyse clinical practice of recording smoking status against best-practice guidelines, as well as patterns of patient smoking cessation and uptake.

BMI can be computed in the CIS when a provider enters a patient's weight and height in the appropriate fields and format. Data for this report included BMI status obtained directly from the CIS if it had been recorded within the last 24 months. Where this data was not available, BMI was calculated using the most recent height and weight data (collected within the last 24 months) available for each patient. A 24-month period was applied as this is consistent with RACGP Redbook

guidelines, which recommend measuring and recording BMI and waist circumference every 2 years in patients with low-average risk.[15]

Alcohol intake data are based on the most recent information ever recorded in the CIS about the patient's alcohol status and consumption. Data about alcohol use are recorded differently in BP and MD but were amalgamated for this analysis into the variable 'units per week', indicating the number of standard drinks of alcohol consumed per week. Alcohol data that was available for use and analysis in this report was recorded within the 2016–17 financial year.

Medicines

MedicineInsight collects comprehensive data on the medicines that a GP prescribes and may include data on other medicines that a patient takes (such as medicines that are prescribed by a specialist, purchased over the counter or drug samples) if the GP records them in the CIS. In this report, medicines data are restricted to medicines where a GP uses their CIS to print a prescription for a patient, and whether the patient had an encounter with a GP on the same day that a prescription was recorded. These prescriptions include medicines that are partly or wholly government-rebated from the PBS and RPBS[16] and also private (non-rebated) prescriptions. Private prescriptions are those paid for entirely by the patient or their private health insurer as they do not meet PBS/RPBS requirements related to the medicine prescribed, its indication for use, the amount supplied or the number of repeats. Prescriptions data does not reflect whether a medicine was dispensed or used by the patient (dispensing data is available from the PBS).

Prescription data are available for both 'original' prescriptions and a stated number of repeats recorded in the CIS. Whenever a new (but not necessarily first-time) prescription is recorded, this is counted as an 'original' prescription. When reporting the volume of prescriptions, the number of original prescriptions and the total number of prescriptions, including both originals and repeats, are both used. For example, when a prescription for a medicine with five repeats is entered in the CIS it will be counted once when the analysis focuses on original prescriptions and will be counted six times when the analysis is for the original-plus-repeat prescriptions, which we refer here to as the total number of prescriptions.

All medicines recorded, whether by generic or brand name, were grouped to one of the 14 categories of the ATC level 1.[17] For ATC level 3, the top 30 medicines by volume for total prescriptions (original and repeats) from the unweighted data were included in this report.

Pathology tests

Most Australian practices now receive pathology test results electronically, transferred directly into the CIS from pathology providers. There are three potential sources of information about pathology within the CIS – tests requested, result summaries and the associated result details – which are all linked to the patient. This report used the pathology test result details because a GP may not order all tests electronically. The result summaries and result details also include data from tests ordered by

specialists or doctors outside the practice, when they have requested that a GP receive a copy of a result.

Most of the common pathology test results are recorded using Logical Observation Identifiers Names and Codes (LOINC),[18] and contain the detailed results, including whether the result is normal or abnormal depending on the normal ranges for that laboratory. Each component of a pathology test result is recorded separately, eg, for full blood counts there would be over a dozen separate test results documented, such as white blood cell count, haemoglobin, and so on.

2.3 Comparative datasets

We have used comparative population-level data from the MBS. Three primary datasets were used, and these are summarised in Table 2.2.

Table 2.2 Description of comparative MBS datasets

	MBS encounter weighting data[8]	MBS patient and encounter statistics[19]	MBS patient loyalty data[10]	MedicineInsight
Purpose of inclusion	Weighting data to reflect national population distribution	National data source for comparison of patients and encounters	National information on patient loyalty statistics (number of practices visited, and encounters per practice)	Research cohort
Time period	July 2016–June 2017	July 2016–June 2017	December 2016–November 2017	July 2016–June 2017
Number of patients	21,177,823	21,177,823	20,796,594	2,168,084
Number of encounters	148,750,245	144,053,140	131,726,111	10,429,217
Encounter (service) definition	One MBS non-referred attendance, excluding Practice Nurse Items	One MBS non-referred attendance, excluding Practice Nurse Items. Multiple services on the same day with the same provider are not counted separately	One MBS non-referred attendance, excluding: After Hours, Acupuncture, RACF, and Practice Nurse Items	All non-administrative encounters involving an included practice, GP and patient

2.4 Statistical methods

Weighting

Weighting is the process of adjusting results from a subset of the population to infer results for the Australian patient population. The practice-centric recording of patient data makes patient-level weighting a complex issue. Full details of the weighting process are available in Appendix 5. In brief, encounter weights were calibrated to independent estimates of the population of interest from national MBS billed data to ensure that the estimates conform to independently estimated distributions of the population of interest rather than to the distribution within MedicineInsight itself. Calibration helps to compensate for over- or under-representation of particular categories of patients.

Data analysis

For the descriptive analyses, numbers, rates per 100 encounters, rates per 100 patients, and means were calculated. Calculations did not include missing data, and all tables include notes on the proportion of records missing based on the unweighted MedicineInsight data. Estimates of errors were calculated using the 'delete-a-group jack-knife' method in the SAS PROC SURVEYFREQ procedure. Comparisons within or between categories and with other selected data sources were made by comparing the degree of overlap of the corresponding 95% confidence intervals (CI). A difference between two point estimates was deemed statistically significantly higher or lower if there was no overlap of the 95% CIs, equivalent to $p < 0.006$ for each separate comparison.[20] Analysis of the data was performed using SAS version 9.3 Enterprise Guide 7.1 (SAS Institute Inc, Cary, NC, USA).

3 PRACTICES, PROVIDERS AND PATIENTS

This chapter describes the characteristics of practices, GP providers and patients included in this report.

3.1 General practices

Data are included for 475 general practices from 418 general practice sites, representing 5.9% of all practices nationally.[6] Table 3.1 provides a summary of the number of general practices for each general practice site. Most sites consisted of a single practice.

Table 3.1 General practices per practice site

General practice sites	Number of general practices within each site	Total number of general practices
373	1	373
36	2	72
6	3	18
3	4	12
Total 418		**Total 475**

Table 3.2 presents data on MedicineInsight general practices compared with national data, by state/territory, rurality and PHN. This table presents both the proportional geographical representation and the differences in relative coverage of MedicineInsight practices compared with national data.

MedicineInsight contains data on a higher proportion of practices located in Tasmania, with coverage of 21% of all practices. There has been active recruitment of practices in Tasmania, and MedicineInsight data have been used for research and to inform local health policies and planning. There has also been active recruitment in the Hunter New England and Central Coast PHN (14.6% of practices were included) where data from MedicineInsight support primary care clinicians is improving the management of patients living with type 2 diabetes through the provision of benchmarked practice reports.

South Australia has the lowest state-level coverage of practices, at 2.5%. Western Queensland is the only PHN in Australia that does not contain at least one MedicineInsight practice.

Nationally, 8.5% of practices in inner regional areas and 7.8% of practices in outer regional areas are represented in MedicineInsight. A lower proportion (2.6%) of practices from remote or very remote areas are included.

Table 3.2 Comparison of the MedicineInsight practice cohort with national practices by location

Location	MedicineInsight practices (N = 475)		National practices* (N = 8065)		Coverage of MedicineInsight practices (%)
	N	% practices	N	% practices	
Australia	475		8065		5.9
State/Territory					
NSW	161	33.9	2809	34.8	5.7
VIC	94	19.8	1990	24.7	4.7
QLD	96	20.2	1604	19.9	6.0
WA	57	12.0	696	8.6	8.2
TAS	36	7.6	171	2.1	21.1
SA	14	2.9	570	7.1	2.5
NT	9	1.9	127	1.6	7.1
ACT	8	1.7	98	1.2	8.2
Rurality**					
Major cities	286	60.2	5503	68.2	5.2
Inner regional	118	24.8	1396	17.3	8.5
Outer regional	61	12.9	779	9.7	7.8
Remote/very remote	10	2.1	379	4.7	2.6
Primary Health Network (PHN)					
Adelaide	11	2.3	369	4.6	3.0
Australian Capital Territory	8	1.7	98	1.2	8.2
Brisbane North	16	3.4	308	3.8	5.2
Brisbane South	29	6.1	323	4.0	9.0
Central and Eastern Sydney	22	4.6	626	3.5	3.5
Central Queensland, Wide Bay, Sunshine	21	4.4	285	7.8	7.4
Country SA	<5	0.6	201	2.5	1.5
Country WA	23	4.8	209	2.6	11.0
Darling Downs and West Moreton	7	1.5	175	2.2	4.0
Eastern Melbourne	18	3.8	427	5.3	4.2
Gippsland	6	1.3	95	1.2	6.3
Gold Coast	17	3.6	181	2.2	9.4
Hunter New England and Central Coast	61	12.8	417	5.2	14.6
Murray	16	3.4	221	2.7	7.2
Murrumbidgee	5	1.1	89	1.1	5.6
Nepean Blue Mountains	<5	0.8	129	1.6	3.1
North Coast	16	3.4	192	2.4	8.3
North Western Melbourne	32	6.7	551	6.8	5.8
Northern Queensland	6	1.3	264	3.3	2.3
Northern Sydney	14	2.9	294	3.6	4.8
Northern Territory	9	1.9	127	1.6	7.1
Perth North	19	4.0	249	3.1	7.6
Perth South	15	3.2	238	3.0	6.3
South Eastern Melbourne	14	2.9	480	6.0	2.9
South Eastern NSW	12	2.5	212	2.6	5.7
South Western Sydney	6	1.3	407	5.0	1.5
Tasmania	36	7.6	171	2.1	21.1
Western NSW	8	1.7	117	1.5	6.8
Western Queensland	0	0.0	68	0.8	0.0
Western Sydney	13	2.7	326	4.0	4.0
Western Victoria	8	1.7	216	2.7	3.7

*Data source: National Health Services Directory (NHSD), 2017,[6] downloaded 15 September 2017.
** 0.1% of national practices were missing data on rurality.

3.2 GP providers

There were 2682 unique GP providers with an encounter with a patient in the MedicineInsight cohort, representing 7.5% of all GPs in Australia in 2016–17.[7]

Consistent with the practice coverage data, the MedicineInsight dataset has a relatively higher proportion of GPs from Tasmania, a lower proportion from South Australia, and a lower proportion from remote areas (Table 3.3).

Demographic data are collected on the age and gender of consenting GPs participating in MedicineInsight quality improvement programs. However, information was only available for approximately one-third of GPs who chose to complete consent forms, and therefore these data have not been further analysed for this report.

Table 3.3 Comparison of included MedicineInsight GPs with national GPs* by location

Location	Number of MedicineInsight GPs		Number of national GPs*		Proportion of GPs in MedicineInsight by location
	N	%	N	%	%
State/Territory					
NSW	891	33.2	10,850	30.2	8.2
VIC	597	22.3	8,646	24.1	6.9
QLD	504	18.8	7,928	22.1	6.4
WA	334	12.5	3,714	10.3	9.0
TAS	190	7.1	883	2.5	21.5
SA	87	3.2	2,793	7.8	3.1
ACT	40	1.5	548	1.5	7.3
NT	39	1.5	572	1.6	6.8
National total	**2,682**	**100**	**35,934**	**100**	**7.5**
Rurality (missing 0.1%)					
Major cities	1,685	62.8	24,648	68.6	6.8
Inner regional	683	25.5	6,641	18.5	10.3
Outer regional	288	10.7	3,263	9.1	8.8
Remote/very remote	23	0.9	1,382	3.8	1.7

* Data source: GP Workforce Statistics – 2001–02 to 2016–17.[7]

3.3 Patients

There were 2,168,084 patients identified with an encounter in MedicineInsight, representing 10.2% of all patients who visited a GP in 2016–17 in Australia.

MedicineInsight patients are recorded separately at each practice site they visit and are not able to be linked. This has two important consequences for the 47% of patients visiting more than one practice in 2016–17.[10]

- The patient record at a practice site is not a complete record of information for that patient. Therefore, patient-level statistics describing the amount of activity per patient (eg, number of encounters per patient) relate only to the amount of activity at a single practice, rather than their total activity. This is discussed further in Chapter 4 on Encounters.
- If a patient visits multiple MedicineInsight practice sites they are recorded as multiple patients. However, using national patient loyalty data, we have estimated that every 104 patient records represent 100 patients, and while the number of MedicineInsight patients used in this

report may overestimate the true number of MedicineInsight patients, this is unlikely to have a significant impact on our analyses.

Consistent with national patient data, MedicineInsight patients were more likely to be female and to reside in areas of socio-economic advantage (Table 3.4). Data were available on Indigenous status for 71% of patients. The proportion of these patients who identified as Aboriginal and/or Torres Strait Islander was similar to that of the national patient population (2.7% vs 2.9%).

A lower proportion of MedicineInsight patients (0.8%) were recorded as having a DVA Health Care Card compared with national data (1.3%) and a higher proportion were identified as having a Health Care Concession Card (14.5%) compared with the overall Australian population (6.2%).

Table 3.4 Patient sociodemographic characteristics

Characteristic	Weighted data		Unweighted data (N = 2,168,084)	National data sources
	% patients	(95% CI)	% patients	% patients
Sex (missing 0.2%)				
Male	46.2	(45.7, 46.7)	45.0	47.6[a]
Female	53.8	(53.3, 54.3)	55.0	52.4[a]
Age group (years) (missing 0.02%)				
0–9	13.7	(13.3, 14.2)	12.4	13.2[a]
10–19	10.5	(10.2, 10.8)	9.9	10.8[a]
20–29	14.1	(13.2, 15.0)	12.8	12.5[a]
30–39	14.8	(14.2, 15.5)	13.8	13.8[a]
40–49	13.4	(13.1, 13.7)	13.1	13.4[a]
50–59	12.2	(11.9, 12.5)	12.7	13.0[a]
60–69	10.4	(9.9, 10.9)	11.6	11.3[a]
70–79	6.9	(6.4, 7.4)	8.3	7.5[a]
80–89	3.2	(2.9, 3.4)	4.2	3.7[a]
90+	0.8	(0.7, 0.9)	1.2	0.8[a]
Indigenous status (missing 28%)				
Aboriginal and/or Torres Strait Islander	2.7	(2.3, 3.2)	2.7	2.9[b]
Not Aboriginal or Torres Strait Islander	97.3	(96.8, 97.8)	97.3	97.1[b]
Socio-economic status (SEIFA IRSAD quintile) (missing 0.9%)				
1 (most disadvantaged)	14.3	(10.9, 17.7)	15.9	16.1[a]
2	15.6	(13.1, 18.1)	14.9	16.2[a]
3	21.7	(18.5, 25.0)	22.4	19.6[a]
4	20.5	(18.1, 22.9)	19.9	20.6[a]
5 (most advantaged)	27.9	(23.1, 32.6)	27.0	27.5[a]
Concession (Health Care) Card				
Yes	14.5	(12.8, 16.3)	15.8	6.2[c]
DVA Health Card				
Yes	0.8	(0.7, 0.8)	1.0	1.3[d]

Data sources:
[a] Medicare Benefits Schedule statistics, 2016–17 (data provided by DoH).[19]
[b] Adjusted non-referred GP (total) services claimed by Indigenous status, Australia, 2015-16, AIHW.[21]
[c] Department of Social Security Demographics, 2017.[22]
[d] Department of Veterans' Affairs, 2016.[23]

As expected, the weighted MedicineInsight patient data closely resemble the national geographical distribution of patients, proportionally, in Australia (Table 3.5). However, consistent with practice and GP coverage, the unweighted data reflect the active recruitment of practices in Tasmania, with a higher proportion of patients, and the low recruitment rate in South Australia, with a lower proportion of patients. Most patients reside in major cities, which is consistent with other national data sources

(Table 3.5). Patients residing in inner regional areas continue to be over-represented in MedicineInsight with 23.8% of the unweighted data compared with 12.3% of patients from MBS data.[19]

Table 3.5 Patient location of residence

Location	Weighted data		Unweighted data (N = 2,168,084)	National data source*
	% patients	(95% CI)	% patients	% people
State/Territory (missing 0.4%)				
NSW	34.4	(28.8, 40.0)	32.4	32.3
VIC	25.0	(20.4, 29.7)	22.8	25.4
QLD	20.0	(15.3, 24.7)	18.7	20.1
WA	9.7	(6.6, 12.7)	12.6	10.4
TAS	1.7	(0.9, 2.5)	6.5	2.1
SA	6.8	(3.0, 10.6)	2.8	7.2
ACT	1.5	(0.3, 2.6)	2.4	1.6
NT	0.9	(0.2, 1.6)	1.7	0.9
Rurality (missing 0.7%)				
Major cities	69.7	(64.1, 75.2)	64.6	71.2
Inner regional	21.5	(17.1, 26.1)	23.8	12.3
Outer regional	7.8	(4.8, 10.8)	10.6	12.5
Remote/very remote	1.0	(0.4, 1.6)	1.0	4.0

* Data source: Medicare Benefits Schedule statistics, 2016–17 (data provided by DoH).[19]

4 ENCOUNTERS

This chapter describes the frequency and types of encounters between patients and GPs at practices included in the MedicineInsight dataset. Based on the inclusion criteria, data on 10,429,217 encounters between patients and GPs during 2016–17 were included, representing 7.0% of GP encounters in Australia.

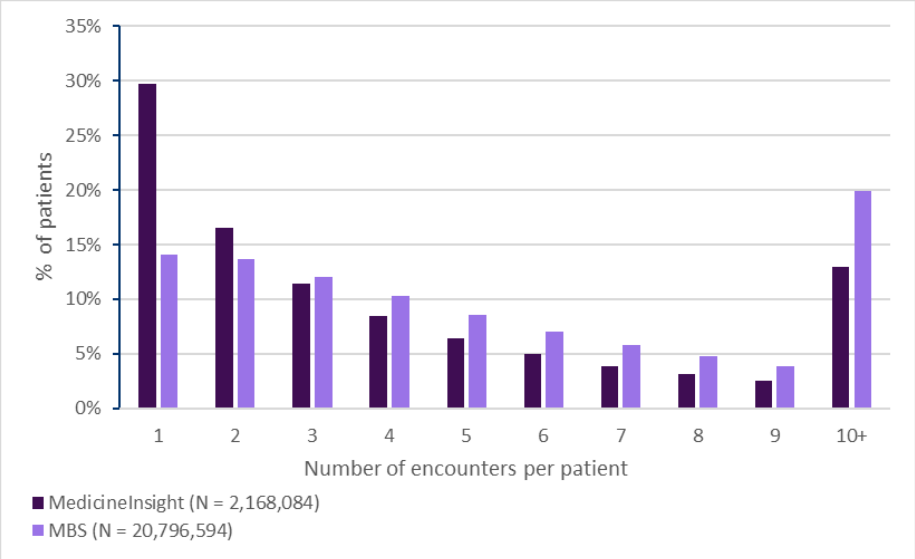
On average, there were 4.6 (95% CI 4.4 to 4.7) encounters per patient in the study cohort, compared to a national average of 6.3 MBS[8] services per patient. We underestimate the number of encounters for patients, but this is in the order of only 1.7 encounters per patient per year, on average.

4.1 Encounters by patient

The relative distribution of the number of encounters by patient in MedicineInsight and the MBS is shown in Figure 4.1. The MedicineInsight data show a peak at 1 visit, with 29% of patients having only one encounter. This is contrasted by the MBS data which show only 14% have one encounter. This gives us some useful information about the different number of encounters that a patient might have at an individual practice from the MedicineInsight data compared with how many encounters they may have overall, given by the MBS data.

