PHARMAC
TE PĀTAKA WHAIORANGA

Medicines access equity outcomes framework report

Methodology document

Establishing the baseline: Updated October 2021

Version 1.1

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Get in touch

This methodology is intended to prompt discussion, we welcome and encourage feedback. Please get in touch with us at accesseguity@pharmac.govt.nz

Disclaimer

All care has been taken in developing the methodology; however, Pharmac gives no indemnity as to the correctness of the methodology described here. Pharmac shall not be liable for any loss or damage arising directly or indirectly from use of the data or insights derived from this methodology.

Implications from this methodology:

Pharmac's Medicine Access Equity and Monitoring and Outcomes Framework (Appendix A) presents key outcomes and measures to track Pharmac's ability to influence equitable access and use of medicines at a system level. The key outcomes identify the changes that we would expect to see when medicine access equity is achieved. Pharmac has adopted a system level focus, which means that it does not have control over all the outcomes in the Framework. Tracking progress at the system level will help Pharmac to exercise our influence with other health sector partners and also see where we can take action or invest resource.

This methodology and the results it generates will:

- be included in Pharmac's Statement of Performance Expectations (SPE) measures,
- support Pharmac's Te Whaioranga 2013-2023: Māori Responsiveness Strategy, along with stage 2 of the Pacific Responsiveness Strategy
- be used to influence better health sector engagement and partnerships with people to help eliminate medicines access inequity.

The methodology presented here is focused on specific conditions. However, in some instances it is difficult to break the information down by condition. It would be desirable to have primary care data that includes the condition which pharmaceuticals are prescribed for to enable pharmaceutical usage to be assigned to the condition for which it is used. This would also enable better identifications of cohorts with multiple conditions.

"Possession" is based on people picking up prescriptions; however, there is currently no information to say a person has actually taken a medicine. As a proxy for this a national laboratory collection (1) that captures test results (rather than tests given) would provide some evidence that the pharmaceuticals are being used and the markers for effectiveness are improving.

This methodology is a starting place, while it provides some insights about medicines use and outcomes further work needs to be done to both refine and broaden the methodology. As refinements are made or new methodology developed, this document will be updated to reflect the advancments made. This will then allow deeper insights and understanding of the role of medicines in people's health outcomes.

This methodology represents our base for measuring, monitoring, and understanding medicines equity. We acknowledge that this is a start and intended to prompt hypothesis and generate discussion on how we can better understand medicines access equity. We intend to expand on the methodology and will be guided by the feedback we receive.

Contents

Glossary

Access: Access to medicine is a larger issue than just whether a medicine can be prescribed. Our definition includes the following aspects:

- **Availability** – relates to whether the medicine has been deemed safe by a regulatory body, is publicly funded, and there is adequate supply.
- **Utilisation** – concerned with the extent to which a population gains access to and uses available medicines optimally.
- **Outcomes** – about the quality, relevance, and effectiveness of prescribing and dispensing.

Access in this context can refer to the first time someone is prescribed a medicine as well as ongoing access for long-term conditions.

Age standardised rates (ASR): The age standardised rates are those that would have existed had the population of interest, for example Māori and non-Māori, had the same age distribution as the 'standard' population. The standard population for the age-standardised analyses in this project was the 2013 Māori estimated resident population.

Any dispensing (persistence): The percentage of people who once starting a medicine continue to be dispensed at least one prescription for the condition in that year. This includes people who started the medicine prior to 30 June 2019 since NHI data was collected from 2006.

Chemical name: Chemical/generic name of the active chemical ingredient.

Disability Adjusted Life Years (DALYs) (2)**:** Disease burden in Māori and non-Māori populations was estimated using DALYs. DALYs integrate the fatal burden (Years of Life Lost, or YLL) with the non-fatal burden (Year Equivalents Lost to 'Disability', or YLD). One DALY represents the loss of one year of healthy life.

Equitable use: Access to pharmaceuticals at a level consistent with a population's health need.

Medicine inequity: unnecessary and avoidable (or unjust) differences in medicines dispensing rates, medicine usage or disease burden between ethnic groups. Inequities can also occur in relation to other factors, such as deprivation and rurality. While the initial work is focussing on ethnicity, later work will explore potential inequities in relation to these other factors.

Medicine access equity: Adapted from the World Health Organization (WHO) definition of equity and health equity, Pharmac defines medicine access equity as:

> *"The absence of avoidable, unfair, or remediable differences in funded medicine access among groups of people, whether those groups are defined socially, economically, demographically, or geographically, or by other means of stratification."*

Medicine access equity means that everyone should have a fair opportunity to access funded medicines to attain their full health potential, and that no one should be disadvantaged from achieving this potential. In this context, unequal inputs are required to attain a fair opportunity to access funded medicines.

Need: Need is about the disease, condition, or illness. Normally we consider need by comparing life expectancy and quality of life (QoL) at full health to life expectancy and QoL with the disease,

condition, or illness. Our previous research (3, 4) used the DALY estimates from the NZ Burden of Disease Study as proxies of health need for Māori, Pacific peoples, and non-Māori, non-Pacific peoples. Need is defined as the ratio of the population group of interest compared to the comparator population group and uses either the National Minimum Dataset (5) or the Mortality Collection (6) as a basis for health need (3, 4).

NHI: National Health Index number is a unique identifier that is assigned to every person who uses health and disability support services in New Zealand (7).

NZBD: New Zealand Burden of Diseases, Injuries and Risk Factors Study (8).

Possession: A person's level of medicine possession can be measured by the amount of medicine they have been dispensed, compared with what they should have been dispensed for a full year of treatment. For the purposes of the insights, we have defined possession as the percentage of people with 'any dispensing' who have had enough medicine prescribed and dispensed to cover the year.

Prioritised ethnicity: For Māori and Pacific peoples we have used prioritised ethnicity. One of the main criteria stipulated in the definition of ethnicity is that a person can belong to more than one ethnic group. The ethnicity question caters for multiple responses[1]. However, the question does not ask people to indicate the ethnic group with which they identify the most strongly. In prioritised output, each respondent is allocated to a single ethnic group with Māori first followed by Pacific peoples (9, 10). There are prioritisation orders for both level 1 and level 2 of the classification. The aim of prioritisation is to ensure that – where some need exists to assign people to a single ethnic group – ethnic groups of policy importance or of small size are not swamped by the New Zealand European ethnic group. Prioritisation is a reduction process for output and analysis purposes and does not assume this is the ethnic group that a respondent identifies most strongly with.

Regular dispensing (persistence and possession combined): The percentage of people who have had any dispensing in the year (persistence) ***and*** have had enough medicine dispensed to cover that year (possession), adjusted for starting the medicine part-way through the year. Note that this does not include dose appropriateness.

Total response ethnicity: Total response ethnic groups involves each person being allocated to all ethnic groups that they have identified with. This can result in overlapping groups, where some people can appear more than once (10) . This means that if someone identifies as being Chinese and Māori, they are classified as both Asian and Māori for the purpose of analysis; in other words, they will appear in the rates for both the Māori population and the Asian population. Statistics New Zealand has compared ethnicity data from the 2013 Census with the ethnicity information collected by administrative sources currently available in Statistics NZ's Integrated Data Infrastructure. (11)

[1] The standard ethnicity question for the health and disability sector is the Stats NZ 2018 Census ethnicity question.

Acronyms

ABBREVIATION	DESCRIPTION
ASH	Ambulatory sensitive hospitalisations
ASR	Age standardised rate or risk (depending on measure)
COPD	Chronic obstructive pulmonary disease
CVR	Cardiovascular risk
DALY	Disability adjusted life year
DHB	District Health Board
ED	Emergency department
FY	Financial year ending 30 June
GP	General practice
GR	Gap ratio
HQSC	Health Quality & Safety Commission
ICD	International classification of disease
MELAA	Middle Eastern, Latin American, African
NES	National enrolment service
NMDS	National Minimum Dataset
RR	Rate ratio
VDR	Virtual diabetes register
YLD	Years living with disease
YLL	Years of life lost

Introduction

In 2017 Pharmac set a bold goal to eliminate inequities in access to medicines by 2025, the intent of that goal is now encompassed in our refreshed Statement of Intent, in which *Equitable use and access to medicines and medical devices* is a strategic (12) priority in our 2020–2024 plan. The goal recognises that everyone should have a fair opportunity to access funded medicine to attain their full health potential, and that no one should be disadvantaged from reaching their potential.

Our Capstone discussion document, *Achieving Medicine Access Equity in Aotearoa: towards a theory for change* (13), provides a narrative and explanation of the drivers (14) that we believe contribute to medicine access equity: availability, affordability, accessibility, acceptability, and appropriateness.

Our discussion document outlined the scope and focus of our work on access to medicines that are already publicly funded for conditions that are significantly amenable to medicines as a treatment mode. This included medicines for the prevention, treatment, and /or management of type 2 diabetes, gout, asthma, and cardiovascular disease. We also noted that our initial priority population will be our Tiriti partner, Māori, whose health inequities are well-evidenced, and that in time other priority populations will include:

- Pacific peoples
- those living in high socioeconomic deprivation
- those residing in rural and isolated areas
- people from former refugee backgrounds.

Currently, not all New Zealanders are achieving 'best health outcomes' (13) from medicines that we fund. In this context, unequal inputs are required to attain a fair opportunity to access funded medicines for better health outcomes.

In 2019, Synergia, the National Hauora Coalition, and Pharmac developed the Medicine Access Equity Outcomes and Monitoring Framework (the Framework) (Appendix A). The Framework recommends a phased approach to implementation as follows:

1. **Establish the baseline for existing indicators.** This could form the basis of a dashboard and/or reports to track progress.

2. **Develop and test analytical approaches** for new indicators that can be supported by existing data sources.

3. **Explore opportunities for data sharing and integration with the sector.** Engaging with District Health Boards and Primary Health Organisations, for example, would support access to prescribing data.

4. **Explore options for investing in new data collection.** This could be adding questions or indicators to existing data sources or investing in additional data collection processes or systems with the sector.

5. **Establish internal review processes** to track changes in internal capability.

This methodology represents the first phase in implementing the Framework and supporting Pharmac's new strategic direction. The Framework supported Pharmac to establish analytical methods and approaches that can be replicated in the future for other population groups and conditions.

The Framework is conceptually designed to monitor:

1. a set of population level measures for medicine access for priority conditions and priority populations
2. a set of indicators for the five drivers of medicine access for the priority populations.

