Health Quality & Safety Commission
Te Tāhū Hauora

Atlas of Healthcare Variation: Methodology | Diabetes

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Te Kāwanatanga
o Aotearoa
New Zealand Government

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General points

Data is not presented where the number of people in the numerator was less than 10. This is to preserve confidentiality.

People were assigned to their Health New Zealand | Te Whatu Ora (Health NZ) district of domicile. Where more than one domicile was recorded, the most recent value was selected.

Ethnicity data is presented by prioritised ethnic group (Māori, Pacific peoples, Indian and European/other). Prioritised ethnic groups involve each participant being assigned to a single ethnic group, based on the ethnicities they have identified with, in the prioritised order of Māori, Pacific peoples, Indian and European/other. The European/other ethnic group includes the following ethnicities: European (including New Zealand European), MELAA (Middle Eastern, Latin American and African) other Asian and Other.

In the Atlas, crude rates are reported. This is because they give a true indication of the magnitude of a problem. To make comparisons between ethnic groups, we recommend you use the age-specific rates provided in the Atlas. While age-standardised rates are commonly used for comparison, we do not report them as they are not accurate measures of actual event rates where populations have different age structures. This means our prevalence rates are different to those on the Health NZ diabetes dashboard (tewhatuora.shinyapps.io/virtual-diabetes-register-web-tool/).

Age group is assigned using 30 June of each calendar year as the cut-off point. For example, a person turning 65 years of age on 30 June 2024 will be assigned to the 65–74 years age group for 2024, while a person turning 65 on 1 July 2024 will be assigned the 45–64 group for the same year.

People who died during the calendar year are included in prevalence and hospital burden indicators (#1 & #13) but are excluded from the management indicators (#2–12, #14–16).

For primary health organisation (PHO) analyses, we analysed indicator #1 to determine the size of diabetic population each PHO serves. Then we categorised them into small (< 2,500), medium (2,500–5,000), medium–large (5,000–12,500) and large (> 12,500).

We combined the following PHOs in the Atlas where PHOs had changed entities or there were regional subsidiaries with enrolled populations that were too small to report separately.

Recorded PHO name	Atlas reporting PHO name
Alliance Health Plus Trust	Included in The Cause Collective
Comprehensive Care PHO – Northland	Included with Comprehensive Care PHO Limited
National Hauora Coalition – Northland	Included with National Hauora Coalition
ProCare Health (PHO) Limited – Northland	Included with ProCare Health (PHO) Limited

Data sources

- Virtual Diabetes Register (VDR), Health NZ. For more details about the VDR, see Appendix 1.
- Pharmaceutical Collection, Health NZ.
- National Minimum Dataset (NMDS), Health NZ.
- PHO Enrolment Collection, Health NZ.
- Laboratory Claims Collection, Health NZ. Laboratory Claims Collection data for several districts between 2019 and 2024 was incomplete. To maintain data quality and ensure reliable analysis, districts with incomplete data over two or more consecutive months were excluded from the dataset for the affected year. This means New Zealand-level rates may not fully reflect true national performance. For more details, see Table 1.
- All information on demographics is obtained from the National Health Index (NHI) database.

Exclusions

People who were excluded from analysis include:

- those who aren't enrolled in a PHO in the calendar year (This allowed us to use the number of PHO-enrolled people as the denominator.)
- individuals with missing demographics, that is, those with no recorded value for one or more of the NHI fields used to derive the demographic variables (age, gender, ethnicity and district of domicile). This means individuals with a missing value for age would be excluded from all analyses. This approach ensures a consistent denominator throughout the analyses.

Confidence intervals

Data for each Health NZ district (previously referred to as district health boards or DHBs) is presented as a percentage and compared with the total New Zealand rate for the same combination of demographics. Upper and lower confidence intervals were calculated to 95 percent level of confidence. If the confidence intervals do not overlap, there is a significant difference between the results. If the upper limit of the Health NZ district confidence interval is less than the lower limit of the New Zealand confidence interval, then the result will be 'Significantly lower'. If the lower limit of the Health NZ district confidence interval is greater than the upper limit of the New Zealand confidence interval, the result will be 'Significantly higher'. Otherwise, the result is 'Not significantly different'.