MBS patient loyalty data[10] show a positive correlation between the number of practices visited, and the average number of encounters per year for a patient. This is reflected in Figure 4.1, which compares MBS and MedicineInsight data on the relative frequency of encounters per patient. Nearly 30% of patients in MedicineInsight are recorded as having an encounter only once during the study period, compared with only 14% of patients nationally.

Figure 4.1 Relative frequency distribution of encounters by patient, MedicineInsight and MBS



The average number of encounters by patient varied between different states and territories, ranging from 3.7 in the Northern Territory, to 5.3 in Tasmania (Table 4.1). Patients residing in inner regional areas had a higher average number of encounters (average 5.0; 95% CI 4.8 to 5.2), and those living in remote/very remote areas had the lowest average number of encounters (average 3.6; 95% CI 3.0 to 4.1), compared with other regions. MBS data also show that patients in remote and very remote regions had a lower number of encounters (5.9) than the national average. However, in contrast to MBS data, MedicineInsight patients in major city areas had, on average, relatively fewer encounters (4.4; 95% CI 4.3 to 4.6). This is likely to reflect differences in ease of access to multiple practices in different geographical areas. Patients in major cities are potentially more likely to attend multiple GP practices, with greater density of practices and more convenient access. Consequently, information about these patients may be incomplete in the MedicineInsight dataset. Further analyses could be undertaken on the national patient loyalty data to understand distribution of activity in different locations such as by state/territory, rurality or PHN.

Table 4.1 Average number of encounters by patient sociodemographic characteristic and location

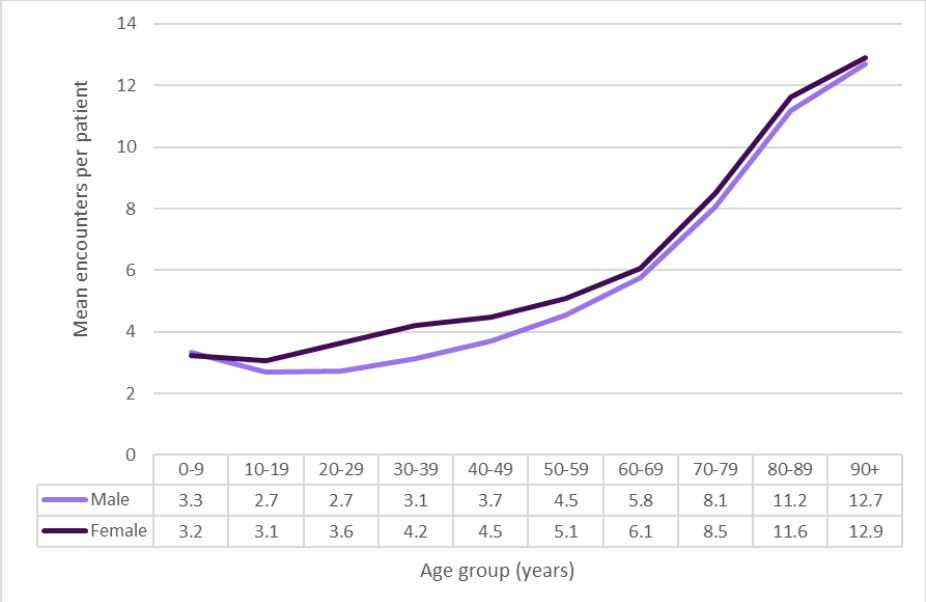
	Weighted MedicineInsight data		Unweighted MedicineInsight data		MBS data 2016–17*
Demographic characteristic	**Average number of encounters by patient**	**95% CI**	**Average number of encounters by patient**	**95% CI**	**Average number of encounters by patient**
All patients	4.5	(4.4, 4.7)	4.6	(4.4, 4.7)	6.3
Sex					
Male	4.2	(4.1, 4.3)	4.5	(4.5, 4.5)	6.1
Female	4.8	(4.7, 5.0)	5.1	(5.1, 5.1)	7.4
Age group (years)					
0–9	3.3	(3.2, 3.4)	3.2	(3.2, 3.3)	5.3
10–19	2.9	(2.8, 2.9)	2.9	(2.9, 2.9)	4.2
20–29	3.2	(3.1, 3.4)	3.3	(3.3, 3.3)	5.7
30–39	3.7	(3.6, 3.8)	3.7	(3.7, 3.8)	6.0
40–49	4.1	(4.0, 4.2)	4.1	(4.1, 4.2)	6.1
50–59	4.8	(4.7, 4.9)	4.8	(4.8, 4.9)	6.8
60–69	5.9	(5.8, 6.0)	5.9	(5.9, 6.0)	8.1
70–79	8.3	(8.1, 8.5)	8.3	(8.3, 8.4)	11.1
80–89	11.4	(11.2, 11.7)	11.6	(11.5, 11.7)	14.5
90+	12.8	(12.3, 13.3)	13.2	(13.0, 13.3)	16.2
State/Territory					
NSW	4.4	(4.3, 4.6)	4.7	(4.7, 4.7)	7.0
VIC	4.7	(4.4, 5.0)	4.9	(4.9, 4.9)	6.9
QLD	4.6	(4.4, 4.8)	4.9	(4.8, 4.9)	6.8
WA	4.3	(4.0, 4.7)	4.5	(4.5, 4.5)	6.1
TAS	5.3	(4.8, 5.7)	5.5	(5.5, 5.5)	6.2
SA	4.8	(4.5, 5.1)	5.3	(5.2, 5.3)	6.8
ACT	4.1	(3.5, 4.6)	4.4	(4.4, 4.4)	5.5
NT	3.7	(2.6, 4.8)	4.6	(4.4, 4.7)	5.6

Demographic characteristic	Weighted MedicineInsight data		Unweighted MedicineInsight data		MBS data 2016–17*
	Average number of encounters by patient	95% CI	Average number of encounters by patient	95% CI	Average number of encounters by patient
Rurality					
Major city	4.4	(4.3, 4.6)	4.6	(4.6, 4.6)	6.9
Inner regional	5.0	(4.8, 5.2)	5.3	(5.2, 5.3)	6.6
Outer regional	4.5	(4.3, 4.7)	5.1	(5.0, 5.1)	6.7
Remote/very remote	3.6	(3.0, 4.1)	3.7	(3.6, 3.8)	5.9
Socio-economic status (SEIFA IRSAD quintile)					
1 (most disadvantaged)	5.1	(4.8, 5.4)	5.4	(5.4, 5.5)	7.5
2	4.8	(4.6, 5.0)	5.0	(5.0, 5.0)	7.1
3	4.8	(4.6, 5.1)	5.1	(5.1, 5.1)	6.9
4	4.3	(4.2, 4.5)	4.5	(4.5, 4.6)	6.8
5 (most advantaged)	4.1	(4.0, 4.3)	4.3	(4.3, 4.3)	6.1

* Data source: Medicare Benefits Schedule statistics, 2016–17 (data provided by DoH).[19]

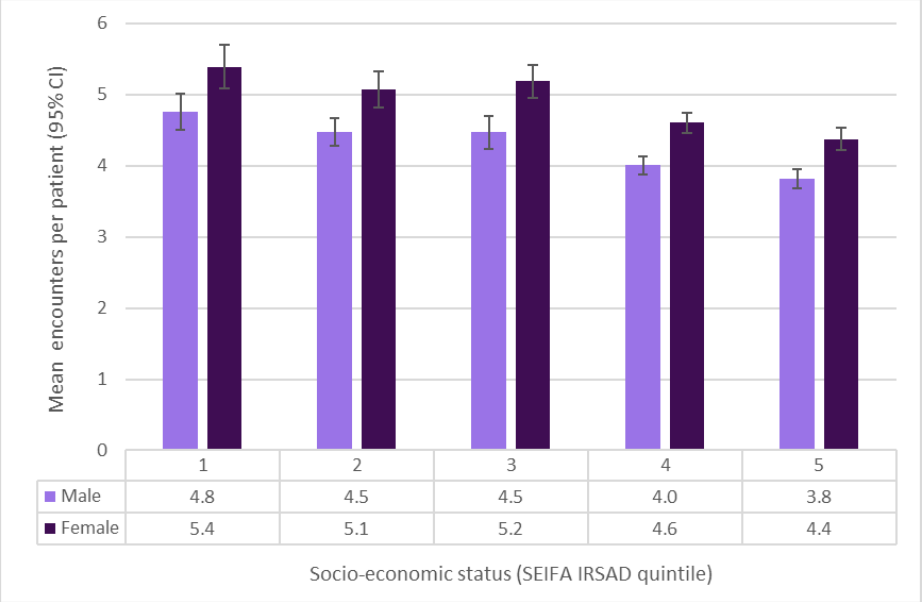
As demonstrated in Figure 4.2, using weighted data, the average number of encounters increased with age in both sexes, and females had more encounters in all age groups compared with males, except for the 0–9-year age bracket. The greatest difference between females and males was in the 20-49-year age brackets, which is consistent with BEACH,[1] and reflects their finding that female-specific conditions accounted for a quarter of all problems managed by GPs for women in childbearing years.[24]

Figure 4.2 Average number of encounters, by age group and sex (weighted)



Patients residing in areas of greater socio-economic disadvantage had a slightly higher average number of encounters compared with patients in areas of least socio-economic disadvantage (5.1 compared with 4.1). In all SEIFA quintiles, females had a higher average number of encounters than males (Figure 4.3).

Figure 4.3 Average number of encounters, by sex and socio-economic group (weighted)



SEIFA IRSAD quintile: 1: most disadvantaged; 5: most advantaged

The distribution of the proportion of encounters, stratified by patient age, in the MedicineInsight unweighted data followed a similar trend to that of the MBS and weighted data (Figure 4.4). Comparing MedicineInsight weighted and unweighted encounter data with data from the MBS,[19] we observed that patients aged between 50 and 79 had the highest proportion of encounters compared with other age groups.

Figure 4.4 Proportion of encounters by age group, MedicineInsight unweighted and weighted data compared with MBS

4.2 Reason for encounter

MedicineInsight contains data on 'reason for encounter' (RFE) which is entered in a coded (Docle/ Pyefinch) or free-text format. The RFE field contains data for 73% of the 10,429,217 encounters included in this cohort, of which 80% were coded entries and 20% free text.

We have analysed the 100 most frequent RFEs in the unweighted data, representing 42% of all encounters with an RFE. Under the guidance of two clinicians, we aggregated similar clinical reasons together (eg, viral/URTI and URTI/viral were aggregated into the category 'URTI'). The five most common RFEs in our data were to obtain a prescription, for review/follow-up purposes, upper respiratory tract infection, immunisation, and to discuss results. However, we found that some of the most frequently given reasons for encounter may not have been associated directly with a GP consultation, and both registered nurse and receptionist feature in the top 20 most common RFEs (Table 4.2).

In consultation with MedicineInsight practices, the data in this field require further exploration in future validation studies, as GPs record similar data in progress notes or reason for prescription or diagnoses fields. The data in the RFE field do not equate to the conditions for which patients consult a GP. For example, depression occurs in 0.8% of all RFE fields, yet 8% of the top 30 original prescriptions are for antidepressants (see Table 7.3 in Chapter 7).

Table 4.2 Most common RFEs, MedicineInsight unweighted data

Reason for encounter	Percentage of total encounters	Rank
Prescription	3.96	1
Review or follow-up	3.82	2
Upper respiratory tract infection (URTI)	2.72	3
Immunisation	2.45	4
Discussion of test results	2.10	5
Hypertension	1.49	6
Registered nurse	1.42	7
Referral letter	1.22	8
Wound care/dressing change	1.17	9
Pap smear	0.88	10
International Normalised Ratio (INR)/INR management	0.83	11
Depression	0.80	12
Cough	0.62	13
Anxiety	0.59	14
Check-up	0.58	15
Skin check	0.55	16
Back pain	0.55	16
Asthma	0.54	18
Receptionist	0.52	19
Sinusitis	0.52	19

5 CHRONIC CONDITIONS

This chapter reports on selected chronic conditions recorded in MedicineInsight as a proportion of all patients and as a rate per 100 encounters, including comparison with national data sources where relevant.

5.1 Identifying conditions

In this report, conditions were selected for inclusion based on whether they were identified as one of the top 10 most common chronic problems managed in the 2015–16 BEACH report[1] and data on a further four common conditions that were available in MedicineInsight as a result of its use in reporting back to practices to support quality improvement activities.

The BEACH data are based on 'problems managed'. This is the provider's understanding of a health problem and, as part of the data collection, the GP is asked to record up to four problems. In MedicineInsight, conditions data are based on data from multiple fields (reason for encounter, reason for prescription and a diagnosis or medical history field). None, one or many conditions may be recorded at an encounter.

For this chapter, data on conditions are presented in two ways: (1) whether the condition was recorded on the same day as an encounter during the 2016–17 study period; or (2) whether the condition was ever recorded in the MedicineInsight data for that patient.

5.2 Conditions by patient

Table 5.1 shows the proportion of patients with the selected chronic conditions recorded at encounters in 2016–17. Among the selected conditions, the six most common conditions recorded at encounters in 2016–17 for the weighted MedicineInsight patient population were hypertension, depression, dyslipidaemia, anxiety, asthma and gastro-oesophageal disease (Table 5.1).

Table 5.1 Proportion of MedicineInsight patients with selected chronic conditions recorded at encounters in 2016–17

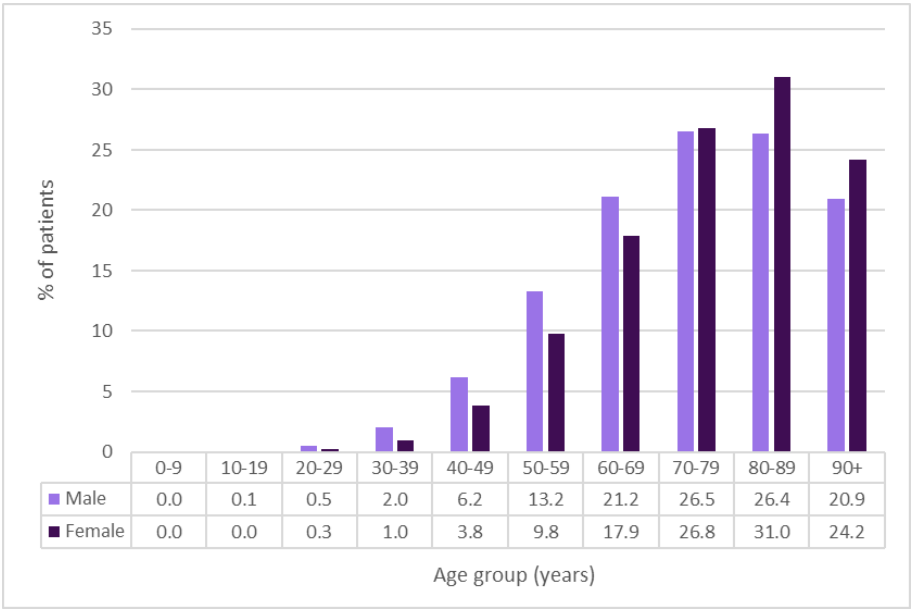
Condition	Weighted data		Unweighted data (N = 2,168,084)
	% patients	(95% CI)	% patients
Hypertension*	7.3	(6.8, 7.7)	8.4
Depression*	5.5	(5.1, 5.9)	5.6
Dyslipidaemia*	4.4	(4.0, 4.7)	4.9
Anxiety	4.4	(4.1, 4.7)	4.4
Asthma*	4.2	(3.9, 4.4)	4.2
Gastro-oesophageal disease*^	4.1	(3.8, 4.4)	4.6
Diabetes mellitus *	3.0	(2.8, 3.2)	3.3
Arthritis*	2.6	(2.3, 2.8)	2.9
Cardiovascular disease	1.9	(1.7, 2.0)	2.2
Osteoporosis*	1.0	(0.9, 1.1)	1.2
Malignant neoplasm, skin*	1.0	(0.9, 1.1)	1.2
COPD	0.9	(0.8, 1.0)	1.1
Atrial fibrillation*	0.7	(0.7, 0.8)	0.9
Heart failure	0.4	(0.4, 0.4)	0.5

* Most common problems managed: Britt et al, General practice activity in Australia (BEACH) 2015–16.[1]
^ Referred to in the BEACH report as oesophageal disease.

Figures 5.1 to 5.4 show age- and sex-specific rates for patients with the four most common chronic conditions recorded at encounters in the study period: hypertension; depression; dyslipidaemia; and anxiety.

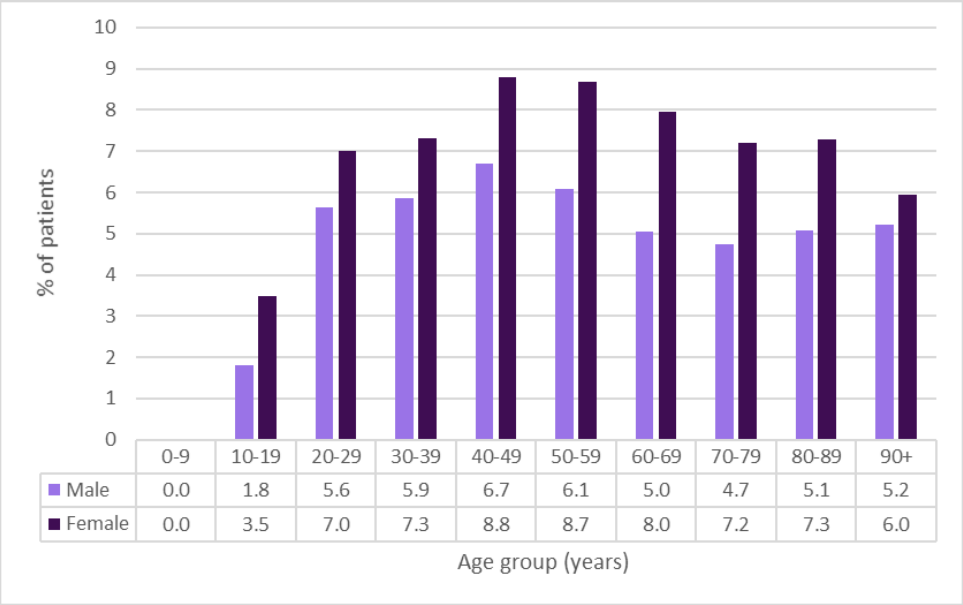
As expected, the rate of patients with hypertension recorded in 2016–17 increased with age until 79 years for males, and 89 years for females (Figure 5.1). Females aged 80–89 years had the highest recorded rate of hypertension overall (30%). However, hypertension was more frequently recorded in male patients attending general practice until the age of 69 years.

Figure 5.1 Age- and sex-specific rates for patients with hypertension recorded in 2016–17 (weighted)



Across all age groups, females were more likely to have a record of depression than males. The highest rate was seen in females aged 40–59 years, with almost 9% of female patients in this age bracket presenting to general practice with a record of depression (Figure 5.2).