The Framework identified key outcomes and how they can be measured. With clear and specific outcomes defined at the outset, Pharmac has a better chance of prioritising actions which will successfully contribute to the key outcome, which is priority populations having equitable access to funded medicines that is in line with their health need.

The Framework presents measures on the five key drivers (14) of medicine access equity, population level monitoring, and Pharmac's internal capability (Appendix A).

The Framework separates the monitoring into two parts:

- population level monitoring measures and
- medicine access equity outcome domains which focus on the drivers of inequity (13, 14).

This methodology focuses on using data that are readily available to be analysed. The Framework focuses on priority populations and conditions; however, this methodology can be extended to other conditions or population groups as needed. The focus of this work has been on comparing Māori and Pacific peoples to non-Māori, non-Pacific peoples (comparator population) for cardiovascular risk (CVR), gout, type 2 diabetes, asthma, and chronic obstructive pulmonary disease (COPD).

For the medicine access population measures, the methodology created enables measuring the below for medicines that treat type 2 diabetes, gout, asthma, COPD, and CVR for Māori and Pacific peoples versus a comparator population. The following describes the population level measures for medicine access:

- Access – this is theoretical and uses need adjusters to determine if the level of pharmaceutical usage is sufficient given the need (which varies by condition). This was calculated for:
    - individuals
    - prescriptions
    - new starters
- Any dispensing (persistence) – the percentage of people who, once starting a medicine, continue to be dispensed at least one prescription for the condition in the year.
- Possession (adherence) – the percentage of people with 'any dispensing' who have had enough medicine prescribed and dispensed to cover that year.

For the population measures, these are an expansion on the methods first developed in research undertaken by Pharmac looking at prescription usage in 2006/07 (3) adjusted by the burden of disease with a further update for prescriptions usage in 2012/13 (4, 15). One of the main parts of this work was to not only look at the access rates by Māori compared with non-Māori but to compare these rates to the rate of need, as defined by NZ Disability Adjusted Life Years (DALYs) (8). As DALYs are not readily available for different population groups and are not often updated, this work looked to develop an alternative need adjuster based on hospitalisation or mortality data depending on the condition.

Methodology: key points

The below are key points regarding the methodology that need to be taken into account when looking at the results.

Data sources: The primary data source for the population level measures in the reports is from the National Pharmaceutical Collection (16), using FY19 as the base year. The Virtual Diabetes Register (17) (VDR) was used to assist identifing those people with type 2 diabetes. National Minimum Dataset (5) (NMDS) hospitalisation data for FY19 was used for need adjustments (with an alternative rolling 5 years) for conditions where the burden of the disease is more closely linked to the years lost with disability (YLD). The Mortality Collection (6) was used to calculate the years of life lost (YLL) for conditions where the burden of disease is more closely linked to mortality.

Medicines: The inclusion criteria and classification of each medicine for each group was developed with clinical input from both Synergia and Pharmac. The list of included medicines, their monitor group, and treatment classification (eg ‘preventive’ or ‘acute’) is included in Appendix B.

Need adjuster: Disability adjusted life years (DALYs) from the NZ Burden of Disease Study (8) are only available for Māori and non-Māori. Therefore, alternative sources were needed to establish the burden of disease for each ethnicity and each priority condition. For asthma, type 2 diabetes, and gout, a unique count of individuals experiencing a hospitalisation was used, where the primary diagnosis ICD-10 codes for the condition are detailed in Appendix C. For cardiovascular risk and COPD, years of life lost (YLLs) (8) were calculated from the Mortality Collection that contained data up to 2016.

Comparator population: The comparator population is based on prioritised ethnicity and is made up of New Zealand Europeans, Europeans, Asian, Middle Eastern, Latin American, African (MELAA) and other ethnicities. It excludes Māori and Pacific populations. The same comparator population is applied to both the Māori and Pacific outputs generated (4). The Ministry of Health Whakamaua: Māori Health Action Plan 2020-2025 (18) establishes a comparator population of non-Māori, non-Pacific peoples which this method is consistent with. For conditions such as type 2 diabetes, the Asian population is removed from the comparator population due to the high prevalence of type 2 diabetes in the South Asian and Indian population.

Standard population: All data was age standardised to the standard 2013 Māori population as described by the Ministry of Health (19) using a SAS procedure stdrate (20) which includes output with confidence intervals.

Reference population: The Stats NZ Estimated Resident Population (ERP) (21) was used as the reference. A known limitation of this analysis is the inconsistency with how ethnicity is captured between the reference population and the other datasets (11, 22).

Further assumptions and limitations are described in the Risks and limitations section.

Population measures

The methodology presented here seeks to establish a baseline for the equity gap for the population level monitoring measures.

Measures

The following tables show the indicators that have been created for each measure. The measures from the Framework (Appendix A) are:

- reduce variation in access to medicine for priority populations and conditions
- reduce variation in persistence
- increase rate of medicine possession
- decrease avoidable hospitalisation rates for priority conditions and populations
- reduce variations in amenable mortality rates for priority populations and conditions.

It should be noted that the avoidable hospitalisations and amenable mortality rates are reflected in the need adjusters used in this methodology.

The indicators for these measures are:

- Access – individuals, prescriptions, and new starters
- Persistence
- Any dispensing
- Possession (adherence)
- Regular dispensing
- Need adjuster – hospitalisations and YLL.

Access

INDICATOR #1	**ACCESS – INDIVIDUALS**
Numerator	Individuals accessing medicine in that time period.
Denominator	Population
Time period	FY
Analysis	ASR, RR, [GR]
Medicines included	See Appendix B
Rationale	This measure tracks whether priority population groups are continuing on dispensed medicines for priority conditions, in line with their health need, over time.
Variations	None
Comment	Each access measure was calculated as an age standardised rate per 1,000 population, for Māori and the comparator population separately, using the Stats NZ estimated population, and the Māori standard population. The rates for each population were then combined to give a rate ratio for Māori versus comparator population access. Breakdowns of this indicator are available at condition level and the medicine monitor group level.
Exclude	Acute medicines for overall results by condition. All medicines in Appendix B included at the monitoring level.

Access continued…

INDICATOR #2	ACCESS – PRESCRIPTIONS
Numerator	Prescriptions dispensed in that time period. (Only the first dispensing of each prescription is counted, so as to avoid double counting.)
Denominator	Population
Time period	Financial Year
Analysis	ASR, RR, [GR]
Medicines included	See Appendix B
Rationale	This measure tracks whether priority population groups are being dispensed medicines for priority conditions, in line with their health need, over time.
Variations	None
Comment	Each access measure was calculated as an age standardised rate per 1,000 population, for Māori and the comparator population separately, using the Stats NZ estimated population, and the Māori standard population. The rates for each population were then combined to give a rate ratio for Māori versus comparator population access. Breakdowns of this indicator are available at condition level and the medicine monitor group level.
Exclude	Acute medicines for overall results by condition. All medicines in Appendix B included at the monitoring level.

INDICATOR #3	ACCESS – NEW STARTERS
Numerator	Individuals accessing medicine in that time period who had not previously (since 2009) accessed medicine.
Denominator	Population
Time period	FY
Analysis	ASR, RR, [GR]
Medicines included	See Appendix B
Rationale	This measure tracks whether priority population groups are starting on medicines for priority conditions, in line with their health need, over time.
Variations	None
Comment	Each access measure was calculated as an age standardised rate per 1,000 population, for Māori and the comparator population separately, using the Stats NZ estimated population, and the Māori standard population. The rates for each population were then combined to give a rate ratio for Māori versus comparator population access. Breakdowns of this indicator are available at condition level and the medicine monitor group level.
Exclude	Acute medicines for overall results by condition. All medicines in Appendix B included at the monitoring level.

Persistence

INDICATOR #4	PERSISTENCE
Numerator	Individuals from the cohort who accessed medicine in that year. See variations below.
Denominator	Individuals from the cohort who could have accessed medicine in that year if they had continued.
Time period	Financial year or rolling time period of 5 financial years.
Analysis	ASR, RR
Medicines included	See Appendix B
Rationale	This measure tracks how many people continue medicine over time compared to when they started. ie year 1, 2, 3, 4, 5 etc.
Cohort	Those starting on medicine for the first time (ignoring people who started between January 2006 to December 2006 as this reflects the capture of NHIs) within year 1 of the time period.
Variations	Over 5 years: • Numerator: Sum over cohort of years in the period that they received medicine • Denominator: Sum over cohort of years in the period that they were alive.
Comment	The persistence measure is a snapshot of the age standardised rate (per 1,000 people) at which individuals who started on medicine in FY15, received at least one dispensing in their 5th year (FY19) and were still alive within that year. The age group and DHB are based on the individual's status in FY19. Rates were calculated for Māori and for the comparator population, which were then combined to give a rate ratio.
Exclude	Acute medicines for overall results by condition. All medicines in Appendix B included at the monitoring level.

Any dispensing

INDICATOR #5	ANY DISPENSING (PERSISTENCE)
Numerator	Individuals who accessed medicine in the year ending 30 June.
Denominator	Individuals who could have accessed medicine in the year ending 30 June if they had continued on medicine.
Time period	Financial year
Analysis	ASR, RR
Medicines included	See Appendix B
Rationale	This measure tracks how many people could re-engage with medicine in a given year particularly if barriers to access are removed.
Cohort	People who started medicine on or before the year ending 30 June.
Variations	Overall • Numerator: Sum of cohort in that year • Denominator: Sum of all possible people who could have still been on medicine in that year.
Comment	Overall persistence looks at all the people who have previously started long-term medicine that, had they persisted, would still be on medicine in the year being examined.
Exclude	Acute medicines for overall results by condition. All medicines in Appendix B included at the monitoring level.

Possession

INDICATOR #6	POSSESSION (ADHERENCE)
Numerator	Sum cohort, pro-rated by the fraction of the 24 months that individuals received medicine for.
Denominator	Sum cohort, pro-rated by the fraction of the 24 months that individuals would be expected to be receiving medicine, ie have started and have not died.
Time period	Yearly rolling period of 2 financial years
Analysis	ASR, RR
Medicines included	See Appendix B
Rationale	This measure tracks if a person is using their medicine consistently over the year as taking the medicine regularly is likely to improve health outcomes.
Cohort	All individuals who received medicine within or prior to the period, and who had not died prior to the start of the period.
Variations	Possession – good (>80% possession) • Numerator: Sum of people with more than 80% of days covered • Denominator: Sum of cohort in that year Possession – overall • Numerator: Sum of people as a proportion of the days covered • Denominator: Sum of people in that year Repeats • Numerator: Total dispensings • Denominator: Total expected dispensings if all repeats were collected.
Comment	The possession calculations were based off whether the dispensings were recorded as being daily, weekly, fortnightly, monthly, quarterly, bi-monthly, half yearly, or one off. It assumes that this is a reliable measure of how long a period the medicine was dispensed for. The amount of days someone was on medicine in a year is then compared to a full year's treatment.
Exclude	Acute medicines for overall results by condition. All medicines in Appendix B included at the monitoring level.