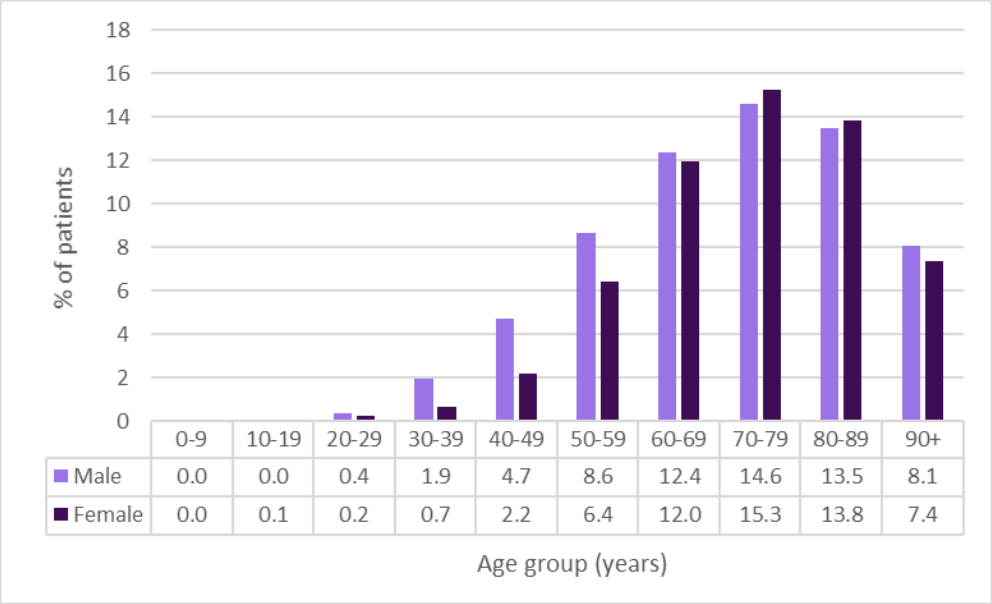
Figure 5.2 Age- and sex-specific rates for patients with depression recorded in 2016–17 (weighted)



	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90+
Male	0.0	1.8	5.6	5.9	6.7	6.1	5.0	4.7	5.1	5.2
Female	0.0	3.5	7.0	7.3	8.8	8.7	8.0	7.2	7.3	6.0

Males were more likely to have dyslipidaemia recorded (Figure 5.3) compared with females in age groups up to 59 years, after which the rates are more similar. Females aged 70–79 years had the highest rate of dyslipidaemia (15.3%).

Figure 5.3 Age- and sex-specific rates for patients with dyslipidaemia recorded in 2016–17 (weighted)



	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90+
Male	0.0	0.0	0.4	1.9	4.7	8.6	12.4	14.6	13.5	8.1
Female	0.0	0.1	0.2	0.7	2.2	6.4	12.0	15.3	13.8	7.4

As with depression, females were more likely to have a record of anxiety compared with males across all age groups. However, it was most frequently recorded in females aged 20–29 years (7.2%) (Figure 5.4).

Figure 5.4 Age- and sex-specific rates for patients with anxiety recorded in 2016–17 (weighted)

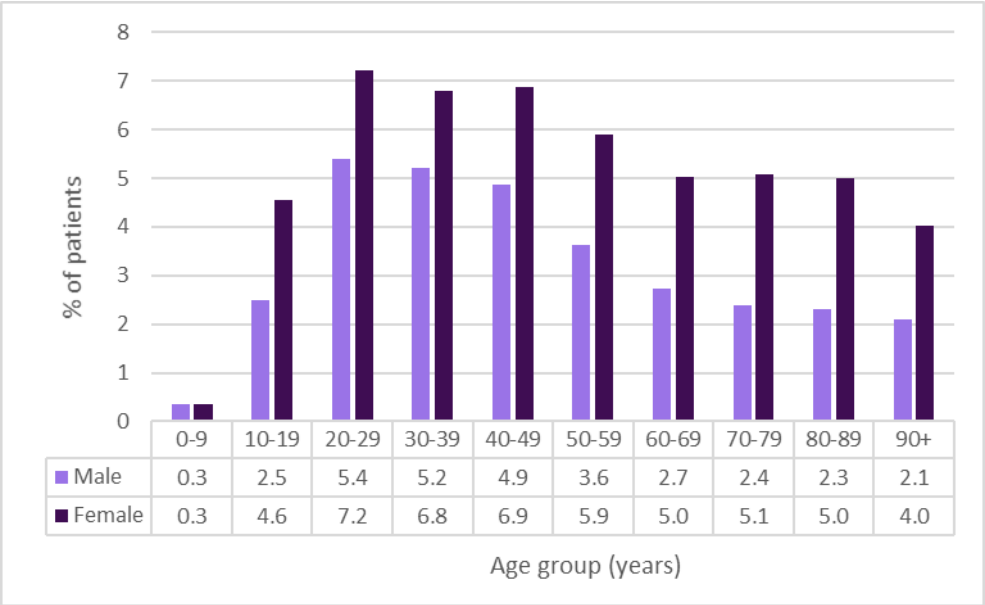


Table 5.2 shows the proportion of patients with the selected chronic conditions ever recorded in MedicineInsight. The unweighted proportion of patients who had hypertension ever recorded was 18.1%, followed by 14.2% for depression, 11.8% for asthma and 11.1% for anxiety disorders.

These data are compared with data from the ABS NHS[2] for persons who reported seeing a GP in the previous 12 months. The ABS NHS and MedicineInsight use different classification systems and definitions, so care needs to be taken when comparing MedicineInsight data with the NHS data. The weighted MedicineInsight data shows that hypertension is the most common chronic condition that patients in general practice have recorded as a condition, with 15.7% of patients in the cohort having any record of a diagnosis of hypertension in their clinical notes (excluding progress notes), while 13.1% of people in the ABS NHS self-report hypertension as a current long-term health condition.

The ABS NHS found that the most common of these self-reported selected conditions is arthritis (17.2%) for people who reported attending a general practice in the previous year. It is possible that these differences are because patients may self-manage their arthritis rather than seeking treatment from their GPs.

Table 5.2 Proportion of patients with selected chronic conditions ever recorded in MedicineInsight

	Weighted data		Unweighted data (N = 2,168,084)	ABS National Health Survey 2014–15* (current conditions only)
Condition	% patients	(95% CI)	% patients	% patients
Hypertension	15.7	(14.9, 16.6)	18.1	13.1
Depression	13.6	(12.9, 14.3)	14.2	10.1
Asthma	11.7	(11.2, 12.2)	11.8	12.1
Anxiety	11.0	(10.4, 11.5)	11.1	12.3
Arthritis	9.3	(8.6, 10.0)	10.9	17.2
Diabetes mellitus	5.5	(5.2, 5.7)	6.2	5.9
Cardiovascular disease	4.7	(4.3, 5.1)	5.7	5.8
COPD	2.2	(2.0, 2.4)	2.6	3.0
Atrial fibrillation	1.6	(1.4, 1.7)	1.9	1.1
Heart failure	0.9	(0.8, 1.0)	1.1	0.6

* Data source: ABS National Health Survey 2014–15, (data provided by ABS).[2]

5.3 Conditions by encounter

The rate of patients with one of the selected chronic conditions reported for every 100 encounters from the MedicineInsight and BEACH data is presented in Table 5.3. Both data sources shared the same top two conditions or problems managed, which were hypertension and depression.

For most MedicineInsight conditions, with the exception of anxiety, rates per 100 encounters were lower than those reported in BEACH. This may occur for several reasons. For example, conditions that have previously been entered into the patient record might not be re-entered by the GP into the relevant CIS fields used for analysis (reason for encounter, reason for prescription or medical history or diagnosis fields), or data may be entered into the progress notes (which are not accessible to MedicineInsight). In the BEACH data, GPs are asked to provide complete information on specifically designed forms about the problems managed at a given encounter.

Anxiety is not included in the BEACH top 10 most frequently managed chronic problems – it is the 25th most commonly managed chronic problem. COPD is the 14th most commonly managed chronic problem and heart failure is the 20th most common. Other common chronic problems reported in BEACH are not yet coded by MedicineInsight (hypothyroidism/myxoedema and back syndrome with radiating pain).

Table 5.3 Selected conditions recorded per 100 encounters in 2016–17

	Weighted data		BEACH 2015–16*			
Condition	Conditions per 100 encounters	(95% CI)		Problems per 100 encounters	(95% CI)	Rank (of top 30)
Hypertension	2.5	(2.3, 2.6)	Hypertension (non-gestational)	7.5	(7.0, 7.9)	1
Depression	2.0	(1.8, 2.1)	Depressive disorder	4.2	(4.0, 4.4)	2
Asthma	1.7	(1.6, 1.8)	Asthma	2.0	(1.8, 2.1)	7
Anxiety	1.6	(1.5, 1.8)	Anxiety disorder	0.5	(0.4, 0.5)	25
Dyslipidaemia	1.2	(1.1, 1.3)	Lipid disorder	3.0	(2.8, 3.3)	5
Oesophageal disease	1.2	(1.1, 1.2)	Oesophageal disease	2.6	(2.4, 2.8)	6
Diabetes mellitus	1.0	(0.9, 1.1)	Diabetes (non-gestational)	4.0	(3.7, 4.3)	3
Arthritis	0.6	(0.6, 0.7)	Chronic arthritis	3.5	(3.3, 3.7)	4
Cardiovascular disease	0.5	(0.4, 0.5)	Ischaemic heart disease	0.9	(0.8, 1.0)	13
Atrial fibrillation	0.2	(0.1, 0.2)	Atrial fibrillation/flutter	1.3	(1.1, 1.4)	8
Malignant neoplasm, skin	0.2	(0.2, 0.3)	Malignant neoplasm, skin	1.1	(0.9, 1.2)	9
Osteoporosis	0.2	(0.2, 0.2)	Osteoporosis	1.0	(0.9, 1.1)	10
COPD	0.2	(0.2, 0.3)	COPD	0.9	(0.8, 1.0)	14
Heart failure	0.1	(0.1, 0.1)	Heart failure	0.5	(0.5, 0.6)	20

* Data source: Britt et al, General practice activity in Australia (BEACH) 2015–16.[1]
Note: The classification systems for BEACH and MedicineInsight are not completely consistent eg, cardiovascular disease in MedicineInsight includes a wider range of disease than ischaemic heart disease.

5.4 Using MedicineInsight condition data to inform clinical practice

The following vignette on the prevention and management of cardiovascular disease demonstrates how these data are being used to support quality improvement in MedicineInsight general practices. The data in the vignette are from a recent practice report and use a separate set of data inclusion criteria, and the cohort and denominators in the vignette are different from those used in this report. The data in this vignette are not intended to show indications of population health, and should not be interpreted in this way.

Using MedicineInsight data: Prevention and management of cardiovascular disease

General practices participating in MedicineInsight are provided with transformed data via practice reports, along with patient lists to help them follow up patients who may not be receiving optimal management. Regular benchmarked reports, on a range of topics related to the national therapeutic programs developed by NPS MedicineWise, are used to identify clinical practice gaps, promote effective patient management and improve patient outcomes. To provide meaningful information to inform clinical care and support clinical decision making, these reports contain information on conditions; patient demographics; clinical information including risk factors and comorbidities; medicines prescribed; and pathology test results.

How can the data be used to assist clinical decision making?

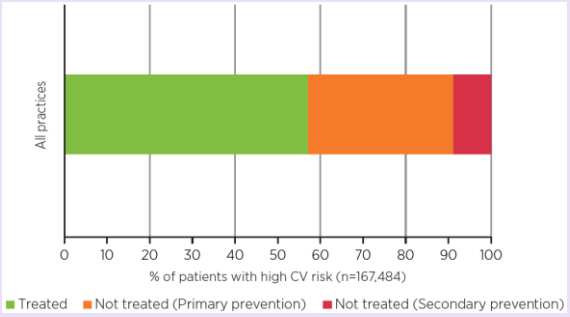
In 2017, NPS MedicineWise rolled out a national program on improving the management of cardiovascular disease (CVD) across Australia and practices were provided with benchmarked reports containing data at a GP, practice and national level. RACGP Redbook[15] guidelines recommend testing serum lipid levels every 5 years from the age of 45, or from age 35 if the individual is of Aboriginal or Torres Strait Islander background. Some of the aggregate national data shared with practices are shown below, based on a cohort of active patients at March 2018, which contained data from 867,558 patients aged 45–75 years.

To calculate absolute CVD risk, which is an estimate of the risk of having a CVD event such as a heart attack in the next 5 years, the results of lipid testing were used with other cardiovascular risk factors such as age, family history of CVD, smoking status and comorbidities. In this cohort, 9.4% of patients had a recorded diagnosis of dyslipidaemia, 2.7% had a record of previous CVD and 8.9% were prescribed lipid-modifying medicines, of which 96% were statins.

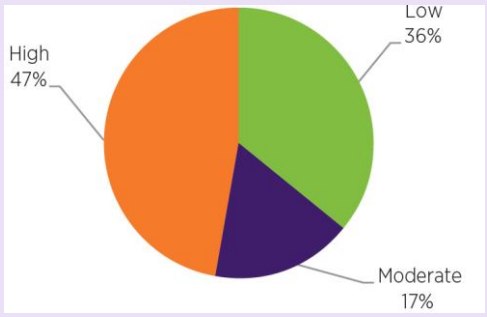
CVD risk was assessable for 60% of patients. This was calculated using information about diagnoses (eg, history of CVD, diabetes, chronic kidney disease), clinical measures (eg, blood pressure), pathology test results (eg, eGFR, total cholesterol) and Indigenous status.

High CVD risk was found in 7% of patients. Of these, 43% were not treated with statins, identifying a significant proportion of patients who may be missing out on therapy proven to reduce risk of cardiovascular events and mortality.

Proportion of patients aged 45–74 years at high CVD risk according to statin treatment and prevention status



Proportion of patients on statins according to CVD risk prior to starting treatment



Previous clinical guidelines suggested that everyone with abnormal lipid levels should be treated with lipid-modifying medicines. However, the most recent evidence-based guidelines recommend that only patients with a moderate to high CVD risk should be treated. Of those treated with a statin, over one-third of patients had low CVD risk recorded before starting a statin and may be less likely to benefit from treatment.

To our knowledge this is the first time that pre-treatment CVD risk has been calculated in Australia.

What are the implications?

MedicineInsight data can be used to support general practices, and guide management and treatment decisions for patients with specific conditions who may benefit from more appropriate management.

6 RISK FACTORS

This chapter presents data on three important risk factors which have a significant impact on the health of the Australian population: smoking status, BMI and alcohol use. Comparisons with ABS NHS 2014–15[2] are included where available.

6.1 Smoking status

Smoking status is recorded for 82% of MedicineInsight patients aged 16 years and over. Table 6.1 presents the weighted and unweighted data on the most recently recorded smoking status in the patient records. Smokers accounted for 15.6% of patients aged 16 years and older with smoking status recorded, and 21.6% were ex-smokers. Compared with data from the ABS NHS, a similar proportion of patients were reported as smoking (16%) but fewer were recorded as ex-smokers (21.6% vs 30%).

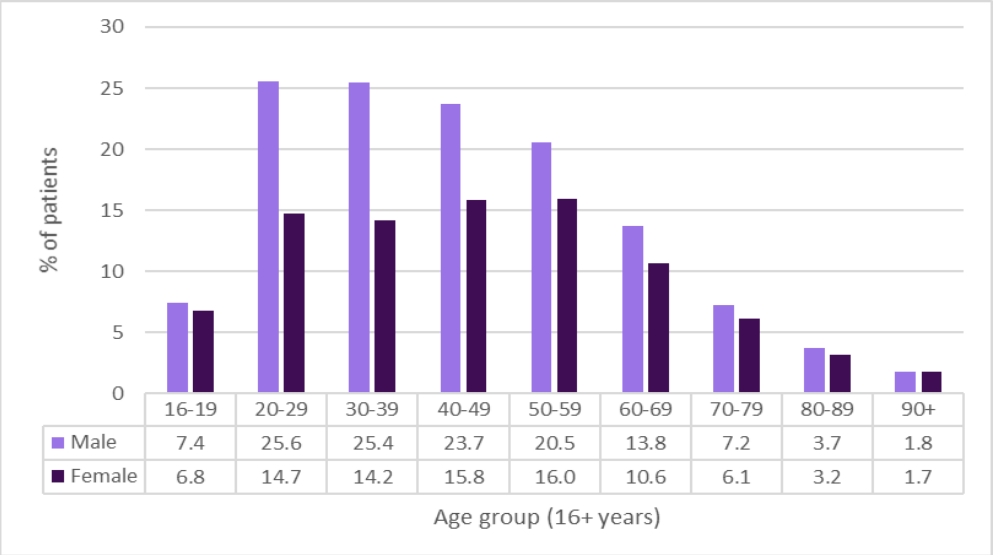
Table 6.1 Smoking status recorded for patients 16 years and over

Risk factor	Weighted data		Unweighted data N = 1,461,756*	ABS National Health Survey 2014–15**
	% patients	(95% CI)	% patients	% patients
Smoking status (18% missing)				
Smoker	15.6	(14.7, 16.4)	15.2	15.6
Ex-smoker	21.6	(20.6, 22.5)	22.8	30.4
Non-smoker	62.9	(61.7, 64.1)	62.0	54.0

* Including patients over 16 years of age who had smoking status recorded.
** Data source: ABS National Health Survey 2014–15 (data provided by ABS).[2]

Where smoking status was recorded, males were more likely to be current smokers than females across all age groups (Figure 6.1). Males aged 20 to 39 years had the highest recorded rates of smoking, which then decreased with age. Around 15% of women aged 20 to 59 years were recorded as current smokers, and this also decreased with age.

Figure 6.1 Smoking rates recorded in patients aged 16 years or more, by age group and sex (weighted)



6.2 Body mass index status

BMI or both height and weight were recorded within a 24-month period for 29% of patients aged 18 years and older. One-third of these patients were overweight and a further 36% were obese. Compared with ABS NHS data, a higher proportion of MedicineInsight patients were obese (29% vs 36% respectively) and a lower proportion were of normal weight (35% vs 28% respectively) (Table 6.2). This may reflect GP clinical practice of more regularly recording the weight and BMI of at-risk patients.

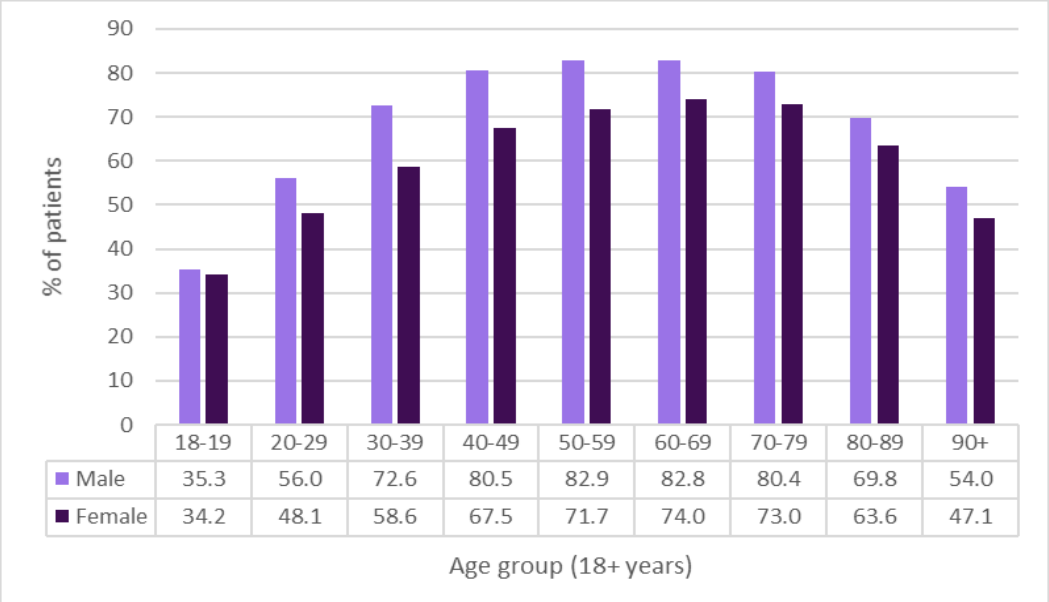
Table 6.2 BMI status recorded for patients 18 years and older

Risk factor	Weighted data		Unweighted data N = 640,214*	ABS National Health Survey 2014–15**
	% patients	(95% CI)	% patients	% patients
BMI status (71% missing)				
Underweight (< 18.5)	2.2	(2.1, 2.3)	2.1	1.6
Normal weight (18.5 to < 25.0)	28.4	(27.5, 29.3)	28.0	34.6
Overweight (25.0 to < 30.0)	33.0	(32.8, 33.3)	33.3	35.3
Obese (≥ 30.0)	36.4	(35.4, 37.5)	36.6	28.6

* Patients over 18 years of age who had BMI status available.
** Data source: ABS National Health Survey 2014–15 (data provided by ABS).[2]

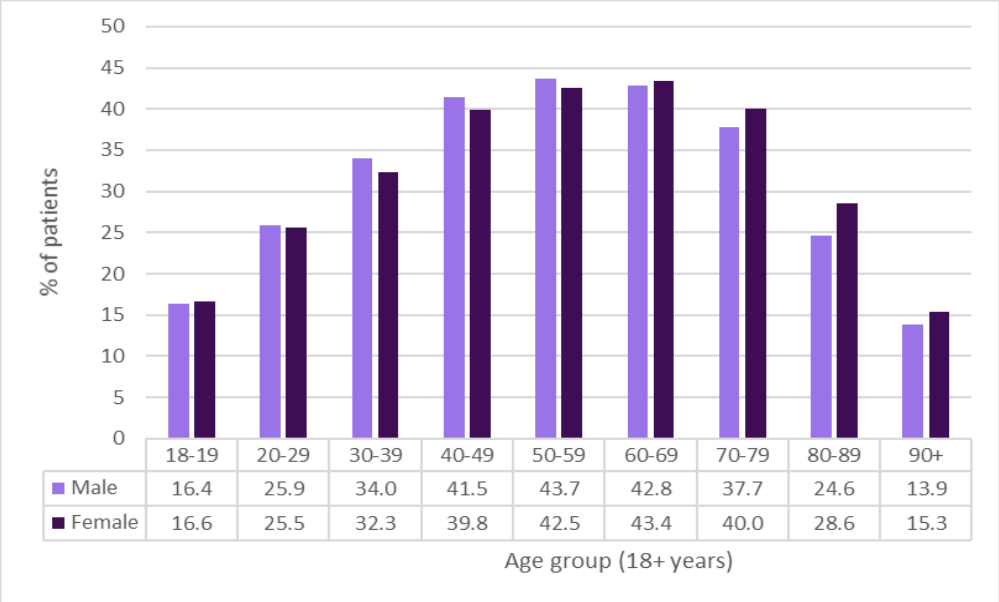
Rates of overweight or obesity increased with age for both sexes until 70 years of age (Figure 6.2). More than 80% of males aged 40–79 years were overweight or obese. Results from the ABS NHS[2] also showed a similar trend with a greater proportion of males being overweight or obese in all age groups. A higher proportion of patients were obese compared with the ABS NHS (36.4% vs 28.6%).

Figure 6.2 Age- and sex-specific rates of overweight or obesity in patients aged 18 years or more (weighted)



When recorded obesity alone was examined, over 30% of men and women between the ages of 30 and 79 years were obese (Figure 6.3).

Figure 6.3 Age- and sex-specific rate of obesity in patients aged 18 years or more (weighted)



6.3 Alcohol consumption

Information on self-reported alcohol consumption in the 2016-17 financial year, including the number of units per week for patients with alcohol use recorded, was available for only 14% of patients aged 16 years and over (Table 6.3). Of these patients, 42% were recorded as non-drinkers. One in 10 patients with alcohol use recorded (11%) drank more than 14 standard drinks per week (or more than two standard drinks per day), on average, thus increasing their lifetime risk of harm from alcohol-related disease or injury.[25]

It is not possible to directly compare this data with the ABS NHS[2] due to differences in methodology and populations used in these studies. However, analyses of the ABS NHS[2] (for persons aged 16 years and over who had visited a GP in the last 12 months) show that 20.2% last consumed alcohol more than 12 months ago or had never consumed alcohol; 22.9% did not consume alcohol in the last week but did less than 12 months ago, while 56.3% had consumed alcohol in the last week. The ABS NHS[2] found that 16.5% of people aged 16 years and over who had visited a GP in the last 12 months, consumed more than two standard drinks per day on average. A national survey conducted in 2018 by the Foundation for Alcohol Research and Education found that 18% of respondents did not consume alcohol.[26]

Table 6.3 Alcohol consumption status recorded in 2016–17 for patients 16 years and over

Risk factor	Weighted data		Unweighted data N = 245,401
	% patients	(95% CI)	% patients
Alcohol use, units per week (86% missing)			
None	42.0	(39.5, 44.5)	42.4
1–7	35.2	(33.5, 36.8)	35.1
8–14	12.3	(11.4, 13.1)	12.2
15–28	7.1	(6.5, 7.7)	7.0
29–42	2.2	(2.0, 2.4)	2.1
43+	1.3	(1.2, 1.4)	1.3

* Including patients over 16 years of age who had alcohol consumption status available.

6.4 Recording of risk factors in MedicineInsight

Most patients aged 16 years and older (82%) had their smoking status recorded; BMI data was available for 29% of patients aged 18 years and older; and 14% of patients aged 16 years and older had data for alcohol use recorded.

Table 6.4 summarises patient characteristics for those with smoking status recorded. Both males and females over the age of 16 have similar rates of smoking status (which includes current, former and never smokers) recorded at just over 80%. Apart from teenagers 16–19 years old, a high proportion of patients across all other age groups had smoking status recorded, with a peak for those aged 70–79 years. There were no obvious trends in variability of recording smoking status among patients living in different socio-economic areas.

Table 6.4 Sociodemographic characteristics of patients aged 16 years and older with smoking status recorded (weighted)

Characteristic	Smoking status recorded	
	%	95% CI
Sex		
Male	80.7	(79.2, 82.3)
Female	82.7	(81.3, 84.1)
Age group		
16–19	57.3	(54.7, 59.9)
20–29	76.0	(73.0, 78.9)
30–39	81.5	(79.7, 83.4)
40–49	84.5	(83.1, 85.9)
50–59	86.4	(85.2, 87.6)
60–69	86.6	(85.5, 87.7)
70–79	87.5	(86.6, 88.4)
80–89	86.6	(85.3, 87.9)
90+	79.1	(76.3, 82.0)
Socio-economic status (SEIFA IRSAD quintile)		
1 (most disadvantaged)	84.2	(82.7, 85.7)
2	82.7	(80.3, 85.0)
3	84.0	(82.3, 85.6)
4	81.2	(78.9, 83.5)
5 (most advantaged)	78.9	(76.5, 81.4)

Table 6.5 shows the patient characteristics for those with BMI data recorded, including BMI or the separate components of height and weight that were used to calculate BMI. Around one-third of all males and females had BMI recorded and recording increased with each decade until reaching a peak for those aged 80–89 years. BMI was recorded most often for those residing in more disadvantaged areas (SEIFA IRSAD 1), and least often for those residing in the most advantaged areas (SEIFA IRSAD 5). People living in more advantaged areas have been shown to have lower rates of obesity[12] and these lower-risk patients may not be monitored for BMI as regularly.

Table 6.5 Sociodemographic characteristics of patients aged 18 years and older with BMI status recorded (weighted)

Characteristic	BMI status recorded	
	% patients	95% CI
Sex		
Male	35.3	(33.3, 37.3)
Female	35.8	(33.7, 37.8)
Age group		
18–19	22.2	(20.4, 24.0)
20–29	24.9	(22.2, 27.5)
30–39	29.4	(26.9, 31.8)
40–49	33.9	(31.5, 36.2)
50–59	38.5	(36.5, 40.5)
60–69	42.6	(40.6, 44.5)
70–79	51.2	(49.0, 53.4)
80–89	58.5	(56.1, 61.0)
90+	44.4	(41.6, 47.2)
Socio-economic status (SEIFA IRSAD quintile)		
1 (most disadvantaged)	40.0	(36.0, 44.1)
2	39.5	(37.0, 41.9)
3	36.8	(33.8, 39.8)
4	36.1	(33.2, 39.0)
5 (most advantaged)	29.7	(26.6, 32.8)

Although recording rates for alcohol use were relatively low for both men and women in the 2016–17 financial year, patients aged 80–89 years had the highest recording of alcohol use with about a quarter having alcohol use recorded (Table 6.6). Only 7% of teenagers aged 16–19 years had alcohol use recorded. There were no significant differences in the recording of alcohol status of patients residing in areas of different socio-economic advantage.

Table 6.6 Sociodemographic characteristics of patients aged 16 years and older with alcohol use recorded (weighted)

Characteristic	Alcohol recorded	
	% patients	95% CI
Sex		
Male	13.8	(12.0, 15.6)
Female	13.7	(11.8, 15.5)
Age group		
16–19	7.5	(6.3, 8.7)
20–29	12.8	(10.8, 14.9)
30–39	13.3	(11.4, 15.3)
40–49	13.1	(11.3, 14.8)
50–59	13.0	(11.2, 14.8)
60–69	13.8	(12.0, 15.6)
70–79	17.7	(15.4, 19.9)
80–89	23.7	(20.9, 26.5)
90+	19.0	(16.2, 21.8)
Socio-economic status (SEIFA IRSAD quintile)		
1 (most disadvantaged)	12.0	(9.1, 15.0)
2	15.9	(12.6, 19.2)
3	15.3	(12.1, 18.4)
4	15.0	(12.3, 17.6)
5 (most advantaged)	11.4	(9.4, 13.4)

7 PRESCRIPTIONS

This chapter reports on medicines prescribed in the general practice setting by GPs, whether or not the prescription was dispensed by a pharmacist to the patient. Information is included on all prescriptions for medicines categorised as PBS or RPBS or private scripts in the CIS. Medicines were grouped by ATC level 1 and 3, by patient and as a rate per 100 encounters.

In the unweighted data there were 8,032,699 original (not repeat) prescriptions and 25,514,037 total prescriptions, including originals and all repeats with ATC codes available (5.9% of original prescriptions were not able to be mapped to ATC codes). To provide a nationally representative sample, the prescription data were weighted using the encounter weights. Private prescriptions accounted for 14.5% of original prescriptions.

7.1 Prescription numbers

Nearly one-third of patients had no prescriptions recorded during the study period (31.1%) and a small proportion of patients (4.8%) had more than 15 original prescriptions recorded (Figure 7.1). The average number of original prescriptions recorded for patients in the cohort is 3.4 and the average for total prescriptions is 10.5. This is likely to be an underestimate of the total number of prescriptions per patient as it does not include those prescribed in other clinical settings or at practices that are not part of MedicineInsight.

Figure 7.1 Number of original prescriptions recorded per patient (weighted)

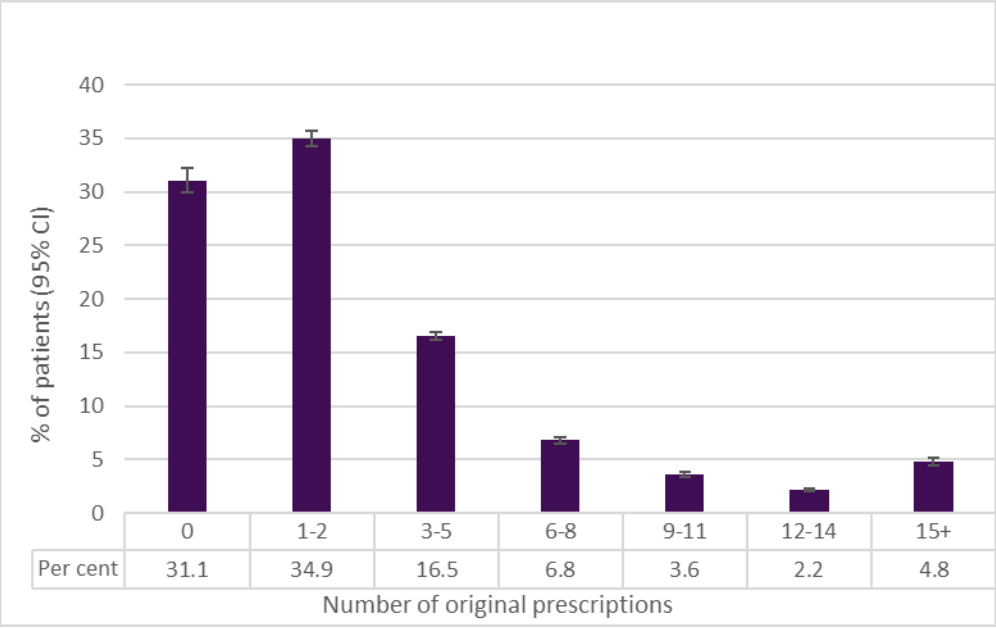


Table 7.1 shows the average number of original prescriptions recorded by patient characteristics. The average number of prescriptions was higher for females, increased with age and was highest among patients aged 80 and older. Patients residing in inner regional

areas had a higher average number of prescriptions compared with all other regions. Patients residing in Tasmania had the highest average number of prescriptions compared with all states/territories, and Northern Territory had the lowest, with nearly 50% fewer prescriptions per person than the national average. There are several explanations for the Northern Territory statistic. Firstly, it has the lowest median age of any state/territory in 2016 (32.4 years) while Tasmania has the highest (42 years),[27] and the average number of prescriptions increases with age. Secondly, 25.5% of Northern Territorians are Aboriginal and/or Torres Strait Islander,[28] a rate more than five times higher than for any other state/territory. Aboriginal and/or Torres Strait Islander people living in remote areas may receive a different model of primary health care. Remote Area Aboriginal Health Services have special arrangements to provide free specified PBS medicines to approved patients without writing a prescription, thus such prescriptions are not recorded in MedicineInsight.

Those residing in more disadvantaged areas (SEIFA IRSAD 1 and 2) also had a higher average number of prescriptions compared with those who resided in more advantaged areas (SEIFA IRSAD 4 and 5).

Table 7.1 Average number of original prescriptions recorded by patient characteristics (weighted)

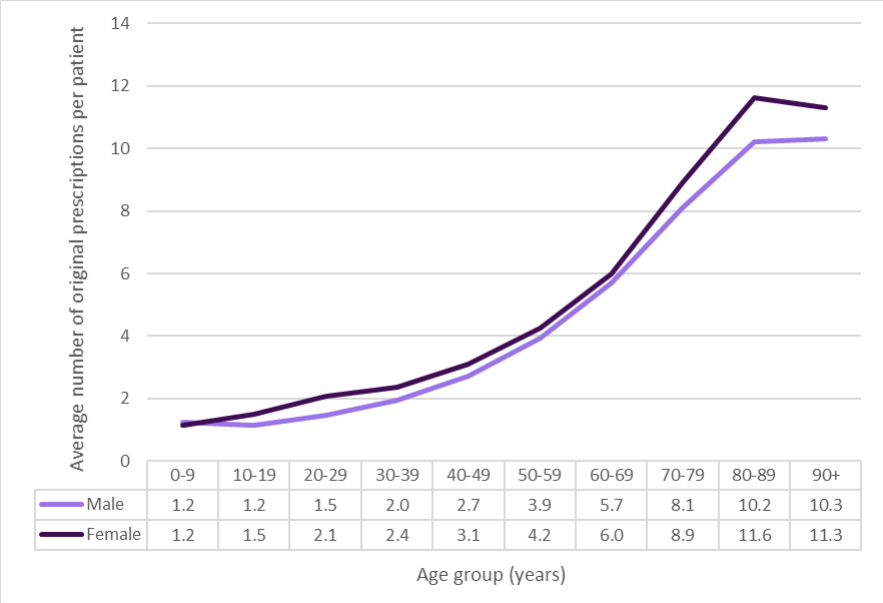
Characteristic	Weighted data	
	Average*	(95% CI)
Sex		
Male	3.2	(3.0, 3.3)
Female	3.6	(3.5, 3.8)
Age group (years)		
0–9	1.2	(1.1, 1.3)
10–19	1.3	(1.3, 1.4)
20–29	1.8	(1.7, 1.9)
30–39	2.2	(2.1, 2.3)
40–49	2.9	(2.8, 3.1)
50–59	4.1	(3.9, 4.3)
60–69	5.8	(5.6, 6.0)
70–79	8.5	(8.3, 8.8)
80–89	11.0	(10.7, 11.3)
90+	10.9	(10.4, 11.5)
Rurality		
Major city	3.2	(3.0, 3.4)
Inner regional	4.1	(3.9, 4.4)
Outer regional	3.5	(3.3, 3.8)
Remote/very remote	2.7	(2.1, 3.4)
State/Territory		
NSW	3.3	(3.1, 3.6)
VIC	3.5	(3.1, 3.9)
QLD	3.3	(3.1, 3.6)
WA	3.3	(2.9, 3.6)
TAS	4.3	(3.9, 4.7)
SA	3.8	(3.1, 4.4)
ACT	3.0	(2.7, 3.4)
NT	1.8	(1.2, 2.4)

Characteristic	Weighted data	
	Average*	(95% CI)
Socio-economic status (SEIFA IRSAD quintile)		
1 (most disadvantaged)	4.3	(4.0, 4.6)
2	3.8	(3.5, 4.1)
3	3.7	(3.4, 4.0)
4	3.1	(2.9, 3.2)
5 (most advantaged)	2.8	(2.6, 2.9)

* The average was based on all patients including those who did not have a prescription recorded.

There were similar age-specific patterns of prescribing for both males and females, with the highest average number of prescriptions observed for patients aged over 80 years (Figure 7.2). Across all age groups, the average number of prescriptions was greater for females than males.

Figure 7.2 Average number of original prescriptions recorded per patient, by age group and sex (weighted)



7.2 Prescriptions per medicine type

Original and total prescriptions were ranked from highest to lowest volume of total prescriptions for ATC level 1 (Table 7.2). National PBS data for the 2016–17 financial year, for all medicines dispensed where the prescription was written by a medical practitioner whose primary clinical specialty indicated they were a GP, are also included.

At ATC level 1, the most commonly prescribed medicines in the study cohort were for the cardiovascular system, 29.9% of total prescriptions in the weighted dataset, which is comparable to the 33% of medicines dispensed under the PBS. As expected, there was discrepancy between original prescriptions and total prescriptions, reflecting the natural history of the conditions for which GPs are prescribing. For example, chronic diseases will require ongoing repeat prescriptions, whereas acute or time-limited conditions will require fewer or no repeat prescriptions. An illustration of this is that anti-infective medicines are 16.6% of original prescriptions but only 8.2% of total prescriptions. The differences in proportions between

originals and repeats can be also explained by the limit on the number of repeats allowed under PBS restrictions for the various medicine subgroups such as opioids, hypnotics and sedatives, and anxiolytics.

Overall, there was close correlation between the MedicineInsight total prescriptions data and the PBS data, except for respiratory system prescriptions and prescriptions for the genitourinary system and sex hormones. Some of this variation in proportions between prescriptions recorded and medicines dispensed may be due to patients purchasing over-the-counter medicines, or not filling their prescriptions. The inclusion of private prescriptions in MedicineInsight may also account for some of this variation. In future, it will be possible to separately analyse private prescriptions in MedicineInsight, as these equate to 14.5% of all original prescriptions in the unweighted data.