Regular dispensing

INDICATOR #7	REGULAR DISPENSING (PERSISTENCE AND POSSESSION COMBINED)
Numerator	The percentage of people who have had any dispensing in the year (persistence) *and* have had enough medicine dispensed to cover that year (possession).
Denominator	Individuals from the cohort who could have accessed medicine in that year.
Time period	Financial years
Analysis	ASR, RR
Medicines included	See Appendix B
Rationale	This measure tracks if people are engaging with their medicine each year and if they take the medicine consistently over the year.
Cohort	All individuals who received medicine within or prior to the period, and who had not died prior to the start of the period.
Variations	None
Comment	Regular dispensing is a combination of the persistence and possession data.
Exclude	Acute medicines for overall results by condition. All medicines in Appendix B included at the monitoring level.

Prevalent population

INDICATOR #8	PREVALENCE
Numerator	Individuals from the cohort who could have accessed preventive medicine in that year.
Denominator	Population
Time period	Financial years
Analysis	ASR, RR
Medicines included	See Appendix B
Rationale	This measure tracks the people that have started preventive medicine previously for a specific condition compared to the population.
Cohort	All individuals who received medicine within or prior to the period and who had not died prior to the start of the period.
Variations	None
Comment	Prevalence is important in understanding the percent of the population impacted by a condition which then can be used for the any and regular dispensing calculations as a proportion of the prevalent population.
Exclude	Acute medicines for overall results by condition (apart from gout where colchicine is included). All medicines in Appendix B included at the monitoring level.

Need adjuster

INDICATOR #9	NEED – HOSPITALISATIONS
Numerator	Number of unique individuals admitted to hospital with a primary ICD code matching condition.
Denominator	Population
Time period	FY
Analysis	ASR, RR, [GR]
ICD codes included	See Appendix C
Rationale	Useful measure of the quality of the primary care system for conditions including asthma, type 2 diabetes, gout, COPD, and CVD. If these conditions are being appropriately supported and managed in primary care they should result in fewer hospitalisations. While medicine access is one aspect of care for patients, a decrease in avoidable hospitalisation rates for the priority populations and conditions would reflect on the performance of primary care.
Variations	Yearly • Number of unique individuals admitted to hospital with any ICD code matching condition • Count of hospital admissions with a primary ICD code matching condition • Count of hospital admissions with any ICD code matching condition Rolling 5 years • Results summed over a yearly rolling 5 year period • Population counts summed over a rolling 5 year period
Comment	Age standardised rates per 1,000 population and rate ratios were calculated for the number individuals with hospitilisations with a primary diagnosis for the condition. To reduce the confidence intervals when adjusting by need, events were aggregated over 5 years and standardised.

Need adjuster continued…

INDICATOR #10	NEED – YLL
Numerator	Sum of years of life lost due to condition, compared with best life expectancy.
Denominator	Population
Time Period	FY **Note:** There is a lag in the mortality data that is used to calculate YLL. Therefore, the YLL used in the GR analysis is for the year prior to that used for the access rates.
Analysis	ASR, RR, [GR]
ICD codes included	See Appendix C
Rationale	Useful measure of reducing inequities in health care due to premature death. This measure however, will not be relevant for all of the priority conditions. Gout, for example, is unlikely to result in death. This measure is about whole system change.
Variations	Yearly • YLLs calculated with a primary ICD code matching condition. Rolling 5 years • Yearly YLLs aggregated over 5 years.
Comment	Age standardised rates per 1,000 population and rate ratios were calculated for the number of years of life lost with a primary diagnosis for the condition. To reduce the confidence intervals when adjusting by need YLLs were aggregated over 5 years and standardised.

Mortality

INDICATOR #11	MORTALITY
Numerator	Number of individuals dying with a primary ICD code matching condition.
Denominator	Population
Time Period	FY
Analysis	ASR, RR, [GR]
ICD codes included	See Appendix C
Rationale	Useful measure of the quality of the primary care system for conditions, including asthma, diabetes, COPD and CVR. If these conditions are being appropriately supported and managed in primary care they should result in fewer deaths. While medicine access is one aspect of care for patients, a decrease in mortality rates for the priority populations and conditions would reflect on the performance of primary care.
Variations	Yearly • Number of individuals dying with any ICD code matching condition. Rolling 5 years • Results summed over a yearly rolling 5 year period. • Population counts summed over a rolling 5 year period.
Comment	Age standardised rates per 1,000 population and rate ratios were calculated for the number of individuals dying with a primary diagnosis for the condition. To reduce the confidence intervals individuals were aggregated over 5 years and standardised.

Data sources

Dispensing dataset

The primary data source for the population level monitoring analysis in this report is from the National Pharmaceutical Collection (16). This dataset is held by the Ministry of Health and accessed by Pharmac.

Financial year 2019 was used as the base year.

Key considerations for this dataset:

- Data from 2006 onwards was used to identify when patients first received particular medicines as the rate that people start medicines gives additional insights into possible interventions.

Age groups

During the age standardisation process it was found that some of the conditions where you would generally expect an older population had some limited data for people under 25, which resulted in wide confidence intervals for those age groups and less certainty for the overall results. To reduce the impact of younger age groups impacting the results, it was decided that – for cardiovascular, type 2 diabetes, and gout – people under 20 were removed from the data (23). Only asthma included all age groups. This means that the age standardised results need to be interpreted in the context of the age groups analysed.

The biggest improvement in taking this approach is having more certainty on the need adjuster by DHB. The graphs below show (Figure 1) the original need adjuster (hospitalisations) for type 2 diabetes including the younger age group on the left, and (Figure 2) the need adjuster with the younger age group removed on the right. This provides more certainty for the ratio used to adjust the access measures.

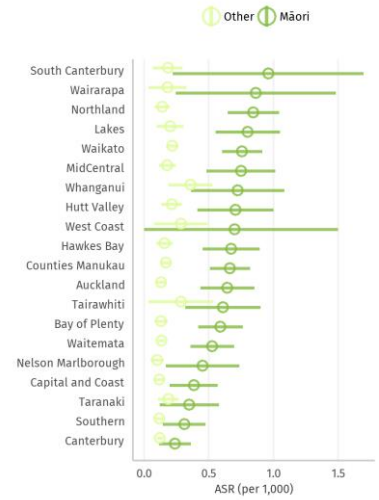


Figure 1: ASR of type 2 diabetes hospitalisations including <25years

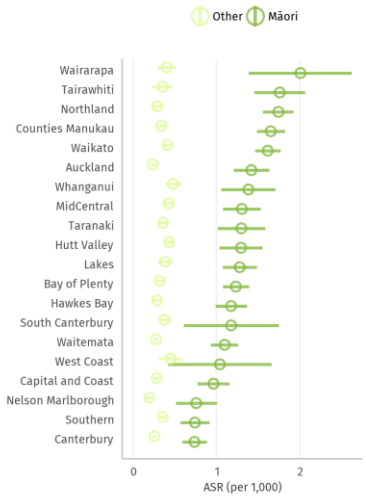


Figure 2: ASR of type 2 diabetes hospitalisations excluding <25years

The insights use age groups that aligned with our previous methodology on variations in access to medicines (3, 4). However – based on feedback – we will look to create finer age grouping (eg five-year bands) to determine the impact this has on the age standardised results.

The Virtual Diabetes Register (VDR)

The VDR (17) was used to assist in identifying those with type 2 diabetes. While the VDR does not identify the diabetes type, it was assumed that restricting people to who first started on metformin and were in the VDR (to remove gestational-related diabetes and people with polycystic ovarian syndrome) would be a good proxy for people with type 2 diabetes. We acknowledge that this method has its limitations (24); however, until a clinically defined population is available this remains our best option from the data currently available.

Key considerations for this dataset:

- There can be a time lag between individuals starting medicine for diabetes and being included on the VDR as the VDR is updated at the end of each calendar year.
- There is not an explicit way to distinguish between those on the VDR due to Type 1 or type 2 diabetes. However, people with gestational diabetes and people with polycystic ovarian syndrome are not included in the VDR.
- Whether the individual's first diabetes medicine was metformin (as this is the standard starting treatment for type 2 diabetes) was used to determine diabetes type.

National Minimum Dataset (NMDS)

Hospitalisations data from the NMDS (5) was used to create a proxy need adjuster, in place of disability adjusted life years from the NZ Burden of Disease (8) Study.

The need adjuster may be artificially inflated in the populations that show a strong preference for emergency department (ED) over general practice (GP) use. This had not been adjusted for. Future updates may consider bed-days or cost weights to account for severity of disease.

Ministry of Health Mortality Collection

Mortality data (6) provided by the Ministry of Health is used within the YLL (8) calculations. This is used as another proxy need adjuster, in place of DALYs from the NZ Burden of Disease Study (8).

Unavailable datasets

National level prescribing data was unavailable for inclusion, so only dispensing data has been used.

Populations

Priority population

For the monitoring and insights generated, Māori, as a Te Tiriti partner, and Pacific peoples, as experiencing some of the largest health inequities (along with Māori), have been prioritised to produce results for first. Prioritised ethnicity has been used for the insights however for specific ethnicity results shown in the Pacific peoples insights total response ethnicity has been used.

Comparator population

The comparator population is based on prioritised ethnicity and is made up of NZ Europeans; Europeans; Asians; Middle Eastern, Latin American, and African (MELAA); and other ethnicities. It excludes Māori and Pacific populations. The same comparator population is used for both the Māori and Pacific insights generated.

Total response ethnicity was investigated. However, to keep the comparisons simple, prioritised ethnicity was used for the first phase. Deprivation and rurality have not been included or controlled for at this stage but may feature in future updates.

Age standardisation

The data needs to be age standardised to ensure accurate comparison between populations with different age structures. The Māori population in New Zealand is substantially younger than the non-indigenous population. If these different age structures are not appropriately accounted for, then the level of inequity experienced by Māori and Pacific peoples would appear smaller.

Standardisation to the WHO or Segi populations was considered, but both were deemed unsuitable for the Māori population (19, 25).