Table 7.2 Number and proportion (%) of original and total prescriptions for ATC level 1 compared to number and proportion (%) of national PBS GP-prescribed medicines dispensed

		Original prescriptions			Total prescriptions*			PBS #	
ATC level 1	Medicine class	Unweighted data (number)	Unweighted data (%)	Weighted data (%)	Unweighted data (number)	Unweighted data (%)	Weighted data (%)	Number	%
C	Cardiovascular system	1,477,632	18.4%	17.2%	7,982,453	31.3%	29.9%	82,184,241	33.7%
N	Nervous system	2,097,757	26.1%	26.0%	5,470,552	21.4%	21.8%	51,947,065	21.3%
A	Alimentary tract and metabolism	922,784	11.5%	11.2%	3,556,212	13.9%	13.7%	35,808,335	14.7%
J	Anti-infectives for systemic use	1,236,232	15.4%	16.6%	1,896,986	7.4%	8.2%	23,427,839	9.6%
R	Respiratory system	449,427	5.6%	5.8%	1,854,363	7.3%	7.5%	11,886,826	4.9%
G	Genitourinary system and sex hormones	342,050	4.3%	4.5%	1,113,166	4.4%	4.7%	5,826,410	2.4%
M	Musculoskeletal system	367,138	4.6%	4.5%	983,900	3.9%	3.9%	9,838,079	4.0%
B	Blood and blood forming organs	247,672	3.1%	2.9%	842,701	3.3%	3.1%	8,320,756	3.4%
D	Dermatologicals	357,991	4.5%	4.7%	562,271	2.2%	2.4%	3,734,664	1.5%
S	Sensory organs	199,871	2.5%	2.5%	546,269	2.1%	2.1%	4,679,624	1.9%
H	Systemic hormonal preparations, excl. sex hormones and insulins	244,467	3.0%	3.1%	484,294	1.9%	1.9%	4,715,308	1.9%
L	Antineoplastic and immunomodulating agents	35,362	0.4%	0.4%	124,847	0.5%	0.5%	1,066,613	0.4%
P	Antiparasitic products, insecticides and repellents	45,884	0.6%	0.6%	68,732	0.3%	0.3%	89,100	0.0%
V	Various	8,432	0.1%	0.1%	27,291	0.1%	0.1%	66,226	0.0%
	Total	**8,032,699**	**100%**	**100%**	**25,514,037**	**100%**	**100%**	**243,591,086**	**100%**

* Total prescriptions – original and repeat prescriptions.
# Data source: Pharmaceutical Benefits Scheme claims data 2016–17.[29]

A list of the 30 most frequently prescribed medicines at ATC level 3 was obtained from the MedicineInsight unweighted data and these accounted for 77.4% of all original prescriptions recorded in MedicineInsight. In the weighted MedicineInsight data in Table 7.3, the four subgroups with the highest volume of original prescriptions were opioids, beta-lactam antibacterials – penicillins, antidepressants and drugs for peptic ulcer and gastro-oesophageal reflux disease (GORD). The four subgroups with the highest volume of total prescriptions, reflecting GP prescribing patterns and the need for repeat prescriptions for chronic conditions, were antidepressants, lipid-modifying agents, drugs for peptic ulcer and GORD, and adrenergic inhalants.

Table 7.3 Number and proportion (%) of original and total prescriptions for top 30 ATC level 3 classes recorded in MedicineInsight

ATC level 3	Medicine class	Original prescriptions			Total prescriptions#		
		Unweighted data (number)	Unweighted data (%)*	Weighted data (%)*	Unweighted data (number)	Unweighted data (%)*	Weighted data (%)*
N06A	Antidepressants	492,255	7.9%	8.0%	2,333,850	11.1%	11.5%
C10A	Lipid-modifying agents, single agent	396,835	6.4%	6.1%	2,392,338	11.4%	11.0%
A02B	Drugs for peptic ulcer and gastro-oesophageal reflux disease (GORD)	481,165	7.7%	7.4%	2,079,429	9.9%	9.6%
R03A	Adrenergic inhalants	251,237	4.0%	4.1%	1,252,588	6.0%	6.2%
C09C	Angiotensin-II antagonists, single agent	184,733	3.0%	2.8%	1,056,941	5.0%	4.8%
N02A	Opioids	695,278	11.2%	10.9%	936,712	4.5%	4.4%
A10B	Blood glucose-lowering drugs, excl. insulins	169,032	2.7%	2.6%	933,500	4.4%	4.4%
C09A	ACE inhibitors, single agent	165,159	2.7%	2.5%	943,038	4.5%	4.3%
J01C	Beta-lactam antibacterials, penicillins	517,370	8.3%	9.1%	700,659	3.3%	3.7%
C07A	Beta-blocking agents	149,715	2.4%	2.3%	813,237	3.9%	3.7%
C09D	Angiotensin-II antagonists, combinations	130,944	2.1%	2.0%	751,184	3.6%	3.4%
B01A	Antithrombotic agents	173,237	2.8%	2.5%	728,172	3.5%	3.2%
N03A	Antiepileptics	146,473	2.4%	2.3%	650,300	3.1%	3.1%
M01A	Anti-inflammatory and anti-rheumatic products, non-steroids	237,924	3.8%	3.9%	631,322	3.0%	3.1%
C08C	Selective calcium channel blockers with mainly vascular effects	107,736	1.7%	1.6%	612,727	2.9%	2.7%
G03A	Hormonal contraceptives for systemic use	135,239	2.2%	2.5%	349,243	1.7%	1.9%
J01D	Other beta-lactam antibacterials	251,741	4.1%	4.3%	361,991	1.7%	1.9%
R03B	Other drugs for obstructive airway diseases, inhalants	72,471	1.2%	1.2%	354,637	1.7%	1.7%
N05A	Antipsychotics	130,216	2.1%	2.1%	328,728	1.6%	1.7%
C09B	ACE inhibitors, combinations	60,749	1.0%	0.9%	348,120	1.7%	1.6%
H02A	Corticosteroids for systemic use, single agent	157,897	2.5%	2.6%	310,808	1.5%	1.5%
D07A	Corticosteroids, single agent	189,487	3.0%	3.2%	285,783	1.4%	1.4%
N05C	Hypnotics and sedatives	207,978	3.3%	3.3%	285,012	1.4%	1.4%
J01A	Tetracyclines	10,0231	1.6%	1.7%	245,497	1.2%	1.3%
N05B	Anxiolytics	226,503	3.6%	3.8%	250,947	1.2%	1.3%
G04B	Urologicals	58,096	0.9%	0.9%	250,131	1.2%	1.2%
N02B	Other analgesics and antipyretics	72,712	1.2%	1.1%	261,513	1.2%	1.1%
J01F	Macrolides, lincosamides and streptogramins	134,202	2.2%	2.3%	195,969	0.9%	1.0%
G03C	Oestrogens	60,699	1.0%	1.0%	202,525	1.0%	1.0%
M04A	Antigout preparations	58,283	0.9%	0.9%	183,598	0.9%	0.9%
	Subtotal^	**6,215,597**	**100%**	**100%**	**21,030,499**	**100%**	**100%**

* Proportions (%) are given for the top 30 ATC level 3 classes only. # Total prescriptions include original and repeat prescriptions. ^Total for the top 30 ATC level 3 classes.

7.3 Prescriptions per 100 encounters

Prescriptions per encounter were calculated individually for each ATC level by dividing the number of prescriptions by the total number of encounters for all patients, recognising that prescriptions are not linked directly to an encounter in MedicineInsight but to a patient. The rates of prescribing per 100 encounters are presented for both original and total prescriptions for ATC level 1 in Table 7.4 and for ATC level 3 in Table 7.5. Also included for comparison are BEACH data,[1] which recorded up to four original prescriptions for each problem managed, with a maximum of four problems managed at each encounter. For all patients in the study cohort, 66.5 original prescriptions and 195.3 total prescriptions were prescribed for every 100 encounters in the study period (Table 7.4).

The three most frequently prescribed ATC level 1 medicine classes for original prescriptions per 100 encounters were anti-infective medicines for systemic use (15.0 per 100 encounters), medicines for the nervous system (12.8 per 100 encounters), and cardiovascular system medicines (9.8 prescriptions per 100 encounters). The most frequently recorded medicine classes for total prescriptions were cardiovascular medicines (53.6 prescriptions per 100 encounters), medicines for the nervous system (36.8 per 100 encounters) and medicines for the alimentary tract and metabolism (23.0 per 100 encounters).

The rankings for original prescriptions per 100 encounters and for BEACH data are similar, with only a small amount of variation. For example, anti-infectives for systemic use were the top-ranked ATC level 1 medicine class in MedicineInsight and the second-top-ranked in BEACH.

Table 7.4 Original and total prescriptions recorded per 100 encounters, ATC level 1 (weighted) compared with BEACH data on original prescriptions recorded

ATC level 1	Medicine class	Weighted data						BEACH 2016*
		Original prescriptions			Total prescriptions#			
		Rate per 100 encounters	(95% CI)	Rank	Rate per 100 encounters	(95% CI)	Rank	Rank
J	Anti-infectives for systemic use	15.0	(14.5, 15.6)	1	22.6	(21.7, 23.5)	4	2
N	Nervous system	12.8	(12.2, 13.3)	2	36.8	(34.7, 38.9)	2	1
C	Cardiovascular system	9.8	(9.2, 10.5)	3	53.6	(49.9, 57.4)	1	3
A	Alimentary tract and metabolism	6.3	(6.1, 6.6)	4	23.0	(21.7, 24.3)	3	4
R	Respiratory system	4.7	(4.6, 4.9)	5	17.8	(17.0, 18.6)	5	5
D	Dermatologicals	4.2	(4.0, 4.3)	6	6.6	(6.3, 6.9)	8	6
G	Genitourinary system and sex hormones	4.2	(4.0, 4.3)	7	12.9	(12.3, 13.5)	6	8
M	Musculoskeletal system	3.0	(2.9, 3.2)	8	7.7	(7.1, 8.2)	7	7
H	Systemic hormonal preparations, excl. sex hormones and insulins	2.3	(2.2, 2.4)	9	4.1	(3.9, 4.3)	11	9
S	Sensory organs	2.1	(2.0, 2.2)	10	4.2	(4.0, 4.5)	10	11
B	Blood and blood forming organs	1.3	(1.2, 1.4)	11	4.2	(4.0, 4.5)	9	10
P	Antiparasitic products, insecticides and repellents	0.5	(0.5, 0.5)	12	0.7	(0.7, 0.7)	13	12
L	Antineoplastic and immunomodulating agents	0.2	(0.2, 0.3)	13	0.8	(0.7, 0.9)	12	13
V	Various	0.1	(0.0, 0.1)	14	0.2	(0.1, 0.2)	14	14
	Total	**66.5**	**(64.7, 68.4)**		**195.3**	**(186.1, 204.5)**		

* Based on a maximum of four original prescriptions for each problem at an encounter managed to a maximum of 16 medicines.[1]
# Total prescriptions- original and repeat prescriptions.

The ranking of the rate of medicines prescribed per 100 encounters at ATC level 3 in MedicineInsight varied in some areas from BEACH data.[1] For example, hormonal contraceptives for systemic use were ranked ninth for original prescriptions in MedicineInsight at 3.2 prescriptions per 100 encounters, compared with 23rd in the BEACH data (Table 7.5). Blood glucose-lowering drugs, excluding insulin, were ranked 18th per 100 encounters in the MedicineInsight dataset and eighth in the BEACH data. It is unclear whether these differences are due to the different methods of data collection or different prescribing practices by the participating GPs.

Table 7.5 Original and total prescriptions recorded per 100 encounters, ATC level 3 (weighted) compared with BEACH data on original prescriptions recorded

ATC level 3	Medicine class	Weighted data						BEACH 2016*
		Original prescriptions			Total prescriptions#			
		Rate per 100 encounters	(95% CI)	Rank	Rate per 100 encounters	(95% CI)	Rank	Rank
J01C	Beta-lactam antibacterials, penicillins	6.8	(6.4, 7.1)	1	9.0	(8.5, 9.4)	5	2
N06A	Antidepressants	3.9	(3.7, 4.1)	2	19.0	(17.9, 20.2)	1	3
N02A	Opioids	3.2	(3.0, 3.4)	3	4.4	(4.0, 4.7)	13	1
A02B	Drugs for peptic ulcer and gastro-oesophageal reflux disease (GORD)	3.1	(3.0, 3.3)	4	13.3	(12.5, 14.2)	3	4
J01D	Other beta-lactam antibacterials	2.9	(2.7, 3.1)	5	4.0	(3.7, 4.3)	14	7
C10A	Lipid-modifying agents, single agent	2.7	(2.5, 2.9)	6	16.4	(15.2, 17.5)	2	5
R03A	Adrenergics, inhalants	2.5	(2.4, 2.6)	7	11.9	(11.3, 12.5)	4	8
M01A	Anti-inflammatory and anti-rheumatic products, non-steroids	2.2	(2.1, 2.3)	8	5.3	(4.9, 5.7)	11	6
G03A	Hormonal contraceptives for systemic use	2.2	(2.1, 2.3)	9	5.9	(5.6, 6.1)	8	23
D07A	Corticosteroids, single agent	2.0	(1.9, 2.1)	10	3.1	(2.9, 3.2)	19	10
J01F	Macrolides, lincosamides and streptogramins	1.6	(1.5, 1.7)	11	2.2	(2.1, 2.4)	24	12
H02A	Corticosteroids for systemic use, single agent	1.6	(1.5, 1.7)	12	2.7	(2.6, 2.9)	22	16
C09C	Angiotensin-II antagonists, single agent	1.3	(1.2, 1.4)	13	7.5	(7.0, 8.0)	6	11
N05B	Anxiolytics	1.3	(1.2, 1.4)	14	1.4	(1.3, 1.5)	29	16
N05C	Hypnotics and sedatives	1.3	(1.2, 1.3)	15	1.8	(1.7, 1.9)	26	20
C09A	ACE inhibitors, single agent	1.2	(1.1, 1.3)	16	6.7	(6.2, 7.3)	7	15
J01A	Tetracyclines	1.2	(1.1, 1.2)	17	3.1	(2.9, 3.3)	18	26
A10B	Blood glucose-lowering drugs, excl. insulins	1.1	(1.0, 1.1)	18	5.8	(5.4, 6.1)	9	9
C09D	Angiotensin-II antagonists, combinations	1.0	(0.9, 1.0)	19	5.6	(5.3, 6.0)	10	18
C07A	Beta-blocking agents	0.9	(0.9, 1.0)	20	5.1	(4.7, 5.5)	12	18
N05A	Antipsychotics	0.9	(0.8, 0.9)	21	2.2	(2.1, 2.3)	25	21
N03A	Antiepileptics	0.8	(0.8, 0.9)	22	3.6	(3.4, 3.8)	16	21
B01A	Antithrombotic agents	0.8	(0.8, 0.9)	23	3.5	(3.2, 3.7)	17	13
C08C	Selective calcium channel blockers with mainly vascular effects	0.7	(0.6, 0.7)	24	3.8	(3.5, 4.2)	15	24
R03B	Other drugs for obstructive airway diseases, inhalants	0.6	(0.6, 0.7)	25	2.9	(2.7, 3.0)	20	26
G04B	Urologicals	0.6	(0.5, 0.6)	26	2.4	(2.3, 2.6)	23	37
C09B	ACE inhibitors, combinations	0.5	(0.5, 0.5)	27	2.8	(2.6, 3.0)	21	29
G03C	Oestrogens	0.5	(0.4, 0.5)	28	1.7	(1.5, 1.8)	27	37
M04A	Antigout preparations	0.5	(0.4, 0.5)	29	1.5	(1.4, 1.6)	28	37
N02B	Other analgesics and antipyretics	0.5	(0.4, 0.5)	30	1.3	(1.2, 1.4)	30	13
	Subtotal^	**50.1**	**(48.5, 51.6)**		**159.8**	**(151.8, 167.7)**		

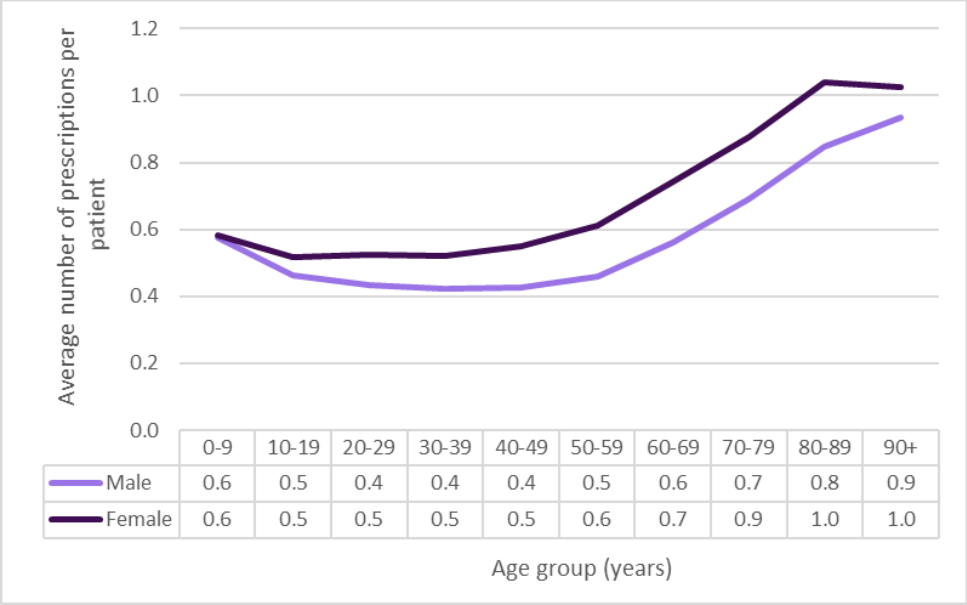
* Based on a maximum of four original prescriptions for each problem at an encounter managed to a maximum of 16 medicines.[1]
# Total prescriptions include original prescription and repeats prescribed.
^ Subtotal does not include ATC level 3 categories not included in the MedicineInsight top 30 prescriptions.

7.4 Patterns of prescribing for selected medicines

In this section, data are presented on the average number of prescriptions per patient, by sex and age group for four high-volume medicine groups: two ATC level 1 medicine groups – original prescriptions for anti-infectives for systemic use (J) and total prescriptions for cardiovascular drugs (C); and two ATC level 3 medicine subgroups – original prescriptions for opioids (N02A) and total prescriptions for antidepressants (N06A).

There are similar patterns of prescribing anti-infectives for males and females (Figure 7.3). Males and females have a similar rate of prescribing up until 9 years of age with an average of 0.6 original prescriptions per patient. Females then have higher prescribing rates, peaking for women aged 80 years and over, with an average of 1 prescription per patient in the 12-month period.

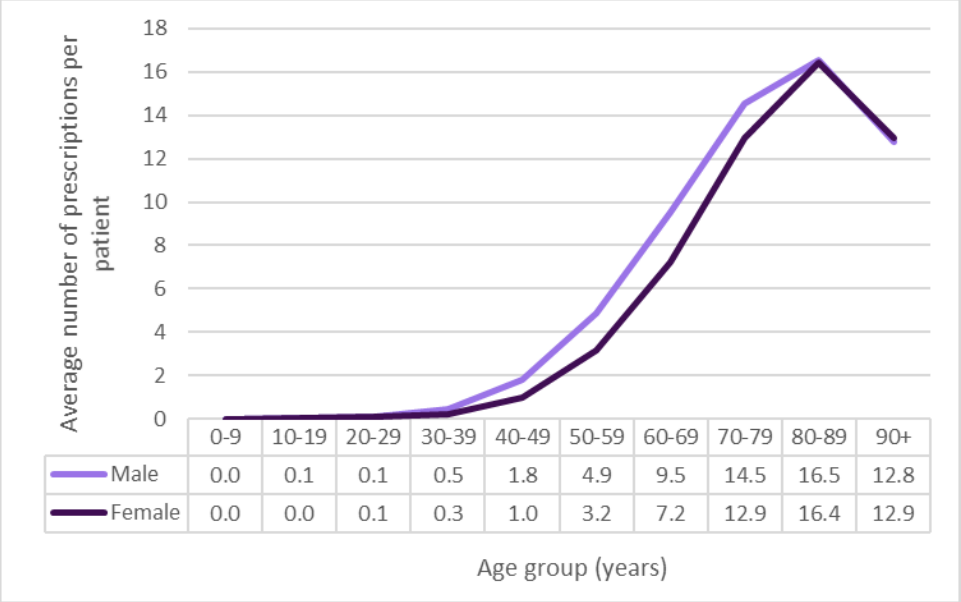
Figure 7.3 Average number of original prescriptions per patient, for anti-infectives for systemic use (ATC level 1), by age group and sex (weighted)



	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90+
Male	0.6	0.5	0.4	0.4	0.4	0.5	0.6	0.7	0.8	0.9
Female	0.6	0.5	0.5	0.5	0.5	0.6	0.7	0.9	1.0	1.0

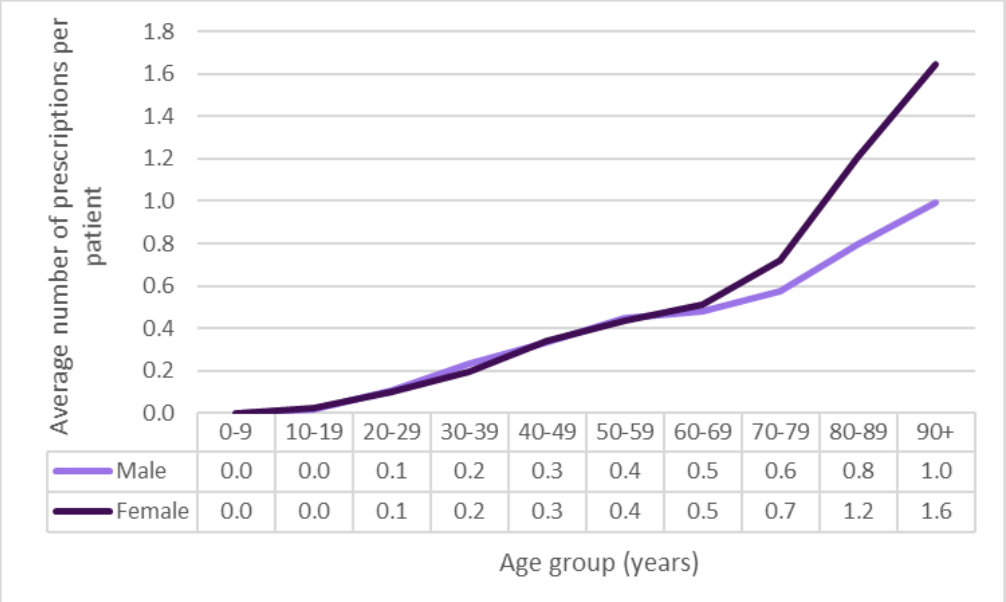
Further analysis of the prescribing of medicines for treating cardiovascular disease showed that the rates of total prescriptions per patient increased in both sexes with age, peaking in the 80–89-year age group, with an average number of original prescriptions of 16.5 for males (Figure 7.4). On average, males were more likely to have a greater number of cardiovascular system prescriptions in most age groups, compared with their female counterparts, until the age of 90 years.

Figure 7.4 Average number of total prescriptions per patient, for cardiovascular system medicines (ATC level 1), by age group and sex (weighted)



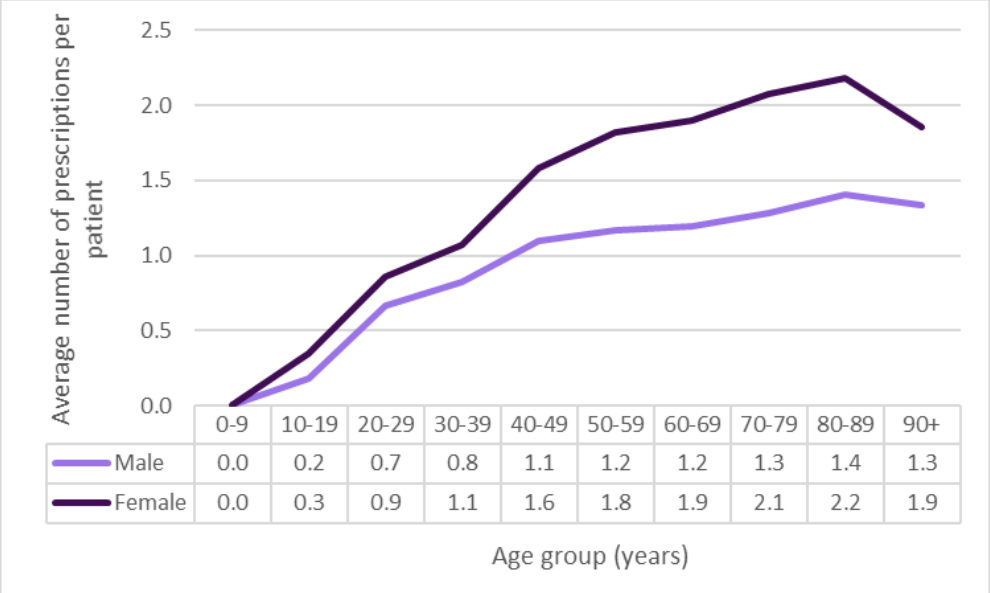
The average number of original prescriptions recorded for opioids increased with age in both males and females (Figure 7.5). Males and females had similar rates of prescribing until 60 years, when the rate of prescribing begins to increase more steeply for females to a high of 1.6 original prescriptions per patient for females over the age of 90 years.

Figure 7.5 Average number of original prescriptions per patient, for opioids (ATC level 3), by age group and sex (weighted)



Overall, males are prescribed antidepressants less commonly than females across all age groups but particularly over the age of 40 years (Figure 7.6). The highest rate of GP prescribing for antidepressants is for females aged 80–89 years, who receive on average 2.2 total prescriptions per patient.

Figure 7.6 Average number of total prescriptions per patient for antidepressants (ATC level 3), by age group and sex (weighted)



	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90+
Male	0.0	0.2	0.7	0.8	1.1	1.2	1.2	1.3	1.4	1.3
Female	0.0	0.3	0.9	1.1	1.6	1.8	1.9	2.1	2.2	1.9

7.5 Using MedicineInsight condition data to inform clinical practice

The following vignette demonstrates how these data can be used to analyse antibiotic prescribing patterns and use. The purpose of this vignette is to highlight the different types of research that can be undertaken using MedicineInsight data. The study described here has used a separate set of data inclusion criteria, and the cohort and denominators in the vignette are different from those used in this report. The data in this vignette are not intended to show indications of population health and should not be interpreted in this way.

Using MedicineInsight data: Monitoring antibiotic use

Antibiotic resistance is increasing in Australia and internationally. Australia has a very high rate of antibiotic use compared with other countries (eighth highest out of 29 countries evaluated by the OECD). Most antibiotic prescribing occurs in the community, and particularly in the general practice setting.

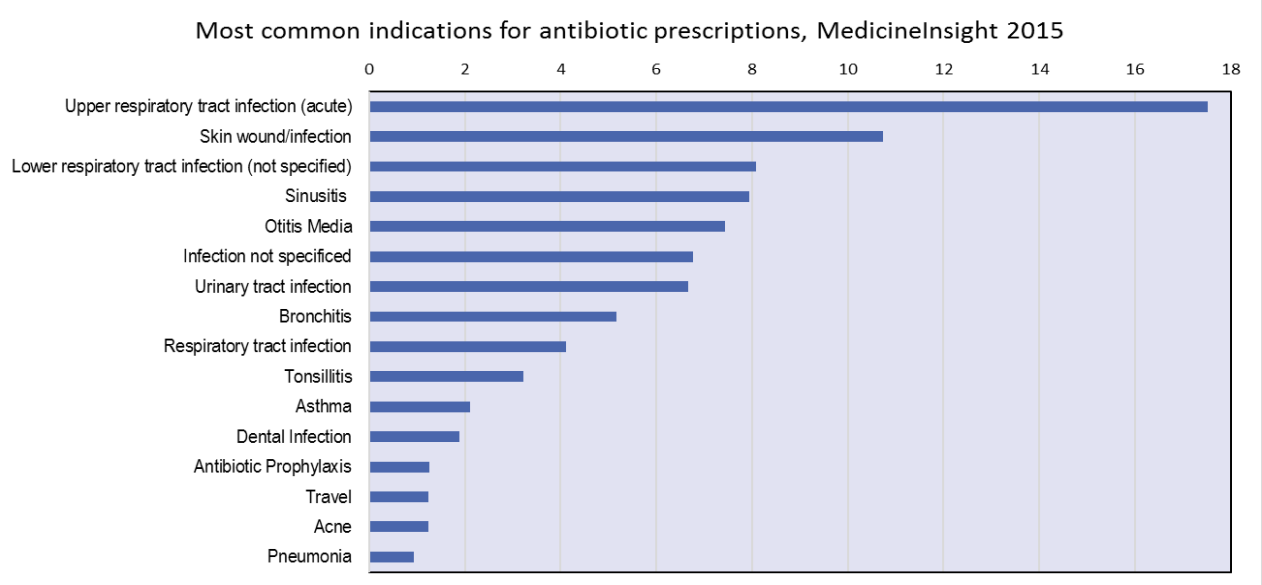
How can the data be used to assist clinical decision making?

In 2015, more than 30 million antibiotic prescriptions were dispensed under the PBS and RPBS, and about 45% of the Australian population (10.7 million people) received a prescription for at least one antibiotic. PBS data show the volumes of prescriptions dispensed through pharmacies, but do not include the reason for the script. MedicineInsight can provide information on patterns of antibiotic use, as well as the demographic characteristics and risk factors of patients prescribed systemic antimicrobials. The data have also been used to assess prescribing for specific conditions, such as upper respiratory tract and urinary tract infections, against national and international guidelines.

Data from MedicineInsight were used in the *Australian Report on Antimicrobial Use and Resistance in Human Health* (AURA, ACSQHC 2016 and 2017) to report on the patterns of use and appropriateness of antibiotic prescribing in general practice. The data showed that almost 30% (968,259 out of 3,181,923) of MedicineInsight patients had been prescribed systemic antimicrobials between 1 January and 31 December 2015. Demographic analysis of these patients suggested that women and older people were more likely to be given a prescription for antibiotics, and prescribing rates were highest in New South Wales compared with other states and territories.

The most commonly prescribed antibiotics were amoxicillin, amoxicillin-clavulanate and cefalexin. The reason or indication for prescription was recorded in MedicineInsight for only 23.5% of patients, although some reasons for prescription may have been recorded in progress notes, which are not available for analysis for privacy reasons. The use of coded fields in clinical software rather than free-text or progress notes would greatly improve the quality of the data.

From the available data, we found that a very high proportion of antibiotic prescriptions (60%) were for patients with upper respiratory tract infection reported as the reason, although antibiotics are not generally recommended for these infections. Cefalexin was regularly used for urinary tract infections, and skin or soft-tissue infections, although it is not recommended as a first-line treatment for these conditions.



What are the implications?

MedicineInsight data can be used to identify medicine usage patterns, assess the appropriateness of prescribing against national guidelines, provide feedback on individual GP prescribing patterns and develop best practice guidance for clinicians.

8 PATHOLOGY TESTS

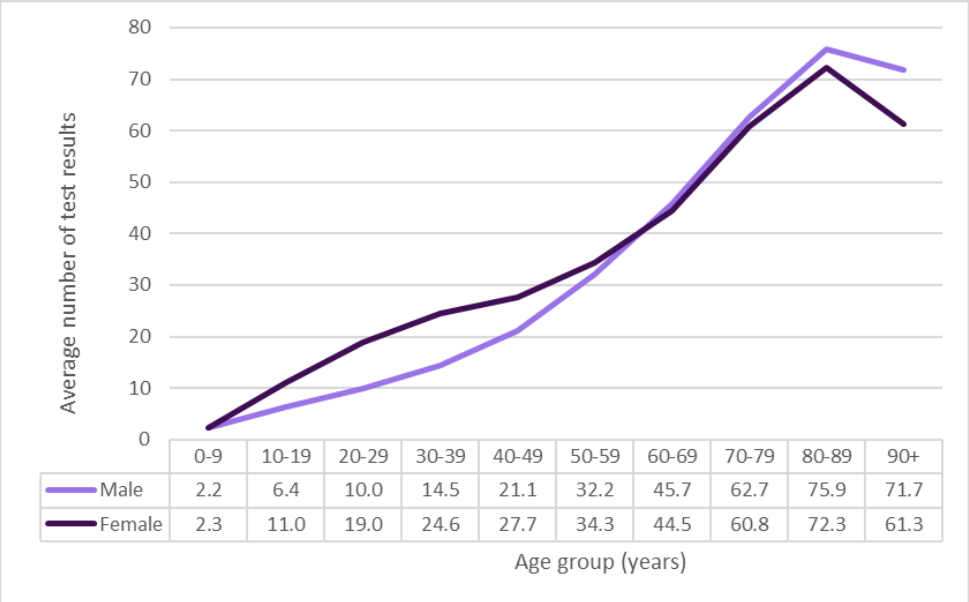
This chapter reports on pathology test results recorded in MedicineInsight in 2016–17. Each component of a pathology test result is recorded separately; for example, for full blood counts there would be over a dozen separate test results documented, such as white cell count and haemoglobin. The reliability of the pathology data that MedicineInsight receives varies for several reasons, including the way results are transferred from the pathology lab to the CIS, the configuration of the CIS within each practice, and the way the data are extracted from the CIS.

There were 60,222,450 individual pathology test results included in the unweighted data, and 832,467,165 pathology test results in the dataset following weighting by encounter. We have presented the analysis of the weighted data here.

8.1 Pathology test results by patient

Overall, on average 25 pathology test results were recorded per patient in MedicineInsight, with a significantly higher average number of test results recorded for females compared with males (27.7 versus 23.0; Table 8.1). Patients residing in areas classified as disadvantaged had a higher average number of test results per patient compared with patients residing in more advantaged areas (as measured by SEIFA), and the average number of test results also increased with age. While females had a higher average number of test results than males for those under 60 years of age, particularly in the female child-bearing years, this trend was reversed in patients aged 60 years and over (Figure 8.1).

Figure 8.1 Average number of pathology test results per patient, by age group and sex (weighted)



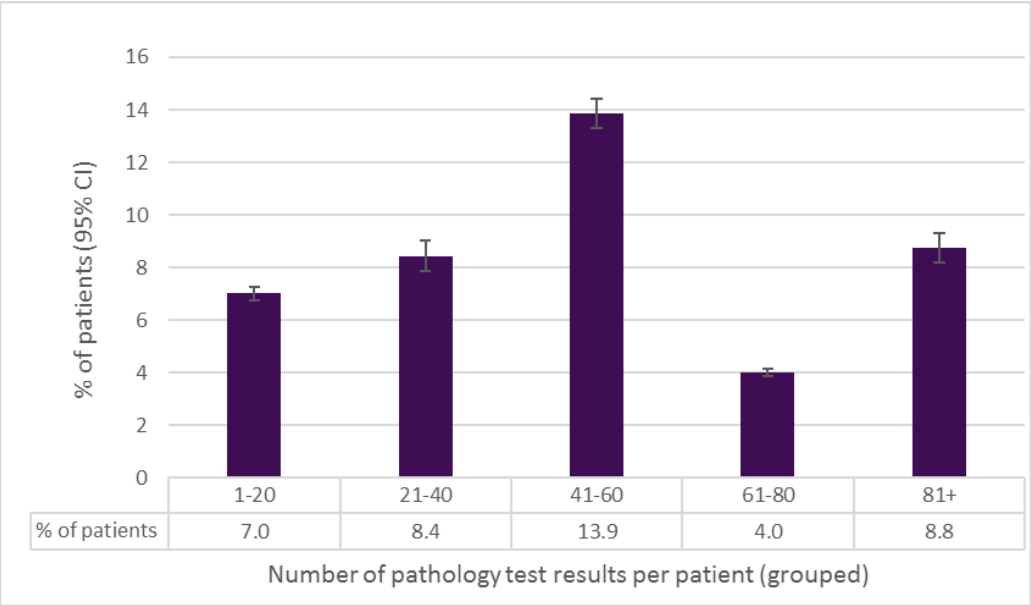
	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90+
Male	2.2	6.4	10.0	14.5	21.1	32.2	45.7	62.7	75.9	71.7
Female	2.3	11.0	19.0	24.6	27.7	34.3	44.5	60.8	72.3	61.3

Table 8.1 Average number of pathology test results by patient demographics (weighted)

Characteristic	Weighted data	
	Average	(95% CI)
Sex		
Male	23.0	(21.8, 24.3)
Female	27.7	(26.6, 28.8)
Age group (years)		
0–9	2.3	(2.1, 2.4)
10–19	8.8	(8.4, 9.1)
20–29	15.2	(14.4, 15.9)
30–39	20.1	(19.3, 20.8)
40–49	24.6	(23.8, 25.5)
50–59	33.3	(32.2, 34.5)
60–69	45.1	(43.5, 46.6)
70–79	61.7	(59.6, 63.8)
80–89	73.8	(71.2, 76.4)
90+	64.7	(62.4, 67.1)
Rurality		
Major cities	24.2	(22.8, 25.6)
Inner regional	29.7	(27.4, 32.0)
Outer regional	26.0	(23.4, 28.5)
Remote/very remote	23.3	(17.6, 29.0)
State/Territory		
NSW	27.0	(25.1, 28.9)
VIC	22.2	(19.8, 24.7)
QLD	29.2	(26.6, 31.8)
WA	20.8	(19.0, 22.7)
TAS	23.3	(22.0, 24.7)
SA	27.7	(24.3, 31.1)
ACT	28.0	(24.2, 31.9)
NT	12.5	(8.8, 16.1)
Socioeconomic status (SEIFA IRSAD quintile)		
1 (most disadvantaged)	29.0	(25.8, 32.3)
2	28.3	(26.4, 30.2)
3	26.1	(24.0, 28.1)
4	24.4	(22.9, 26.0)
5 (most advantaged)	22.6	(21.4, 23.8)

We found that 42% of patients had at least one pathology test result recorded. The highest proportion of these patients (13.9% of all patients) had between 41 and 60 test results recorded, and almost 9% of all patients had more than 80 test results recorded during the 12-month period (Figure 8.2).