All data was age standardised (per 1,000) to the 2013 Māori population.

Direct age standardisation of rates (26) were used for the access, hospitalisation, and mortality measures. However, for numbers that represented proportions (such as the any dispensing, regular dispensing, possession, and prevalence measures) an age standardised risk (27) was calculated. This was due to the fact that the confidence intervals for direct age standardisation rates are not bound between 0–100% and a risk measure is more appropriate for proportions.

All standardisation was done using the stdrate (20) procedure in SAS (see code in Appendix D). Importantly this calculates both standard errors and confidence intervals for the results, which were not included in Pharmac's previously published research on the variations in medicines use. (3, 4)

Reference population

The Stats NZ Estimate Resident Population (21) was used as the reference population when calculating age standardised rates. Prioritised ethnicity (Māori, Pacific peoples, Asian, Other) was used within both the reference population and the event data. This means that individuals already considered within the Māori insights would not be included within the Pacific peoples insights.

Methodology Details

Need adjuster

Disability adjusted life years (DALYs) from the NZ Burden of Disease Study (8) are only available for Māori and non-Māori. Therefore, hospitalisations and mortality were used to establish a need adjuster for each ethnicity and each priority condition. This also enables the creation of need adjusters for different population groups. The below table shows comparative sources for Māori versus non-Māori in FY13 (using WHO standard population) to provide validity to using alternative measures. The DALY shown is what was used to adjust for need from our previous research (4, 28) by condition. Ratios were then calculated from the mortality and hospitalisation data using similar assumptions that were described in the NZ Burden of Disease Study (8), namely Māori versus non-Māori age standardised to the WHO standard population for the year ending 30 June 2013.

CONDITION	DALY (REFERENCE)	MORTALITY	HOSPITALISATIONS	YLL
Asthma	1.87*	3.73	1.88	6.57
COPD		1.98	2.90	2.64
Cardiovascular	2.19	1.41	1.41	2.22
Diabetes-Type2	3.71	4.13	3.22	5.10
Gout	2.55	NA	4.93	NA

* Note the DALYs did not separate out asthma and COPD

Based on this comparison, hospitalisation data was chosen as a good proxy for asthma, type 2 diabetes, and gout, while YLLs were used for cardiovascular disease and COPD.

Gout showed a substantial difference from the DALY. However, it should be noted that the DALY used for gout previously was possibly not gout specific (3), and included other arthritis conditions and/or that the DALY estimate used previously was confounded by the inclusion of Pacific peoples in the non-Māori cohort (4). Using ICD codes (Appendix C) that are gout specific gives us a better indication of the level of need.

The comparison in the table above was used to determine which method provided the most consistent ratio when compared with the NZ Burden of Disease Study (8). However, the actual ratio used was then adjusted to make the comparator population non-Māori, non-Pacific peoples and the standard population changed to the 2013 Māori population (19, 25). In addition, to reduce the confidence interval for the need adjusters, 5 years of data were aggregated together to provide more certainty to the results, especially at a DHB level.

The need adjuster used is dependent on the priority condition and in some cases the YLL is instead used. A reference age of 92 (29) was used to calculate the YLL and a discounting of 3% (30, 31) to the life expectancy result was applied using the following formula.

$$YLL = \sum_i \left(\frac{1}{0.03}\right)\left(1 - e^{(-0.03(92 - age\_at\_death_i))}\right)$$

DALYs are only available for Māori and non-Māori (8), which means that there is not an accurate need adjustor for Pacific peoples against a comparator population of non-Māori, non-Pacific peoples. DALYs also do not allow for accurate over-time tracking (as they are not frequently updated). This means that DALYs will not provide an accurate current estimate of the equity gap, and will be difficult to track progress if used. So an alternative was needed.

Decision: to use the following sources as need adjusters for each condition:

- Cardiovascular Risk –YLL
- COPD – YLL
- Asthma – hospitalisations
- Type 2 diabetes – hospitalisations
- Gout – hospitalisations

DHB

For any DHB breakdowns, the individual's latest recorded DHB is used. This is determined by looking at a person's most recent pharmaceutical dispensing and assigning the DHB they were living in at the time to limit the variation in the analysis due to movement between DHBs. They are treated as if they have always been at that DHB for the purpose of this analysis. Currently, there is also no way to identify those who have left the country and exclude them from the persistence and possession measures.

Identifying cohorts

This analysis assumes that if someone receives preventive medicine for one of the priority conditions, that they should continue receiving this for the remainder of their life, regardless of any changes in lifestyle or life circumstances.

Condition specific adjustments

Diabetes

Given the overlap of medicines for the diabetes subtypes, identifying the relevant cohort with type 2 diabetes was a challenge. In order to exclude those with gestational diabetes and people with polycystic ovarian syndrome, it was assumed that only those included on the VDR (17) should be included. It was also assumed that those with type 2 diabetes would start on metformin (32). Therefore, only those whose first diabetes medicine was metformin were included in the diabetes cohort and tracked forward from that point in time. Some lag between people starting on metformin and appearing on the VDR was noted, which will impact FY19. Assuming that this lag applies to both Māori and to the comparator population consistently, the impact on the final rate ratios should be minimal if any. However, this does impact the gap calculation because the usage by financial year is under represented as people starting treatment in the second half of the year are potentially excluded. Once the VDR is available for 2019 the FY19 access measures could be rerun to confirm this.

For type 2 diabetes, a comparator of non-Māori, non-Pacific peoples, non-Asian has been used due to the increased prevalence of type 2 diabetes in Māori, Pacific peoples, and Asian populations (33).

Cardiovascular disease

We want cardiovascular disease to cover arteriosclerotic cardiovascular risk/disease, not the entire very disparate whole ICD chapter for cardiovascular disease. Hypertensive renal disease is a kidney disease, not arteriosclerotic cardiovascular risk/disease and so this has not been included in our monitoring work. Chronic rheumatic heart disease is a disease of overcrowding and poverty and poor housing, inter alia, not the usual arteriosclerotic cardiovascular risk and so has not been included.

The prevalent population is based on people starting medicines to prevent cardiovascular disease and is not based on the population at risk of cardiovascular disease. A recent study

has looked at how the national datasets can be used to predict a person's CVD risk (34) and we can look to incorporate this in the future.

Asthma / COPD

In developing insights and monitoring from this methodology, it became apparent that we needed to treat these diseases seperately. A Pharmac Respiratory Subcommittee meeting (35) discussed the process of identifying different combinations of treatment and if these would mainly treat COPD or asthma. As a result of this discussion the table below was produced.

Treatment acronyms:

- Short-acting beta agonists (SABA)
- Inhaled corticosteriods (ICS)
- Long-acting beta agonists (LABA)
- Long-acting muscarinic antagonists (LAMAs)

One-off presentations of treatments that are not likely to be Asthma or COPD:

- SABA to ICS likely to be asthma
- SABA to ICS/LABA likely to be asthma
- SABA to LAMA likely to be COPD

A persons prescription history, treatment transition, and age are key variables to delineate between asthma and COPD.

Omalizumab and mepolizcumab are add-on asthma therapies

	ASTHMA	**COPD**	**ASTHMA/COPD OVERLAP**
Demographic	Age < 30, 30-40 unlikely COPD	Predominately older age group 40+. History of smoking (NRT use or indication of quit smoking advise given when hospitalised).	Diagnosed 35-60
SABA	Adults 60%. Children 100% (under 18)	Likely if no ICS co-prescribed.	
ICS	70–80%	20–30%	
ICS/LABA	Vast majority (80%)	Low (20%)	
LABA	Low percentage monotherapy. Likely asthma if with ICS.	High percentage monotherapy. Likely COPD if no ICS.	
LAMA	≤ 10%	≥ 90%	
LAMA/LABA	≤ 5%	≥ 95%	
Anticholinergic	≤ 5%	≥ 95%	

From this we determined that LAMA and LAMA/LABAs would be used for COPD and that ICS and ICS/LABA would be used for asthma. Hospitalisation and mortality data were then also seperated into those relating to asthma and those relating to COPD.

We note that in focusing on ICS and ICS/LABA for asthma that we will be including some people with asthma/COPD overlap or with COPD. The use of finer age groups in the analysis

will allow for focusing the asthma insights on people <35 and the COPD insights for people >50 making them more representative of people with these conditions.

Gout

For the prevalent population with gout, we have included gout-specific urate-lowering therapy (allopurinol, febuxostat, benzbromarone, probenecid) or colchicine. However for any and regular dispensings we have used gout-specific urate-lowering therapy (allopurinol, febuxostat, benzbromarone, probenecid) as these are the medicines people should be on long-term. This is the only condition that uses an acute medicine (colchicine) to determine the prevalent population and it assumes that these people should transition to urate lowering therapy long-term.

First seen

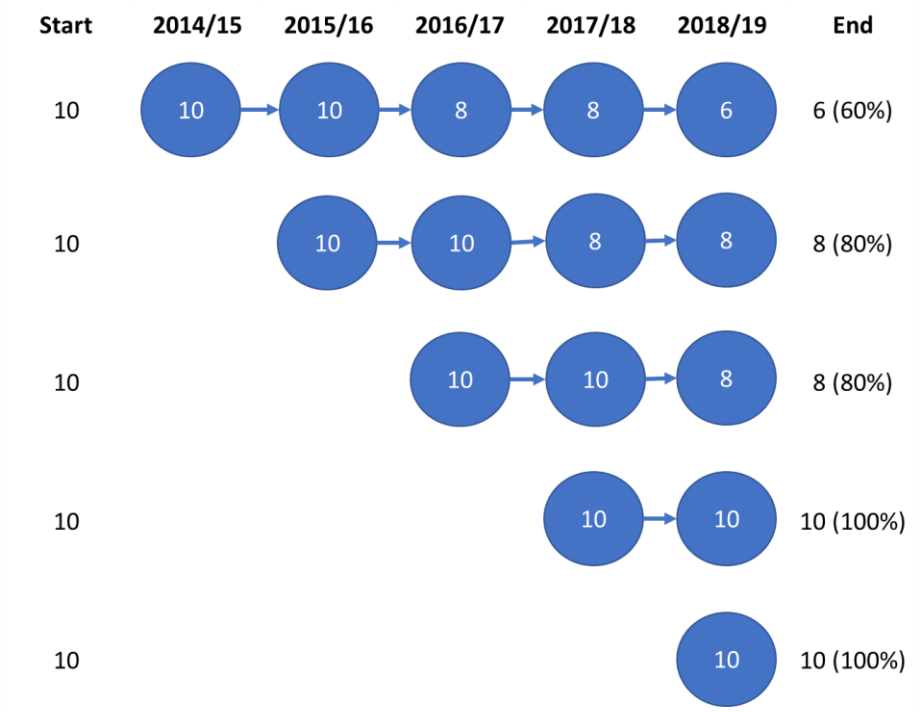
When establishing an individual's start date for a medicine and/or for treatment of the condition, it was not possible to look at their full history of dispensings. For the purpose of this report, the start date was defined as the first time since 2006 they received the medicine. When a person starts on a medicine is important to separate out new starters from those that continue medicine as interventions are different for these patient groups. Year ending December 2006 is used as the base year as this reflects the start of NHI reporting on pharmaceutical dispensings rather than people starting medicine, if a person is seen after the 2006 calendar year then it is assumed they have started medicine for the first time rather than re-initiated treatment. The longer that NHI information is captured the more reliable the estimate of new starters becomes (ie for people starting in the year ending 30 June 2019, this means they have not been dispensed any medicine for the condition since January 2006 through to 30 June 2018).