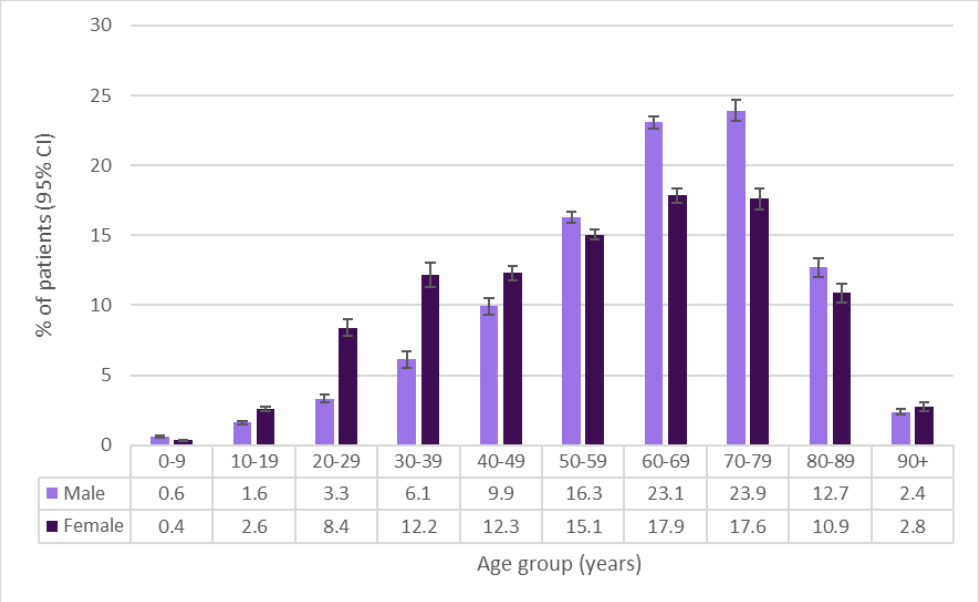
Figure 8.2 Relative distribution of pathology tests results recorded per patient (weighted)*



*42% of patients had a pathology test result recorded.

We analysed the age and sex stratification of patients who had more than 80 pathology test results recorded, as this level of testing would suggest that they may have a chronic condition that requires regular monitoring. We found that the highest proportion of both male and female patients were in the 50–79-year age group (Figure 8.3), with a greater proportion of males. In younger age groups, there was generally a higher proportion of female patients who had over 80 test results recorded, compared with males.

Figure 8.3 Patients with over 80 pathology test results recorded, by age and sex (weighted)



As shown in Table 8.2, patients who had more than 80 pathology test results recorded also had a significantly higher relative risk of having one or more chronic conditions recorded compared with other patients. Chronic kidney disease was almost 18 times more frequently recorded in

these patients, and cardiovascular diseases, including heart failure and atrial fibrillation, were also significantly more common. Of note is the higher relative risk of these patients also having depression and anxiety, which are not related to a requirement for increased pathology testing and may indicate their association with other chronic illnesses.

Table 8.2 Proportion and relative risk of selected conditions in patients with over 80 pathology test results (weighted)

	≤ 80 pathology tests	> 80 pathology tests	Relative risk	
Condition	% patients	% patients	RR	95% CI
Chronic kidney disease	0.1	1.7	17.7	(16.1, 19.6)
Heart failure	0.2	2.6	13.4	(12.4, 14.6)
Atrial fibrillation	0.5	3.6	7.9	(7.4, 8.5)
Diabetes mellitus	1.9	14.6	7.8	(7.3, 8.3)
Cardiovascular disease	1.2	8.6	7.2	(6.7, 7.7)
Osteoporosis	0.7	4	5.8	(5.4, 6.2)
COPD	0.7	3.8	5.7	(5.3, 6.2)
Arthritis	1.9	9.2	4.8	(4.5, 5.1)
Dyslipidaemia	3.4	14	4.1	(3.8, 4.3)
Oesophageal disease	3.3	12.4	3.7	(3.5, 3.9)
Cancer	4.7	17.3	3.7	(3.5, 3.8)
Hypertension	5.9	21.5	3.6	(3.5, 3.8)
Depression	5	10.9	2.2	(2.1, 2.3)
Anxiety	4.1	7.6	1.8	(1.7, 2.0)
Asthma	4	6	1.5	(1.4, 1.6)

8.2 Selected pathology test results

Table 8.3 shows the proportion of patients who had results for selected pathology tests, and the average number of these test results per 100 patients. These eight tests represent approximately 10% of the total number of pathology test results recorded. The higher average number of tests per patient compared with the proportion of patients with results recorded reflects multiple testing of these patients.

Table 8.3 Selected pathology test results per patient (N = 2,168,084) (weighted)

Pathology test result	% patients with result recorded	Average number of tests per 100 patients	95% CI
Haemoglobin (as a proxy for full blood count (FBC))	33.1	58.4	(55.6, 61.2)
ALT (as a proxy for liver function tests (LFTs))	30.4	49.0	(46.2, 51.7)
Sodium (as a proxy for urea, electrolytes and creatinine (UECs))	28.0	46.9	(43.6, 50.3)
Total cholesterol (as a proxy for lipids)	26.6	49.7	(45.0, 54.3)
TSH (as a proxy for thyroid function tests)	19.0	24.9	(23.5, 26.3)
Ferritin	12.2	16.0	(14.6, 17.4)
Vitamin B_{12}	10.3	12.1	(11.5, 12.6)
Vitamin D	9.2	10.6	(10.0, 11.3)

8.3 Using MedicineInsight condition data to inform clinical practice

MedicineInsight contains information on the number of pathology tests requested, the results, sequencing of tests, and co-requested tests. The following vignette demonstrates how these data can potentially be used to analyse ferritin and iron studies testing, to provide GPs with the most useful diagnostic information to detect patients with iron deficiency. The purpose of this vignette is to highlight the different types of analyses that can be undertaken using MedicineInsight data. Given the preliminary nature of this work, a separate, less restrictive set of data inclusion criteria were applied, and the denominators in the vignette are different from those used in this report. The data in this vignette are not intended as indicators of population health and should not be interpreted in this way.

Using MedicineInsight data: Improving use of pathology testing for iron deficiency

MedicineInsight data can be used to evaluate patterns of pathology testing in the general practice setting and identify clinical practice gaps or inefficiencies to better target and align pathology tests with clinical need. The data contain information on the number and type of pathology tests requested, the timing of tests, and test results. They also provide patient demographic and clinical information, such as existing conditions and diagnoses.

How can the data be used to assist clinical decision making?

In Australia, ferritin and iron studies are most often requested for patients with suspected iron deficiency. Ferritin testing can be performed on its own, or as part of iron studies. However, a ferritin test is a better indicator of iron deficiency than an iron studies test alone. Ferritin is a good marker of total body iron stores, and a low ferritin level is almost always associated with iron deficiency. While ferritin may be elevated in certain cancers and inflammatory conditions, ferritin testing should be the first option for most patients with suspected iron deficiency.

We used MedicineInsight data to analyse ferritin and iron studies testing in a cohort of patients. Approximately 28% of patients in a two-year study population of 2 million patients had at least one ferritin and/or one iron studies test. In Australia, the ratio of ferritin to iron studies pathology testing was around one to 10 in 2016. In other countries, this ratio is reversed. The ratio in Canada, for example, is 10 ferritin tests to one iron studies test.[30]

Relevant indication	Number	Proportion (%)
Iron deficiency	39,342	12.5
Anaemia	23,746	7.5
Iron overload	8432	2.7
Haemochromatosis	7986	2.6
At least one indication	55,893	17.7

Of the patients in our dataset, 315,512 (99.9%) had a valid test result, with more than 40% (134,908) of these patients reporting at least one abnormal result for ferritin, iron, transferrin, transferrin saturation or iron binding capacity, as indicated by the result being outside the normal range. We also found that 17.7% of patients (55,893) had a diagnosis of iron deficiency, anaemia, iron overload and/or haemochromatosis ever recorded, and some patients recorded more than one of these conditions.

What are the implications?

While it appears that GPs are more likely to request iron studies pathology tests over ferritin, there are both clinical advantages and economic incentives to improving the ratio of ferritin to iron studies testing for iron deficiency. The Medicare Benefits Schedule (MBS) payment for iron studies (MBS Item 66596) is almost twice as much as for a single ferritin test (MBS item 66593): $27.70 compared with $15.30. So, there are opportunities to improve the efficiency of pathology testing by increasing the ratio of ferritin testing to iron studies for many patients with iron deficiency. Moreover, when ferritin tests are used appropriately, they will reduce the need for patients to have further testing, and unnecessary treatments such as taking iron supplements. This represents an opportunity to direct clinical education programs for GPs to improve clinical practice and reduce unnecessary public expenditure.

Future opportunities include using longitudinal MedicineInsight data to provide additional information on patterns of pathology testing by GPs, particularly with regard to rates of repeat testing and co-testing over time.

9 IMPROVING MEDICINEINSIGHT DATA

MedicineInsight provides an important source of national longitudinal general practice data. This 2016–17 report provides information on activities that occur in general practices, including details of encounters, the conditions patients present with and how they are managed. There are recognised limitations to MedicineInsight data, as they are real-world data entered by clinicians into CISs for the purposes of providing patient care and, to protect patient privacy, no data are collected from patient progress notes. This report has only begun to explore and describe general practice activities in Australia. The large volume of data provides further opportunity to analyse in detail the activities that occur within general practice as well as to measure the health outcomes and quality of general practice care. While data may be incomplete and encounters may be missing when patients attend another general practice, there are still many important findings. It is possible to continue to draw significant inferences about the treatment, risk factors and potential outcomes for different patient cohorts, particularly with the trend data that are available.

Various activities are being planned or are already underway within NPS MedicineWise to continue to develop the quality and validity of MedicineInsight data to support the planning and delivery of general practice across Australia.

- MedicineInsight is using the National Clinical Terminology Service (NCTS), operated by the Australian Digital Health Agency, to ensure that MedicineInsight is using national clinical terminologies such as Australian Medicines Terminology (AMT), LOINC and SNOMED CT-AU.
- Clinical data, both coded and free-text, are progressively being mapped into SNOMED CT-AU to identify clinical findings, symptoms and diagnoses within MedicineInsight.
- NPS MedicineWise Health Professional Learning teams are working alongside practices to improve the quality and completeness of the patient records. Practices receive routine feedback on data quality, including completeness of records, as part of practice reports.
- Independent researchers are using the data to support their research and providing feedback on how to improve the quality of the data.
- Improving the identification of unique patients across all practice sites (eg, through record linkage) will allow more accurate estimates of patient-level results. This will also allow enhancements to weighting processes.
- As standards for improving general practice data are applied and enhancements to the CISs occur (defining encounters as either direct [face-to-face with a patient] or indirect), the quality of MedicineInsight data will be incrementally improved.

As both the reach and technical capabilities of MedicineInsight expand, it is anticipated that the breadth and applicability of future reports will ultimately contribute to improved health outcomes by allowing policy makers and health professionals to respond to the identified gaps in healthcare.

Appendix 1. GLOSSARY AND ABBREVIATIONS

Term	Definition	Description
95% CI	95% confidence interval	A 95% confidence interval provides information about a range of values that should contain the actual rate 95% of the time (95 times out of 100), as well as information on the direction and strength of the demonstrated effect. Wider confidence intervals reflect less certainty in the estimate of the rate. Confidence intervals enable conclusions to be drawn about the statistical plausibility and clinical relevance of findings.
ABS	Australian Bureau of Statistics	Australia's national statistical agency, providing official statistics on a wide range of economic, social, population and environmental matters of importance to Australia.
ABS National Health Survey (NHS)	Australian Bureau of Statistics National Health Survey	The 2014–15 National Health Survey is designed to collect a range of information about the health of Australians, including: ▪ prevalence of long-term health conditions ▪ health risk factors such as smoking, overweight and obesity, alcohol consumption and exercise ▪ use of health services such as consultations with health practitioners and actions people have recently taken for their health ▪ demographic and socio-economic characteristics.
ACCHS	Aboriginal Community Controlled Health Service	
ACSQHC	Australian Commission on Safety and Quality in Health Care	This commission is responsible for leading and coordinating national improvements in safety and quality in healthcare.
AIHW	Australian Institute of Health and Welfare	National agency that provides regular information and statistics on Australia's health and welfare.
AMT	Australian Medicines Terminology	A national, standards-based approach to the identification and naming of medicines in clinical systems for Australia.
ASGS	Australian Standard Geographical Classification	Used from 2011 by the Australian Bureau of Statistics (ABS) to calculate geographical statistics. We use ASGS in this report to calculate rurality based on postcode (categorised as in major cities, inner regional, outer regional, remote and very remote areas).
ATC	Anatomical Therapeutic Chemical Classification	System used to classify medicines into groups according to certain characteristics.
AURA	Antimicrobial Use and Resistance in Australia	A national surveillance system for antimicrobial use and resistance in Australia.
Average		Measurement of the 'central' or 'typical' value of a set of values. It is the result obtained by adding together several values and dividing this total by the number of values.
BEACH	Bettering the Evaluation and Care of Health program	Cross-sectional program collecting information on GP activities in Australia.
BMI	body mass index	A measure of healthy weight in relation to height.
BP	best practice	Clinical management software for the GP.
CIS	clinical information system	A generic term to describe one of several Australian national general practice software programs used by

Term	Definition	Description
		GPs to store patient/consultation/ prescription data (of which Best Practice and Medical Director are two examples).
Condition		An illness or abnormality that interferes with a person's usual activities or wellbeing.
COPD	chronic obstructive pulmonary disease	
CVD	cardiovascular disease	A collective term for diseases of the heart and blood vessels.
DoH	Commonwealth Department of Health	Federal department overseeing Australia's health system.
DVA	Department of Veterans' Affairs (Australia)	Federal department responsible for delivering government programs for war veterans, defence force and federal police members and their dependents.
eGFR	estimated glomerular filtration rate	
FBC	full blood count	
GORD	gastro-oesophageal reflux disease	
GP	general practitioner	
INR	International Normalised Ratio	A laboratory measurement of how long it takes blood to form a clot.
IRSAD	Index of Relative Socio-economic Advantage and Disadvantage	A measure of the economic and social conditions of people and households within an area, including both relative advantage and disadvantage.
LDL	low-density lipoprotein	
LFT	liver function test	
LOINC	Logical Observation Identifiers Names and Codes	A universal code system for reporting laboratory and other clinical observations
MBS	Medicare Benefits Schedule	
Median		The number separating the upper and lower half of a sample of values.
MD	Medical Director 3	Clinical management software for the GP.
NCTS	National Clinical Terminology Service	Agency responsible for managing, developing and distributing national clinical terminologies and related tools and services to support the digital health requirements of the Australian healthcare community.
OECD	Organisation for Economic Cooperation and Development	A group of member countries that discuss and develop economic and social policy.
PBS	Pharmaceutical Benefits Schedule	Program providing subsidised prescription medicines to Australians.
PHN	Primary Health Network	
Practice site		The unit of data collection corresponding to either one practice or to several practices that share the same clinical system database. Practices combined into one site are typically under common administration or operating in the same geographical area.
RACGP	Royal Australian College of General Practitioners	
Rate		Measure or ratio of how two factors are associated with one another; eg, a proportion of patients with a condition.
RFE	reason for encounter	

Term	Definition	Description
RPBS	Repatriation Pharmaceutical Benefits Scheme	Program providing subsidised prescription medicines to Australians veterans and their families
SAS	Statistical Analysis Software	Statistical software program.
SEIFA	Socio-economic Indices for Areas	An indication of the relative socio-economic wellbeing of an area. Calculated by ABS index of relative socio-economic advantage and disadvantage.
SNOMED-CT-AU	Systematized Nomenclature of Medicine – Clinical Terms – Australia	A standardised healthcare terminology including comprehensive coverage of diseases, clinical findings, therapies, procedures and outcomes used in electronic health records.
UEC	urea electrolytes and creatinine	This test is a measure of kidney function.
URTI	upper respiratory tract infection	

Appendix 2. DETAILED DATA ELEMENTS

Practice and provider information	
Practice	**Provider**
Encrypted unique ID	Encrypted unique ID
Location (eg, state, rurality)	Encrypted site ID
CIS name	Provider type (eg, doctor or nurse)
Multi-practice flag	Provider status (eg, active or inactive)

Patient information	
Demographics	**Risk factors**
Encrypted unique ID	Alcohol intake status
Birth year	Smoking status
Sex	Smoking ceased date
Aboriginal or Torres Strait Islander status	**Encounter**
Concession/pension status (eg, Health or DVA)	Encounter date
Residential location (state or rurality)	Reason for encounter (free-text or coded)
CIS patient status (eg, active or inactive)	Number of encounters per visit date
Deceased year	**Observation**
Deceased status	Observation type (eg, blood pressure, pulse, weight, height etc)
Diagnosis	Observation value
Diagnosis	Observation performed date
Diagnosis date	**Pathology summary results**
Diagnosis type	Collection date
Diagnosis active	Completion flag
Confidential flag	Confidential flag
Allergy	Encrypted laboratory name
Allergy name	Encrypted laboratory reference number
Reaction severity	Normal result flag
Reaction type	Report date
Prescriptions printed	Request date
Medicine name	**Pathology detailed results**
Medicine active ingredient/generic name	Test result date
Reason for prescription	Test result name
Dose	LOINC code
Frequency	Test result value
Form	Test result units
Quantity	Normal range
Strength	Abnormal flag
Route	**Immunisation**
Regulation 24	Vaccine name
Number of repeats	Batch number
Repeat interval	Sequence number
Restriction code (PBS/RPBS)	Recipient age
Private script	Date administered

PRN	Administered at practice
Current medicines	Type of provider that administered
Date first/last prescribed	Administered route
Deleted/ceased date	Australian Childhood Immunisation Registry (ACIR) report status
Deletion reason	ACIR transmitted date
Previous authority	Consent code
Current prescription	Consent provider
Ceased medication	**Billing data**
	MBS service item number
	Service date
	Patient count
	Visit date

This list excludes derived data (eg, ATC codes, SEIFA or rurality) and fields that allow linkage between tables or that record when a field is updated. https://www.nps.org.au/medicine-insight/using-medicineinsight-data#databook

Appendix 3. SELECTION CRITERIA

This appendix contains further details of the approach and rationale for the cohort selection and exclusion criteria used. This detailed information is provided to help readers understand the assumptions we have used to create a consistent cohort.

MedicineInsight extracts detailed granular data from two separate CISs with different business rules, and combining and describing these data is challenging. Data are entered in both free-text and coded forms, and different fields may be used for similar purposes (eg, reason for encounter or reason for prescription may both contain similar data). CIS users (either clinicians or non-clinicians) may open a patient record for different purposes (eg, updating patient details or for other administrative reasons) or use an inappropriate user login (eg, a practice manager may enter data into the CIS using a GP's user details).

Once each cohort was identified, numbers were incrementally checked to ensure that general practices, GPs and patients were associated with at least one of the included encounters.

General practices

There were initially 555 eligible practice sites recruited to MedicineInsight during the study period, representing 649 general practices. Table A3.1 summarises the inclusion criteria, with additional detail provided below. Data from 475 general practices were included in the 2016–17 study cohort, representing 5.9% of all practices in Australia.[6]

Table A3.1 General practice selection criteria

Final cohort	Inclusion criteria	Rationale	Sites excluded
General practices 475 general practices, representing 418 general practice sites 5.9% of general practices in Australia	Successful data extract	To ensure timely reporting and completeness of data, only general practices that had a successful data extract in the July 2017 database build were included	99
	Met the general practice data quality criteria	To ensure high-quality data, only general practices that met the established quality criteria (established for at least 2 years, no significant gaps in data tables and a reasonable volume of patients) were included	22
	Identified as a general (not a specialised) practice	To ensure consistent reporting of general practice activity, only practices that met the RACGP definition of a general practice were included	2
	With included GPs, patients and encounters	To ensure a consistent cohort, only practices with included GPs, patients and encounters were included	14
		Total excluded	**137**

Successful data extract

When the initial data extraction was performed for the report, 99 of the original 555 practice sites did not meet the successful data extract criteria.