YLL

Those priority conditions which use YLL (cardiovascular and COPD) as the need adjuster are reliant on the MoH Mortality Collection. The mortality data is updated annually. There is a lag in the release of this data due to confirmation of the cause of death by the coroner. This means that YLLs can only be calculated up to the most recent data and projected forwards from that point as a need adjuster. As the mortality rate does not change quickly, projecting the last point forward was deemed to be acceptable.

Persistence

Persistence rates (36) were calculated using two different methods. The diagram below helps explain the different approaches to persistence. The first follows a cohort who starts medicine forwards in time. The limitation of this method is that the cohort is smaller and you can only report on persistence for a cohort after they have reached the threshold number of years being examined, eg 5 years. The second looks at how many people might be expected in a given year if everyone who had started previously had persisted. From the diagram below in 2018/19 you would expect 50 people to be on medicine when only 42 are actively picking up medicine in 2018/19.



The first method calculates rates based on following a cohort starting on medicine for the first time in a particular year forwards in the data (eg. for 5 years). This means that the cohort is small and therefore confidence intervals are wider. The cohort size could be increased by looking at persistence rates for those starting medicines over a longer time period and aggregating them. However, improvements in persistence rates would then take longer to impact on the measure. This first measure helps to determine if people disengage with their medicine quickly (ie in the 2nd year) or the longer a person is on medicine the more likely they are to stop. This can be used to help target any messaging around reingagement with medicine.

The second method looks at the number of people receiving medicine within the year versus how many people would be expected to receive medicine given 100% persistence and still being alive. This is a point in time number that relates to the access rates presented in the insights. To achieve this a record is created for each person, condition, monitor group, and year that they should appear in the data if they are still alive and were 100% persistent. The percentage who remain persistent in any given year is then the actual people in a given year divided by the number of possible people in a given year. As this includes a larger population, confidence intervals are reduced. This method is useful in that if a barrier to access is removed, which caused people to stop taking medicines, then potentially all people who were on medicine previously could reinitiate treatment.

It should be noted that people who start medicine in the year are automatically considered as persisting and for these people it is their possession of medicine in their first year that will be important.

Method 1 has been used in our Statement of Performance measure to look at the 5 year persistence of each cohort while method 2 has been used in the insights.

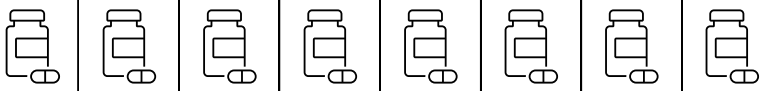
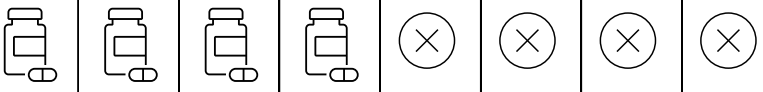
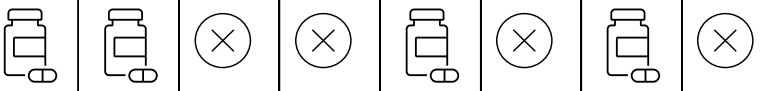
Possession

The possession measure (37) makes an assumption around the frequency that a prescription will be collected and how this compares if a person had consistently collected prescriptions over two financial year periods. This period is offset depending on when a person starts within

the year or if they die within a year. Dispensings are classified into daily, weekly, fortnightly, monthly, bi-monthly, quarterly, or half yearly using the daily dose information (derived for missing values) and the units dispensed to determine the days treatment. Where there is not enough information to determine the days treatment the days between dispensing are used to indicate which group they likely belong to as it is the intended treatment length that is important as this reflects what was expected if a person was taking the medicine as intended by the prescriber. These groups are then converted to days and divided by the total days possible in a two year period.

Any dispensing and Regular dispensing

Using the example below Any and Regular dispensing can be better understood. Below are 3 theoretical people taking medicine over a two year period. The pill bottles indicate a person has picked up a dispensing while the crosses represent that they have not collected a dispensing. This assumes that a person collects 3 months worth of medicine at a time therefore you would expect four dispensings a year. While “Any dispensing” and “Possession” can apply to a person’s individual experience it is how we summarise this across all people each year that we are interested in monitoring.

	Year 1				Year 2			
	Jan	Apr	Jul	Oct	Jan	Apr	Jul	Oct
100% any dispensing 100% possession								
50% any dispensing 100% possession in 12 months not persisting in year 2								
100% any dispensing 50% possession in 12 months								

Key 

The above example would result in the following calculations for Any and Regular dispensing with Possession used to obtain results for Regular dispensing.

	ANY DISPENSING	POSSESSION	REGULAR DISPENSING
Year 1	3/3 or 100%	2.5/3 or 83%	2.5/3 or 83%
Year 2	2/3 or 67%	1.5/2 or 75%	1.5/3 or 50%

Regular dispensing is also:

Any dispensing x Possession (for year 2 -> 67% x 75% = 50%)

Access rates

The access measures follow a similar methodology to the variations in access to medicines work (4) previously published. The variations work included a number of important caveats and limitations (see pages 46-53 (4)), some of which have been accounted for in this update, such as standardising to a Māori population age distribution, making the comparator group non-

Māori, non-Pacific peoples, having a more flexible need adjuster, and calculating confidence intervals.

The previous report on variations in medicine access (4) defined ‘access’ as the count of patients (measured as unique NHIs) receiving one or more prescriptions for a medicine during the analytical period and this definition still holds for this methodology. ‘Access’ is the same as “Any dispensing’. Script was defined to mean the count of the first dispensing of a prescription item with repeats not included in the script count. For this updated work this relates to indicator #2 Access – Prescriptions, as provided in the measures section. The previous report also defined persistence as script minus access, however this measure has not been caculcated in the current methodology. This is due to a separate method for looking at ‘Any dispensing’ (indicator #4) specifically and the inclusion of indicator #3 Access – New Starters in the current methodology.

It should be noted that the access measures are a theoretical number that is created by adjusting for need. The persistence and possession measures presented in this updated work look at what is actually happening in the use of medicines to see if any inequities exist at this level.

Dispensings relative to hospitalisation or mortality

While not one of the indicators – given the methodology developed utilises person level data from medicine dispensings, hospitalisations and mortality – we are able to describe people’s medicine use relative to being hospitalised in the year or death. This is important as taking preventive medicine regularly may help avoid hospitalisations or death and the absence of such medicine either before such an event or after should be examined.

For each hospitalisation in years ending June, a six month before and six month after window was created. The dispensing data can then be examined to see if a person was dispensed any preventive medicine relevant to the condition in the six months before; six months after; both six months before and six months after; or neither six months before nor six months after.

Co-morbidities and complexity

As this methodology has been developed at a person level there is the ability to look at people’s combination of treatments or conditions. SQL 2017 versions and beyond include a function called STRING_AGG (38) which allowed us to roll up the conditions for each person. This has allowed to focus our analysis more around a person and the multitude of conditions that they are managing.

In the case of asthma this allows us to identify people on SABAs alone or in combination.

An example of a SQL snipet is below.

```
STRING_AGG(Priority_Condition,' | ') WITHIN GROUP (ORDER BY Priority_Condition_Order ASC) as Conditions
```

Calculations

For the formulas below the following definitions apply (23). Note also that the calculations for the age standardised rate and age standardised risk were undertaken using the SAS proc stdrate (20) procedure which calculated the rates and provided output with confidence intervals.

e_i is the observed number of events in age group i in the study population

p_i is the number of people in age group i in the study population

r_i is the event rate in study population for the persons in age group i ($r_i = e_i / p_i$)

Direct standardisation

A direct standardisation (39) approach was used to make the results comparable across different demographics. Direct standardisation uses the weights from a reference population to compute the standardised rate of a study group as the weighted average of stratum-specific rates in the study population.

Age Standardised Rate (ASR per 1,000)

A rate (26) is a measure of the frequency with which an event occurs in a defined population in a specified period of time. It measures the change in one quantity per unit of another quantity.

Age Standardised Risk (ASR per 1,000)

A risk (27) is the probability that an event occurs in a specified time period. It is assumed that only one event can occur in the time period for each subject or item. For measures that relate to proportions, a risk method was used rather than a rate as this ensures confidence intervals are between 0 to 100%. These numbers are multiplied by 1000 to give a scale consistent to the rate measures. Note that ASR could relate to age standardised rate or age standardised risk depending on the output being viewed.

Rate Ratio (RR)

A ratio of the age standardised rate for Māori (or Pacific peoples), to the age standardised rate of the comparator population.
Age standardised: $$\mathrm{RR} = \frac{\mathrm{ASR}_{\text{priority population}}}{\mathrm{ASR}_{\text{comparator population}}}$$ Age specific: $$\mathrm{RR}_{\mathrm{i}} = \frac{\mathrm{r}_{\text{i\_priority population}}}{\mathrm{r}_{\text{i\_comparator population}}}$$

Gap-Ratio (Need adjusted ratio of ratios) (GR)

The ratio of the rate ratio for access to the rate ratio of the need adjuster.
Age standardised: $$\mathrm{GR} = \frac{\mathrm{RR}_{\mathrm{access}}}{\mathrm{RR}_{\mathrm{need\ adjuster}}}$$ Age specific: $$GR_i = \frac{\mathrm{RR}_{\mathrm{i\_access}}}{\mathrm{RR}_{\mathrm{i\_need\ adjuster}}}$$

Missing individuals/prescriptions

The ratio of the rate ratio for access to the rate ratio of the need adjuster.
For access: $$Gap = \sum \frac{e_i}{GR_i} - \sum e_i$$ For possession and any dispensing: $$Gap = \sum \frac{e_i}{RR_i} - \sum e_i$$

Confidence limits for Ratios

The confidence limits for the gap ratios have been calculated using the approach outlined in the appendix to 'Te Wero tonu—the challenge continues' (15) following the Bucher method RR for indirect comparison shown below (40, 41).

		Indirect 100(1-α)% Confidence Interval Estimator	
Measure of Association	Indirect Estimator	In terms of Variance	In Terms of Confidence Limits
Relative risk	$\prod_{i-1}^{k-1} RR_{A_iA_{i+1}}$	$exp\left(\sum_{i-1}^{k-1} ln\left(RR_{A_iA_{i+1}}\right) \pm Z_{\propto/2}\sqrt{\sum_{i-1}^{k-1} Var\left(ln\left(RR_{A_iA_{i+1}}\right)\right)}\right)$	$exp\left(\sum_{i-1}^{k-1} ln\left(RR_{A_iA_{i+1}}\right) \pm \frac{1}{2}\sqrt{\sum_{i-1}^{k-1}\left(ln\left(ucl_{A_iA_{i+1}}\right) - ln\left(lcl_{A_iA_{i+1}}\right)\right)^2}\right)$

Importantly, this approach uses the standard errors calculated from the stdrate (20) procedure.

Risks and limitations

Below are some known limitations and risks with this type of analysis and how they have been mitigated. Previous research (3, 4, 15) has listed a large number of limitations. Where a limitation has been addressed it is noted below.

- The results of previous measures of variation (3, 4, 15) and this current analysis are not directly comparable due to different need adjusters but, as would be expected, the findings are consistent.

- Hospital data only captures those people that present at hospital. Ideally the need adjuster would be based on prevelance or updated DALY information. It may also capture people being treated for minor conditions that could have been dealt with in primary care. At the time of developing this methodology this was the best data available at the time, which allows for the most flexibility in population groups and comparator populations. Future methods may try and account for the severity of hospitalisations to adjust similar to what is done in calculating YLDs (8).

- The ratio for the CVR need adjuster may be influenced by the rate of smoking. This may mean that the gap presented for medicines is inflated, and any improvements in outcomes may not be through increased medicines useage. It could be that the need adjuster is altered to account for this or the gaps presented are interpreted with this in mind.

- The data used for this research are based on administrative records, and each record has its own quality performance and validity measures, and the comparability of these different data sources is unknown.

- The use of dichotomous grouping of the cohort into Māori and non-Māori for the disease burden adjusted analysis, which introduces unmeasured confounding, has been somewhat addressed. Now that a need adjuster has been developed using hospitalisation (5) and mortality (6), there is more flexibility in separating out different population groups.

- We used the prioritised ethnicity system. The impact of this has been described using information in the IDI (22). As this method is built at a person level, it is possible to look at the impact of total response ethnicity. For phase one of this research it was simpler to continue using prioritised ethnicity.

- This work standardises the data to the 2013 Māori population (25), which was not possible previously as the choice of standard population was driven by the burden of disease outputs.

- By using the SAS stdrate (20) procedure, estimates of uncertainty could be obtained for the age standardised results. For the gap ratio, confidence intervals were obtained using the standard errors from this output and the method described in the statistical appendix (15) published previously using the Bucher method (40, 41).

- The Pharmaceutical Collection (16) records medicines that were dispensed. It cannot be used to say what was prescribed or what was physically taken.

- A method has been developed for possession and persistence at an individual level. This will allow breakdowns by deprivation and urban/rural in the future, to better

understand the impact of accessibility of community pharmacies and their impact on access and persistence.

- For persistence and possession, we proportioned people either starting within a year or to the date of death and therefore the results are less biased towards survivors.

- The Pharmaceutical Collection (16) does not include any information on the indication for the medicine. This is a particular issue for separating out asthma and COPD treatments.

- Given the overlap of medicines for the diabetes subtypes, identifying the relevant cohort with type 2 diabetes was a challenge. It was assumed that only those included on the Virtual Diabetes Register (VDR) (17) should be included, to exclude those with gestational diabetes. It was also assumed that those with type 2 diabetes would start on metformin, therefore only those whose first diabetes medicine was metformin were included. Some lag between people starting on metformin and appearing on the VDR was noted, which will impact FY19. Assuming that this lag applies to both Māori and to the comparator population consistently, the impact on the final rate ratios should be minimal if any. Once FY20 dispensing data is available, the FY19 access measures could be rerun to confirm this.

- When establishing an individual's start date for a medicine and/or for treatment of the condition, it was not possible to look at their full history of dispensings. For the purpose of this report, the start date was defined as the first time since 2006 they received the medicine. These insights focus on those individuals whose start date was in year ending 20 June 2014 or later, per the above definition.

- Those priority conditions that use YLL (CVD and COPD) as the need adjuster will be reliant on the MoH Mortality Collection. There is a lag in the release of this data, which will mean that either the need adjusted access rates are reported for a less up to date time period or older YLL values are used to adjust the more recent access rates.

- One version of the persistence rates is based on the cohort starting on medicine for the first time in a particular year. This means that the cohort is small and therefore confidence intervals are wider. The cohort size could be widened to look at persistence rates for those starting medicines over a longer time period, however improvements in persistence rates would then take longer to impact on the measure.

- The possession calculations were based on whether the dispensings were intended to be daily, weekly, fortnightly, monthly, quarterly, bi-monthly, half yearly, or stat (a one-off medicine) using the daily dose and units recorded to define the frequency.

- The Stats NZ Estimate Resident Population was used as the reference population. This is supplied to the Ministry of Health using a prioritised ethnicity.

- This analysis assumes that if someone receives preventive medicine for any condition, that they should continue receiving this for the remainder of their life, regardless of any changes in lifestyle or life circumstances.

- Deprivation has not been included or controlled for in this phase.

- There may be possible bias from numerator/denominator mismatch using health data as numerators but Statistics New Zealand census population denominators, which affects medicine estimates and age-specific ethnic proportions. (11, 22)

References

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Appendix A: The Framework:

PHARMAC's Medicine Access Equity Monitoring and Outcomes Framework

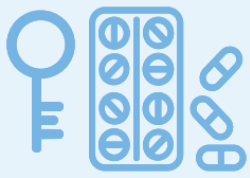
PHARMAC TE PĀTAKA WHAIORANGA | National Hauora Coalition | SYNERGIA

INTRODUCTION

PHARMAC's Medicine Access Equity Monitoring and Outcomes Framework (the Framework) presents key outcomes and measures to track PHARMAC's equity work and the journey towards **BOLD Goal One; eliminating inequities in access to medicines by 2025**.

The key outcomes identify the changes that we would expect to see when medicine access equity is achieved. PHARMAC has adopted a system level focus, which means that it does not have control over all the outcomes in the Framework. Tracking system level progress will help PHARMAC to understand where to invest resource and where to seek to influence change with the sector.

MEDICINE ACCESS EQUITY



Everyone should have a fair opportunity to access funded medicine to attain their full health potential, and that no one should be disadvantaged from achieving this potential. In this context, unequal inputs are required to attain a fair opportunity to access funded medicines.

NATIONAL AND STRATEGIC CONTEXT, SCOPE AND FOCUS OF PHARMAC'S MEDICINE ACCESS WORK PROGRAMME

Te Tiriti o Waitangi
NZ Public Health and Disability Act
Government priorities
Te Whaioranga (Māori Responsiveness Strategy)
Pacific Responsiveness Strategy
Medicine access and health inequity in NZ
Potential health gain from medicine access equity

SCOPE
Publicly funded medicines
Primary care
Conditions significantly amenable to medicine

Priority populations and conditions

Māori, Pacific
Low socio-economic status
Refugee, Rural

CVD, Gout, Diabetes, Asthma and COPD

THE MEDICINE ACCESS EQUITY MONITORING AND OUTCOMES FRAMEWORK

Key outcome: Priority populations have equitable access to funded medicines, in line with their health need

POPULATION LEVEL MONITORING MEASURES

- Reduce variation in access to medicine
- Reduce variations in medicine adherence and persistence
- Decrease amenable hospitalisation rates and emergency department presentations
- Reduce variation in amenable mortality rates

MEDICINE ACCESS EQUITY OUTCOME DOMAINS AND MEASURES

AVAILABILITY
Funding decisions and restrictions do not disproportionately impact on priority populations

Key Measures
- Increase influence of health need and system thinking in medicine availability decisions
- Reduce the impact of funding restrictions and schedule rules as barriers to access
- Increase prescriber awareness to reduce availability barriers

ACCESSIBILITY
People have timely and easy access to prescribers and medicine

Key Measures
- Ensure medicines that are prescribed are dispensed
- Increase timely access to prescribers, community pharmacy and diagnostics

AFFORDABILITY
Costs barriers do not prevent access to funded medicines for priority populations

Key Measures
- Reduce costs as a barrier to accessing a GP/nurse
- Reduce unfilled prescriptions due to cost

ACCEPTABILITY
Primary health care system ensures patients and whānau are informed and engaged in their medication decisions

Key Measures
- Increase patient involvement in medication decisions
- Increase patient rating of proper medication explanations
- Increase cultural competence of primary care staff

APPROPRIATENESS
Patients and whānau receive the most appropriate medicine

Key Measures
- Reduce rates of inadequate prescribing
- Increase consideration of suitability in medicine availability decisions
- Reduce adverse events from inappropriate prescribing

INTERNAL CAPABILITY

KEY OUTCOME

PHARMAC becomes an exemplar as a pro-equity organisation

Key Measures
- Health loss and need is consistently identified as an important driver of PHARMAC's work
- Strong organisational leadership for equity
- Increase understanding of equity and cultural competence
- Increase proportion and influence of Māori and Pacific staff with equity expertise
- Increase pro-equity capability through the advisory groups and consumers

DATA AND ANALYSIS CONSIDERATIONS

When tracking progress, the population level monitoring measures will require a systems response and will take longer to change. Changes in PHARMAC's internal capability and some of the medicine access equity outcome domains should change within a shorter timeframe.

A Medicine Access Equity Monitoring and Outcome Framework is new for New Zealand. Many of the measures and associated indicators do not have existing data sources or have not been analysed with a medicine access equity lens before. New analytical approaches will need to be applied to existing data sources and new indicators will need to be developed.