Since MedicineInsight's inception as a pilot quality improvement program, data extracts from participating practices have been collated into a relational database called Datastore. Currently,

a static complete dataset is created monthly from Datastore, which includes only data from those practice sites that have successfully delivered a data extract in the first 21 days of the previous month. These criteria were designed to ensure that when practices received regular feedback via practice level, there was timely longitudinal data to allow meaningful reporting on the provision of patient care for their quality improvement activities. A data warehouse is now available and this appends (updates new records) rather than replaces data extracted from the CIS. This new system means it is likely that more practices will have a successful data extract and meet the data quality criteria in future.

Met the general practice data quality criteria

Routine data quality criteria were applied to the remaining cohort of 456 practice sites, and this resulted in a further 22 practices being excluded from the cohort.

For all practice sites with a successful monthly data extraction, an automated data quality report was produced and manually checked against the criteria listed below. These data quality criteria were designed to ensure that there were adequate longitudinal data to allow meaningful reporting back to practices. Where practices do not meet the data quality criteria, routine reporting is not provided. The data quality selection criteria for the cohort of general practices (with the number of practices excluded given in parentheses) were:

- established as a practice for at least 2 years, to ensure adequate longitudinal data on patients (4)
- no gaps of more than 1 month in the previous 2 years in data entry into key data tables (patients, diagnoses or patient history, encounters, observations, prescriptions, pathology test requests and results) (15)
- data available for at least 50 patients in the 2 years prior to the database build, to exclude practices that did not record clinical data in their CIS (3).

Identified as a general practice

We have used the commonly applied RACGP definition of a general practice as an organisation that provides ‘person centred, continuing, comprehensive and coordinated whole person health care to individuals and families in their communities’[9] as part of our cohort selection criteria. Two practices were excluded from our cohort as they provide only specialised services, such as mental health, and they do not provide comprehensive general practice services. There are some practices in MedicineInsight that provide specialised services such as sexual or skin health in addition to comprehensive general practice services, and these practices were included in the cohort.

With any included GPs, patients and encounters

A further 14 practices were excluded from the cohort as they had no associated GPs, patients or encounters that were eligible for inclusion during the study period.

General practitioners

A summary of the detailed criteria and rationale for the GP cohort (predominantly general practitioners and general practice registrars) is outlined in Table A3.2. They are referred to as GPs within the report text.

Within a practice, many different types of provider can record information in the CIS, including GPs, nurses, allied health staff and non-health professionals such as receptionists or administrative staff. Identifying GPs within the CIS is challenging as:

- providers select a user type (eg, GP, nurse, nurse practitioner) based on their role; however, this does not appear to be always reliably entered
- providers may have multiple IDs within the CIS as it is possible to create a new CIS login, if, for example, they forget a previous login.

We initially identified 8697 GP provider records from the CISs. Almost 40% of these records were not associated with a complete GP prescriber number, and were excluded. However, as it is very common for GPs to work across multiple practices, many of these were not unique GPs. After deduplication of provider IDs and prescriber numbers, we included 2682 unique (individual) GPs, from 2992 GP provider records, in the study cohort. This represents 7.5% of all GPs in Australia.[7]

Table A3.2 GP selection criteria

Final cohort	Inclusion criteria	Rationale	Number of provider records excluded
GPs 2682 unique GPs* 7.5% of GPs in Australia	Working at an included practice	To ensure a consistent scope	517
	Without an administrative provider name	To ensure that the provider is a GP	16
	With a minimum volume of activity (> 3 encounters, diagnoses or prescriptions in total in the year)	To exclude providers who are not likely to be practising GPs due to the low volume of activity	1748
	Identified with a complete prescriber number	To ensure the report focuses on GPs and doesn't rely on self-identification as a GP by a CIS user	3392**
	With included patient encounters	To ensure a consistent scope	32***
		Total excluded	**5705**

* From 2992 different GP provider records.
** Representing 2431 unique GPs.
*** Representing 10 unique GPs.

Working at an included practice

Only GPs who worked at an included practice were eligible for inclusion. This resulted in the exclusion of 517 provider records.

Without an administrative provider name

In some records, although the user type was recorded as GP, the provider name field included administrative terms such as admin, reception or manager. Applying these criteria resulted in the exclusion of a further 16 provider records.

With a minimum volume of activity

We applied a minimum threshold of clinical activity as part of the criteria for inclusion in the GP cohort. We excluded 1748 GP providers who had fewer than three records of an encounter, diagnosis or prescription recorded during the 2016–17 study period to ensure we were accurately identifying GPs.

Identified with a complete prescriber number

The Medicare prescriber number is issued by the PBS and is unique to each practitioner (including doctors, dentists, optometrists, midwives and nurse practitioners) who is approved to prescribe PBS medicines in Australia. MedicineInsight extracts the Medicare prescriber number from the CIS. To maintain the confidentiality of providers, this information is not released to third parties, and is used for internal data quality purposes only.

There were 3992 GP provider records (representing 2431 unique GPs) that did not contain a complete prescriber number and were excluded from the cohort.

We reviewed the data to understand the impact of excluding provider records without a complete prescriber number, given the volume of records excluded using this criterion. Table A3.3 shows that the excluded records were associated with less activity, and were more frequently marked as inactive in the latest download from the CIS. They were also more likely to have a missing Medicare provider number.

Table A3.3 Comparison of included and excluded GP providers

Criteria	Provider records with complete prescriber number (N = 3024)	Provider records without complete prescriber number (N = 3392)
Activity level (encounters + diagnoses + prescriptions)	Average activity level = 7554	Average activity level = 1682 **78% fewer activities**
Classified as inactive	413 (13.7%) inactive	N = 2200 (64.9%) inactive **Nearly 5 times as likely to be inactive**
Medicare provider number	N = 519 (17.2%) missing	N = 3379 (99.6% missing) **Nearly 6 times as likely to be missing a Medicare provider number**

With included patient encounters

A further 32 provider records were excluded from the GP provider cohort, as they had no associated patient encounters during the 2016–17 study period.

Patients

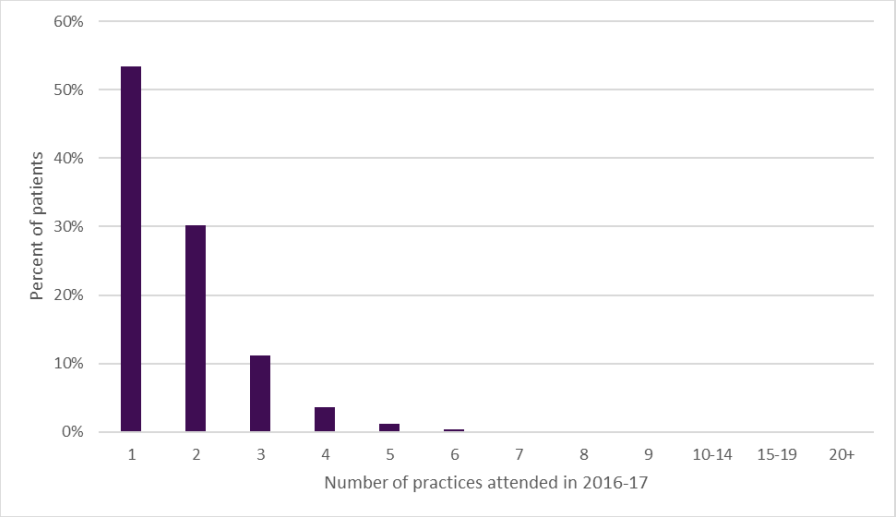
There were 2,850,243 patient records for people with any encounter in the 2016–17 study period. After cohort selection (Table A3.4), 2,168,084 patients were included in the final study cohort. This approximates 10.2% of patients who visited a general practice in Australia in the same period (as defined by MBS patient and encounter data[19]).

Table A3.4 Patient selection criteria

Final cohort	Inclusion criteria	Rationale	Number excluded
Patients 2,168,084 patients Estimated 10.2% of general practice patients in Australia	With an encounter at an included practice with an included GP	To ensure a consistent scope	663,729
	Identified as a patient in the CIS	To include patients and exclude other groups such as next of kin and emergency contacts	14,826
	With included encounters	To ensure a consistent scope	3,514
		Total excluded	**682,159**

Patients are assigned a unique patient ID within the CIS at each practice they attend. Unfortunately, we are currently unable to link patients across different practices within MedicineInsight, and consequently there is duplication of records where patients attend multiple included practices. However, MBS patient loyalty data for the year 2016–17, on the number of practices that patients visit, and the encounters per practice, show that the majority of Australian general practice patients (53%) attended a single practice, and less than 10% of patients attended more than 3 practices (Figure A3.1).[10] Assuming that patient loyalty rates in our cohort are similar to national patient loyalty rates, and using these rates to assess the probability of a patient visiting another included MedicineInsight practice, we can estimate that for every 104 patient records, we have 100 unique patients. As this is not a significant duplication rate, we have not adjusted for it in these analyses.[19]

Figure A3.1 MBS patient loyalty data 2016–17[7]



With an encounter at an included practice and with an included GP

Only patients with at least one encounter at an included practice and with an included GP were eligible for inclusion in the cohort. This resulted in the exclusion of 663,729 patient records.

Identified as a patient in the CIS

Some practices record information in the CIS on a patient's next of kin or emergency contact, and this can create an invalid patient ID. We excluded 14,826 records that were not identified as patients.

We have included patients who met the inclusion criteria irrespective of their recorded patient status (active, inactive or deceased). The rationale for this was that the database contains only the most recent patient status recorded in the practice CIS, and this is likely to be unreliable. For example, not all patients inform practices that they will no longer be attending that practice, or a patient may have died during the year and will still have relevant activity included at that practice.

With included encounters

Only patients who had at least one valid included encounter were eligible for inclusion in the study. A small number of patient records (3514) were removed from the final dataset because they were not associated with an encounter from the included cohort of encounters, as they had encounters that used only administrative terms.

Encounters

There is currently no single consistent accurate electronic marker of an encounter between a patient and a provider in a general practice CIS. If any change is made to an electronic health record, the CIS records this as an 'encounter', regardless of the associated activity (administrative or clinical). If a patient record is opened and no changes or entries are made to the record, an 'encounter' may be recorded. For example, if a record is 'discarded' in MD, the encounter record is still created in the database but with a discarded flag and a deleted record flag. While these data will be available in future datasets, they are not available in the current dataset for the report.

For the purposes of defining this cohort, all encounters with an included GP at an included practice, other than those that were clearly associated with an administrative reason for encounter, were included.

Using the inclusion criteria, there were 10,429,217 encounters in this cohort (Table A3.5). Assuming that these encounters were associated with an MBS GP attendance billing item, this would represent 7.0% of MBS-billed GP encounters in Australia in the same time period.[19]

Table A3.5 Encounter selection criteria

Final cohort	Inclusion criteria	Rationale	Number excluded
Encounters 10,429,217 encounters 7.0% of MBS GP encounters in Australia	At an included practice with an included GP and patient	To ensure a consistent scope	7,748,734
	Did not have an administrative reason for encounter	To ensure inclusion of clinical rather than administrative encounters	73,700
		Total excluded	**7,822,434**

At an included practice with an included GP provider and patient

Only encounters that took place at an included practice, with an included GP provider and with an included patient were eligible for inclusion. This resulted in the exclusion of 7.75 million encounters.

Did not have an administrative reason for encounter

Encounters were excluded if the 'reason for encounter' field included a clear administrative activity such as 'administrative reasons', 'forms', 'recall' or 'update file'. Applying this criterion resulted in the exclusion of a further 73,700 encounters.

Appendix 4. CONDITION CODING AND COMPLETENESS

As part of the data validation process for this analysis, for a subset of 41 general practices with complete data on MBS billing, we investigated the completeness and data entry source of CIS fields used to extract information about conditions. Table A4.1 provides information on the completeness and the proportion of reason for encounter (RFE), reason for prescription (RFP) and diagnosis fields with data recorded, coded (Docle or Pyefinch) and free-text. Of 993,779 MBS-billed encounter groups:

Reason for encounter

- 839,489 (84.5%) had at least one RFE recorded in the RFE field, and 15.5% had no data entered in the field
- 681,453 (68.6%) had at least one coded RFE and 158,036 (15.9%) had only free-text data

Reason for prescription

- 118,662 (11.9%) had at least one RFP recorded in the RFP field, and 88.1% had no data entered in the field
- 83,328 (8.4%) had at least one coded RFP and 35,334 (3.5%) had only free-text data

Diagnosis

- 292,534 (29.4%) had at least one diagnosis recorded in the diagnosis field, and 70.6% had no data entered in the field
- 252,340 (25.4%) had at least one coded diagnosis and 40,194 (4.0%) had only free-text data.

Table A4.1 Frequency and proportion of fields with recorded, coded, free-text and missing data (N = 993,779)

Field	Any data included		Coded data available		Only free-text data		No data	
	N	%	N	%	N	%	N	%
RFE	839,489	84.5	681,453	68.6	158,036	15.9	154,290	15.5
RFP	118,662	11.9	83,328	8.4	35,334	3.5	875,117	88.1
Diagnosis	292,534	29.4	252,340	25.4	40,194	4.0	701,245	70.6

Appendix 5. WEIGHTING PROCEDURE

This weighting procedure was developed by the ABS to assess and ensure the representativeness of the MedicineInsight data for this report. This appendix outlines the steps taken to weight MedicineInsight encounters to provide a representative national dataset for general practice patients and activity in Australia.

The weighting procedure has been developed based on three major factors: (1) the known characteristics of MedicineInsight practices and other data; (2) the estimates that are being produced; and (3) the population-level information that is available.

Statistics for patients, encounters, prescriptions and pathology results were weighted; however, results for general practices and GPs were not weighted, as the purpose of these chapters was to describe the characteristics of the MedicineInsight cohort and alternative national data sources are available which provide more detailed statistics on general practices and GPs than are available in MedicineInsight.

Encounter weighting

The population data used for calibration were Medicare claims data from the MBS.[8] Medicare claims from the following MBS claim groups were included: A1, A2, A5, A6, A7, A11, A14, A15 (subgroup 1 and items 735–758 only), A17, A18, A19, A20, A22, A23, A27, A30. This is equivalent to the DoH broad types of service A, B and M, which is the basis for GP attendance services.[8] The calibration levels used for benchmarking were state/territory, sex and 10-year age group of the patient involved in the encounter. The weight was calculated by dividing the total number of MBS claims of patients in each category by the number of MedicineInsight encounters in that category. As a formula this is:

$$w_{encounter\ S,Sx,A} = \frac{N_{encounter\ S,Sx,A}}{n_{encounter\ S,Sx,A}}$$

In this formula:

- $w_{encounter\ S,Sx,A}$ is the weight of encounters for patients in state S, with sex Sx and age group A. If state or age is missing, or sex is missing or intersex/indeterminate, the practice weight is used in lieu of this weight.
- $N_{encounter\ S,Sx,A}$is the benchmark number of encounters for patients in state S, with sex Sx and age group A.

This weighting procedure ensures that all encounters involving the same patient (at the same practice) are given the same weight.

Limitations of weighting procedure

There is a small mismatch in scope between MedicineInsight encounters and the MBS billing data, as the MBS data do not cover all services provided by a GP. Specifically, the MBS data do not include services funded by other organisations such as the DVA National Treatment Account, state and territory community-controlled health centres, worker's compensation, and other insurance schemes and services paid in full by a patient who is not eligible for Medicare-funded services, such as international visitors not covered by international reciprocal healthcare agreements.

This results in a very slight increase in the size of the weights. The proportion of MedicineInsight encounters in these non-MBS billable categories has not been investigated thoroughly. BEACH 2015–16[1] estimated that 97.4% of GP consultations were MBS/DVA billable, leaving 2.6% of encounters not funded by MBS/DVA. This gives some reassurance that the proportion of MedicineInsight non-MBS billable encounters is sufficiently small not to affect statistics in this report. Furthermore, a preliminary investigation of the MedicineInsight 'reason for encounter' field showed that approximately 0.4% of encounters mentioned worker's compensation, compared with 1.4% in the BEACH 2015–16 data.

All statistics in the GPIR are proportions, rather than totals. Proportions are far less affected by changes in magnitude of weights due to issues such as those described. It is highly unlikely that these issues will have any significant impact on the quality of statistics in this report.

Patient weighting

To weight patients, the encounter weight was used. It was not possible to weight the patient data set to patient-level population data because MedicineInsight data were not recorded at the patient level, but at the patient-by-practice level and detailed population data were not available at the patient-by-practice level for weighting. The patient weight was defined as the same weight as one of the patient's encounters. From a weighting perspective, as all in-scope encounters from MedicineInsight patients are included, it is reasonable for a patient and their encounters to have the same weight.

As the MBS billing information was not available split by Aboriginal and Torres Strait Islander status, separate patient weights were not calculated for Aboriginal and Torres Strait Islander patients.

Prescriptions and pathology weighting

The encounter weight was also used for prescriptions and pathology results. Prescription and pathology results data were not weighted separately (using prescription and pathology result population data) as suitable population data were not available.

Future weighting enhancements

While the weighting procedure is considered suitable to enable nationally representative statistics to be produced, several possible further enhancements could be made to further improve the representativeness of the MedicineInsight data for future national-level reports.

Patient weighting

Weighting patients is a highly complex issue. If a patient weight (not patient-by-practice weight) were able to be calculated, this would enable weighting the patient data to an exact national population attending general practices. MedicineInsight is working to be able to link patients across practices. Data are unlikely to ever become available on the activities of MedicineInsight patients occurring at non-MedicineInsight practices and no weighting enhancement can address this issue.

Encounter weighting

Encounter weighting could be enhanced to better capture the practices participating in MedicineInsight, given the patterns of recruitment. For example, currently there are specific PHNs where there is ongoing active recruitment of practices. To do this, weights could be adjusted according to the volumes of practices within each PHN. Given that encounters are weighted using state/territory, sex and 10-year age groups, encounters from practices where PHNs have higher volumes of practices could be given an additional lower weighting than encounters from practices within PHNs with smaller numbers of participating practices.

Encounter weighting could be further enhanced using additional population data such as the number of encounters by remoteness.

Prescription weighting

PBS data were considered for prescription weighting, but they were not used because of concerns about coherence between MedicineInsight and PBS prescription data. For example, PBS data count numbers of scripts dispensed whereas MedicineInsight counts prescriptions recorded by the GP and include private scripts. Also, it is more practical to have one weighting process only where suitable.

Weighting for data items with high non-response

Statistics for data items with high rates of non-response could be improved by reweighting those data items specifically using responding units only. This would be especially beneficial if it is suspected that missing data are not random, for example if less healthy or older patients are more likely to have a response than younger patients. The most notable example of this is BMI, which was not recorded for 71% of patients over the age of 18.

Weighting for Aboriginal and/or Torres Strait Islander patients

Nationally representative general practice activity data for Aboriginal and/or Torres Strait Islander patients were unable to be included in this report. The large quantity and high level of detail in the MedicineInsight data make it an ideal data source for reporting data for Aboriginal and/or Torres Strait Islander patients but unfortunately the MedicineInsight patient cohort was not considered to be representative of Aboriginal and/or Torres Strait Islander patients nationally because of the small numbers of Aboriginal Community Controlled Health Services (ACCHSs) included. Sufficient population data were not available to adjust for this lack of representativeness.

To produce national statistics, it is essential that a nationally representative sample of ACCHSs are included in the MedicineInsight data. It is important that population data for Aboriginal and/or Torres Strait Islander patients are available so that weighting can be performed. MBS information, based on the Voluntary Indigenous Identifier, may be available as the population data source for weighting encounters in the future.

Future MedicineInsight practice recruitment

Underrepresented areas should be targeted in future MedicineInsight recruitment. In particular, inclusion of more practices in remote areas, lower socio-economic areas and ACCHS practices would enable more representative statistics to be produced.

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