IMPLEMENTATION RECOMMENDATIONS

1. Establish the baseline for existing indicators. This could form the basis of a dashboard to track progress.

2. Develop and test analytical approaches for new indicators that can be supported by existing data sources.

3. Explore opportunities for data sharing and integration with the sector. Engaging with District Health Boards and Primary Health Organisations, for example, would support access to prescribing data.

4. Explore options for investing in new data collection. This could be adding questions or indicators to existing data sources or investing in additional data collection processes or systems with the sector.

5. Establish internal review processes to track changes in internal capability.

Appendix B: Medicines

The inclusion criteria and classification of each medicine for each group was developed with clinical input from both Synergia and Pharmac.

The list of included medicines, their monitor group, and treatment classification (e.g. 'preventive or acute') is below.

Criteria

Inclusion criteria:

- Known usage to treat condition
- Gout – urate lowering medicines, colchicine and NSAIDs (to track harm).
- Asthma – long-term management
- COPD – long-term management and prevention of exacerbation with tiotropium use
- Type 2 diabetes only (determined by those who were first started on metformin as proxy) so long-term management important only
- Cardiovascular risk

Exclusion criteria

- Used for too many different conditions

Medicines List

Asthma medicines

Table 1 Asthma medicines included in baseline analysis

MONITOR GROUP	CHEMICAL NAME	PREVENTIVE / ACUTE
Inhaled Beta-Adrenoceptor Agonists (SABA)	salbutamol	Acute
	terbutaline sulphate	Acute
Inhaled Corticosteroids (ICS)	beclomethasone dipropionate	Preventive
	budesonide	Preventive
	fluticasone	Preventive
Inhaled Long-acting Beta-adrenoceptor Agonists (LABA)	eformoterol fumarate	Preventive
	eformoterol fumarate dihydrate	Preventive
	salmeterol	Preventive
Anti-inflammatory reliever (SMART)	budesonide with eformoterol	Preventive
Inhaled Corticosteroids with Long-Acting Beta-Adrenoceptor Agonists (ICS/LABA)	fluticasone with salmeterol	Preventive
	fluticasone furoate with vilanterol	Preventive

COPD medicines

Table 2 COPD medicines included in baseline analysis

MONITOR GROUP	CHEMICAL NAME	PREVENTATIVE / ACUTE
Long-Acting Muscarinic Antagonists (LAMA)	tiotropium bromide	Preventive
	glycopyrronium	Preventive
	umeclidinium	Preventive
Long-Acting Muscarinic Antagonists with Long-Acting Beta-Adrenoceptor Agonists (LAMA/LABA)	glycopyrronium with indacaterol	Preventive
	tiotropium bromide with olodaterol	Preventive
	umeclidinium with vilanterol	Preventive

Cardiovascular medicines

Table 3 Cardiovascular medicines included in baseline analysis

MONITOR GROUP	CHEMICAL NAME	PREVENTIVE / ACUTE
Agents Affecting the Renin-Angiotensin System	candesartan cilexetil	Preventive
	captopril	Preventive
	cilazapril	Preventive
	cilazapril with hydrochlorothiazide	Preventive
	enalapril maleate	Preventive
	enalapril maleate with hydrochlorothiazide	Preventive
	lisinopril	Preventive
	losartan potassium	Preventive
	losartan potassium with hydrochlorothiazide	Preventive
	perindopril	Preventive
	quinapril	Preventive
	quinapril with hydrochlorothiazide	Preventive
	sacubitril with valsartan	Preventive
	trandolapril	Preventive
Aspirin	aspirin (low dose)	Preventive
Beta Adrenoceptor Blockers	acebutolol	Preventive
	atenolol	Preventive
	bisoprolol fumarate	Preventive
	carvedilol	Preventive
	celiprolol	Preventive
	labetalol	Preventive
	metoprolol succinate	Preventive
	metoprolol tartrate	Preventive
	nadolol	Preventive
	pindolol	Preventive
	propranolol	Preventive
	sotalol	Preventive

MONITOR GROUP	CHEMICAL NAME	PREVENTIVE / ACUTE
	timolol	Preventive
Calcium Channel Blockers	amlodipine	Preventive
	diltiazem hydrochloride	Preventive
	felodipine	Preventive
	isradipine	Preventive
	nifedipine	Preventive
	perhexiline maleate	Preventive
	verapamil hydrochloride	Preventive
Diuretics	amiloride hydrochloride	Preventive
	amiloride hydrochloride with furosemide	Preventive
	amiloride hydrochloride with hydrochlorothiazide	Preventive
	bendroflumethiazide [bendrofluazide]	Preventive
	bumetanide	Preventive
	chlorothiazide	Preventive
	chlortalidone [chlorthalidone]	Preventive
	eplerenone	Preventive
	furosemide [frusemide]	Preventive
	indapamide	Preventive
	metolazone	Preventive
	spironolactone	Preventive
	triamterene with hydrochlorothiazide	Preventive
Other CVS Rx	acipimox	Preventive
	adrenaline	Acute
	amiodarone hydrochloride	Preventive
	amyl nitrite	Acute
	aspirin	Preventive
	atropine sulphate	Preventive
	bezafibrate	Preventive
	cholestyramine	Preventive
	clonidine	Preventive
	clonidine hydrochloride	Preventive
	clopidogrel	Preventive
	colestipol hydrochloride	Preventive
	dabigatran	Preventive
	dalteparin sodium	Acute
	digoxin	Preventive
	dipyridamole	Preventive
	disopyramide phosphate	Preventive
	enoxaparin sodium	Acute
	ezetimibe	Preventive
	ezetimibe with simvastatin	Preventive
	flecainide acetate	Preventive

MONITOR GROUP	CHEMICAL NAME	PREVENTIVE / ACUTE
	gemfibrozil	Preventive
	glyceryl trinitrate	Preventive
	heparin sodium	Acute
	heparinised saline	Acute
	hydralazine hydrochloride	Preventive
	hydrocortisone with cinchocaine	Acute
	isoprenaline [isoproterenol]	Acute
	isosorbide mononitrate	Preventive
	methyldopa	Preventive
	mexiletine hydrochloride	Preventive
	midodrine	Preventive
	minoxidil	Acute
	nicorandil	Acute
	nicotinic acid	Preventive
	pentoxifylline [oxpentifylline]	Acute
	prasugrel	Preventive
	prazosin	Preventive
	propafenone hydrochloride	Preventive
	protamine sulphate	Acute
	rivaroxaban	Preventive
	ticagrelor	Preventive
	warfarin sodium	Preventive
Statins	atorvastatin	Preventive
	pravastatin	Preventive
	simvastatin	Preventive

Type 2 Diabetes medicines

Table 4 Diabetes medicines included in baseline analysis

MONITOR GROUP	CHEMICAL NAME	PREVENTIVE / ACUTE
Insulin (only for people with type 2 diabetes)	insulin aspart	Preventive
	insulin aspart with insulin aspart protamine	Preventive
	insulin glargine	Preventive
	insulin glulisine	Preventive
	insulin isophane	Preventive
	insulin isophane with insulin neutral	Preventive
	insulin lispro	Preventive
	insulin lispro with insulin lispro protamine	Preventive
	insulin neutral	Preventive
	insulin zinc suspension	Preventive
Metformin hydrochloride	metformin hydrochloride	Preventive
Other Diabetes Rx	acarbose	Preventive

MONITOR GROUP	CHEMICAL NAME	PREVENTIVE / ACUTE
	diazoxide	Acute
	glibenclamide	Preventive
	gliclazide	Preventive
	glipizide	Preventive
	glucagon hydrochloride	Acute
	pioglitazone	Preventive
	tolbutamide	Preventive
	vildagliptin	Preventive
	vildagliptin with metformin hydrochloride	Preventive

Gout medicines

Table 5 Gout medicines included in baseline analysis

MONITOR GROUP	CHEMICAL NAME	PREVENTIVE / ACUTE
Allopurinol	allopurinol	Preventive
Benzbromarone	benzbromarone	Preventive
Colchicine	colchicine	Acute
Febuxostat	febuxostat	Preventive
Probenecid	probenecid	Preventive
Non-steroidal anti-inflammatory drugs (NSAIDs)	celecoxib	Acute
	diclofenac sodium	Acute
	diflunisal	Acute
	fenbufen	Acute
	fenoprofen calcium	Acute
	flurbiprofen	Acute
	ibuprofen	Acute
	indomethacin	Acute
	ketoprofen	Acute
	mefenamic acid	Acute
	meloxicam	Acute
	naproxen	Acute
	naproxen sodium	Acute
	phenylbutazone	Acute
	piroxicam	Acute
	rofecoxib	Acute
	sulindac	Acute
	tenoxicam	Acute
	tiaprofenic acid	Acute

Appendix C: ICD-10 codes

ICD-10 codes (ICD-10-AM sixth edition) were used in:

- analysis of hospitalisation data in the population level measures
- analysis of the mortality data for the years life lost in the population measures
- for use in the needs adjustors.

The following ICD-10 codes were used, presented by priority condition in tables 6–10.

Respiratory – Asthma ICD-10 codes

Table 6 ICD-10 codes for respiratory – asthma baseline analysis

CODE	DESCRIPTION
J450	Predominantly allergic asthma
J451	Nonallergic asthma
J458	Mixed asthma
J459	Asthma, unspecified
J46	Status asthmaticus
R062	Wheezing

Respiratory – COPD ICD-10 codes

Table 7 ICD-10 codes for respiratory – COPD baseline analysis

CODE	DESCRIPTION
J40	Bronchitis, not specified as acute or chronic
J410	Simple chronic bronchitis
J411	Mucopurulent chronic bronchitis
J418	Mixed simple and mucopurulent chronic bronchitis
J42	Unspecified chronic bronchitis
J430	MacLeod's syndrome
J431	Panlobular emphysema
J432	Centrilobular emphysema
J438	Other emphysema
J439	Emphysema, unspecified
J440	Chronic obstructive pulmonary disease with acute lower respiratory infection
J441	Chronic obstructive pulmonary disease with acute exacerbation, unspecified
J448	Other specified chronic obstructive pulmonary disease
J449	Chronic obstructive pulmonary disease, unspecified

Cardiovascular ICD-10 codes

Table 8 ICD-10 codes included for cardiovascular baseline analysis

CODE	DESCRIPTION
I10	Essential (primary) hypertension
I110	Hypertensive heart disease with (congestive) heart failure
I119	Hypertensive heart disease without (congestive) heart failure
I200	Unstable angina
I201	Angina pectoris with documented spasm
I208	Other forms of angina pectoris
I209	Angina pectoris, unspecified
I210	Acute transmural myocardial infarction of anterior wall
I211	Acute transmural myocardial infarction of inferior wall
I212	Acute transmural myocardial infarction of other sites
I213	Acute transmural myocardial infarction of unspecified site
I214	Acute subendocardial myocardial infarction
I219	Acute myocardial infarction, unspecified
I220	Subsequent myocardial infarction of anterior wall
I221	Subsequent myocardial infarction of inferior wall
I228	Subsequent myocardial infarction of other sites
I229	Subsequent myocardial infarction of unspecified site
I230	Haemopericardium as current complication following acute myocardial infarction
I231	ASD as current comp following acute MI
I232	Ventricular septal defect as current complication following acute myocardial infarction
I233	Rupture of cardiac wall without haemopericardium as current complication following acute myocardial infarction
I234	Rupture of chordae tendineae as current complication following acute myocardial infarction
I235	Rupture of papillary muscle as current complication following acute myocardial infarction
I236	Thrombosis of atrium, auricular appendage, and ventricle as current complications following acute myocardial infarction
I238	Other current complications following acute myocardial infarction
I240	Coronary thrombosis not resulting in myocardial infarction
I248	Other forms of acute ischaemic heart disease
I249	Acute ischaemic heart disease, unspecified
I250	Atherosclerotic cardiovascular disease, so described
I251	Atherosclerotic heart disease, of autologous bypass graft
	Atherosclerotic heart disease, of native coronary artery
	Atherosclerotic heart disease, of nonautologous bypass graft
	Atherosclerotic heart disease, of unspecified vessel
I252	Old myocardial infarction
I253	Aneurysm of heart
I254	Coronary artery aneurysm
I255	Ischaemic cardiomyopathy

CODE	DESCRIPTION
I256	Silent myocardial ischaemia
I258	Other forms of chronic ischaemic heart disease
I259	Chronic ischaemic heart disease, unspecified
I500	Congestive heart failure
I501	Left ventricular failure
I509	Heart failure, unspecified
I674	Hypertensive encephalopathy
J81	Pulmonary oedema
R072	Precordial pain
R073	Other chest pain
R074	Chest pain, unspecified
G450	Vertebro-basilar artery syndrome
G451	Carotid artery syndrome (hemispheric)
G452	Multiple and bilateral precerebral artery syndromes
G453	Amaurosis fugax
G454	Transient global amnesia
G458	Other transient cerebral ischaemic attacks and related syndromes
G459	Transient cerebral ischaemic attack, unspecified
I630	Cerebral infarction due to thrombosis of precerebral arteries
I631	Cerebral infarction due to embolism of precerebral arteries
I632	Cerebral infarction due to unspecified occlusion or stenosis of precerebral arteries
I633	Cerebral infarction due to thrombosis of cerebral arteries
I634	Cerebral infarction due to embolism of cerebral arteries
I635	Cerebral infarction due to unspecified occlusion or stenosis of cerebral arteries
I636	Cerebral infarction due to cerebral venous thrombosis, nonpyogenic
I638	Other cerebral infarction
I639	Cerebral infarction, unspecified

Type 2 Diabetes ICD-10 codes

Table 9 ICD-10 codes for type 2 diabetes baseline analysis

CODE	DESCRIPTION
E110	Non-insulin-dependent diabetes mellitus with coma, not stated as uncon
	Type 2 diabetes mellitus with hyperosmolarity with coma
	Type 2 diabetes mellitus with hyperosmolarity without nonketotic hyperglycaemic-hyperosmolar coma [NKHHC]
E111	Non-insulin-dependent diabetes mellitus with ketoacidosis, not stated
	Type 2 diabetes mellitus with ketoacidosis, with coma
	Type 2 diabetes mellitus with ketoacidosis, with lactic acidosis, with coma
	Type 2 diabetes mellitus with ketoacidosis, with lactic acidosis, without coma
	Type 2 diabetes mellitus with ketoacidosis, without coma
	Type 2 diabetes mellitus with lactic acidosis, with coma
	Type 2 diabetes mellitus with lactic acidosis, without coma

CODE	DESCRIPTION
E112	Type 2 diabetes mellitus with established diabetic nephropathy
	Type 2 diabetes mellitus with incipient diabetic nephropathy
	Type 2 diabetes mellitus with other specified kidney complication
	Type 2 diabetes mellitus with renal complication, unspecified
	Type 2 DM w end-stage renal disease
E113	Type 2 diabetes mellitus with advanced ophthalmic disease
	Type 2 diabetes mellitus with background retinopathy
	Type 2 diabetes mellitus with diabetic cataract
	Type 2 diabetes mellitus with ophthalmic complication, unspecified
	Type 2 diabetes mellitus with other retinopathy
	Type 2 diabetes mellitus with other specified ophthalmic complication
	Type 2 diabetes mellitus with preproliferative retinopathy
	Type 2 diabetes mellitus with proliferative retinopathy
E114	Type 2 diabetes mellitus with diabetic autonomic neuropathy
	Type 2 diabetes mellitus with diabetic mononeuropathy
	Type 2 diabetes mellitus with diabetic polyneuropathy
	Type 2 diabetes mellitus with other specified neurological complication
	Type 2 diabetes mellitus with unspecified neuropathy
E115	Type 2 diabetes mellitus with circulatory complication, unspecified
	Type 2 diabetes mellitus with diabetic cardiomyopathy
	Type 2 diabetes mellitus with other specified circulatory complication
	Type 2 diabetes mellitus with peripheral angiopathy, with gangrene
	Type 2 diabetes mellitus with peripheral angiopathy, without gangrene
E116	Non-insulin-dependent diabetes mellitus with other specified complications
	Type 2 diabetes mellitus with hypoglycaemia
	Type 2 diabetes mellitus with other specified complication
	Type 2 diabetes mellitus with poor control
	Type 2 diabetes mellitus with specified diabetic musculoskeletal and connective tissue complication
	Type 2 diabetes mellitus with specified periodontal complication
	Type 2 diabetes mellitus with specified skin and subcutaneous tissue complication
E117	Non-insulin-dependent diabetes mellitus with multiple complications, n
	Type 2 diabetes mellitus with features of insulin resistance
	Type 2 diabetes mellitus with foot ulcer due to multiple causes
	Type 2 diabetes mellitus with multiple microvascular and other specified nonvascular complications
E118	Non-insulin-dependent diabetes mellitus with unspecified complications
	Type 2 diabetes mellitus with unspecified complication
E119	Non-insulin-dependent diabetes mellitus without complications, not stated
	Non-insulin-dependent diabetes mellitus without complications, stated
	Type 2 diabetes mellitus without complication

Gout ICD-10 codes

Table 10 ICD-10 codes for gout baseline analysis

CODE	DESCRIPTION
M100	Idiopathic gout, ankle and foot
	Idiopathic gout, forearm
	Idiopathic gout, hand
	Idiopathic gout, lower leg
	Idiopathic gout, multiple sites
	Idiopathic gout, other site
	Idiopathic gout, pelvic region and thigh
	Idiopathic gout, shoulder region
	Idiopathic gout, site unspecified
	Idiopathic gout, upper arm
M109	Gout, unspecified, ankle and foot
	Gout, unspecified, forearm
	Gout, unspecified, hand
	Gout, unspecified, lower leg
	Gout, unspecified, multiple sites
	Gout, unspecified, other site
	Gout, unspecified, pelvic region and thigh
	Gout, unspecified, shoulder region
	Gout, unspecified, site unspecified
	Gout, unspecified, upper arm

Appendix D: SAS code

Direct standardisation for population measures of access measures, hospitalisations, and mortality.

```
proc stdrate data=tmp_raw_aggs
            refdata=tmp_raw_aggs
            method=direct
            stat=rate(mult=1000)
            effect
            ;
  by BaseEthnicity aggregation measure version fyr NZBD_Condition Monitor_Group
current_dhb gender_code;
  population group(order=data)=mpao_ethnicity event=numer total=denom;
  reference  total=std_population;
  strata AGE_group / effect stats;
  ods output StdRate=StdRate1
             Effect=Effect1
             StrataEffect=StrEff1
           StrataStats=StrStats1
           ;
run;
```

Direct risk standardisation for population measures of possession and persistence. Note the only difference is in the *stat* command.

```
proc stdrate data=tmp_raw_aggs
            refdata=tmp_raw_aggs
            method=direct
            stat=risk
            effect
            ;
  by BaseEthnicity aggregation measure version fyr NZBD_Condition Monitor_Group
current_dhb gender_code;
  population group(order=data)=mpao_ethnicity event=numer total=denom;
  reference  total=std_population;
  strata AGE_group / order=data stats effect;
  ods output StdRisk=StdRate2
             Effect=Effect2
             StrataEffect=StrEff2
```

```
        StrataStats=StrStats2
        ;
run;
```

The table below shows the values for each variable in the proc stdrate procedure.

BaseEthnicity	Māori or Pacific peoples
aggregation	Overall, by DHB, by gender
measure	access, adhere, hosp, persist, repeat, yll
version	_, _5, _A5B, _AP, _ev_any, _ev_any5, _ev_pri, _ev_pri5, _ind_any, _ind_any5, _ind_pri, _ind_pri5, _indiv, _new, _scr, _yrB
fyr	2015, 2016, 2017, 2018, 2019
NZBD_Condition	Asthma, Chronic obstructive pulmonary disease, Cardiovascular disorders, Diabetes, Gout
Monitor_Group	Agents Affecting the Renin-Angiotensin System, Allopurinol, Aspirin, Benzbromarone, Beta Adrenoceptor Blockers, Beta-Adrenoceptor Agonists, Calcium Channel Blockers, Colchicine, Diuretics, Febuxostat, Inhaled Corticosteroids, Inhaled Long-acting Beta-adrenoceptor Agonists, Insulin, Metformin hydrochloride, NA, Other CVS Rx, Other Diabetes Rx, Probenecid, Statins
current_dhb	Auckland, Bay of Plenty, Canterbury, Capital and Coast, Counties Manukau, Hawkes Bay, Hutt Valley, Lakes, MidCentral, NA, Nelson Marlborough, Northland, South Canterbury, Southern, Tairawhiti, Taranaki, Waikato, Wairarapa, Waitemata, West Coast, Whanganui
gender_code	F, M, NA
mpao_ethnicity	Māori, Other, Pacific peoples
AGE_group	00-14, 15-24, 25-44, 45-64, 65+

The ods output creates 4 tables of results that are then used in the reports and graphs.