Indicator #1	**Prevalence of diabetes**
Numerator	Count of distinct master NHIs identified as having diabetes as per the VDR Note: Women diagnosed with gestational diabetes are not included.

Denominator	PHO enrolments for relevant years
By variables	For single map analysis: By year (2019–2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other) and Health NZ district of domicile. For PHO analysis: By year (2024), age group, gender, ethnic group, PHO most recently enrolled with (for the relevant year), PHO group (small, medium, medium–large and large).
Data source	VDR PHO enrolment collection
Rationale	Diabetes affects a significant proportion of the population in New Zealand, and an even larger number are estimated to have prediabetes.[1,2] In 2024, the VDR estimated that about 347,000 people have diabetes. Diabetes disproportionately affects Pacific peoples, Indian and Māori populations when compared with European/other ethnic groups.[2] Children and young people are increasingly being diagnosed with type 2 diabetes. In part, this is related to increasing obesity rates.[3] Understanding variation in the prevalence of diabetes is crucial for long-term health care planning. It helps predict future health care needs and allows for the development of sustainable strategies to manage and prevent diabetes. Diabetes is associated with substantial health care costs, both direct (for example, medical treatment) and indirect (for example, productivity losses). Understanding variation in prevalence can help estimate the economic burden and plan for health care expenditure accordingly. Note: We used PHO enrolment data as the denominator for the diabetes prevalence indicator, replacing Stats NZ estimated population projections. This ensures alignment and consistency with data reported by Health NZ on the VDR web tool. However, we acknowledge that some population groups are less likely to be enrolled than other population groups. For more information on access to primary health care by demographics, please see tewhatuora.govt.nz/for-health-providers/primary-care-sector/primary-health-organisations/enrolment-with-a-general-practice-and-primary-health-organisation.
Commentary	Description: This indicator shows the number and percent of the PHO-enrolled New Zealand population recorded as having diabetes in the VDR. Notes: Individuals not enrolled with a PHO as at 31 December of the VDR year have been excluded from the numerator for that year. It was not possible from the national data sets to infer the type of diabetes, so all data presented is a combination of those with type 1 and type 2 diabetes. Women diagnosed with gestational diabetes are not included.

	Why is this indicator important? This indicator shows variation in the prevalence of diabetes by age, gender, ethnic grouping and Health NZ district. This data is essential for tracking progress in diabetes prevention and management. What questions does this prompt? • To what degree does ethnic composition explain prevalence? • How do districts with similar populations compare? • How does prevalence in each age group track along the mean? • How much can be explained by prominent type of diabetes?

Indicator #2	**People with diabetes regularly[1] receiving metformin in the relevant year**
Numerator	People with diabetes dispensed metformin in three or four quarters in the relevant year
Denominator	Count of distinct master NHIs identified as having diabetes as per the VDR
By variables	For single map analysis: By year (2019–2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other) and Health NZ district of domicile. For PHO analysis: By year (2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other), PHO most recently enrolled with (for the relevant year), PHO group (small, medium, medium–large and large).
Data source	Pharmaceutical Collection, Health NZ VDR
Medicines	179401, 179402 metformin hydrochloride 410425, 410426 vildagliptin with metformin hydrochloride 413825, 413826, 413827 and 413828 empagliflozin with metformin hydrochloride Note: Metformin is also used to treat polycystic ovary syndrome in women aged 12–45 years. The VDR attempts to partially address this issue by excluding women aged 12–45 years who are solely identified as a result of metformin use – that is, no other methods identify them as having diabetes.
Rationale	Analysing variation in metformin usage can offer insights into several aspects of diabetes management, including health care access and quality, provider practice, patient preferences, health literacy, adherence and tolerability. This information is valuable for designing targeted interventions to improve diabetes care and reduce disparities in health care delivery.

[1] Regular use was defined as medication dispensed in three or four quarters during a year.

Commentary	Description: This indicator shows the number and percent of people with diabetes receiving metformin regularly. Regular use was defined as metformin dispensed in three or four quarters in a year. Notes: Metformin is also used to treat polycystic ovary syndrome in women aged 12–45 years. Women within this age group, dispensed metformin, have not been included within the VDR unless they also have diabetes. It was not possible to analyse indicator by the type of diabetes. However, it is assumed that type 2 diabetes is more prevalent in people aged 25 years or over than type 1 diabetes. Why is this indicator important? • Metformin is a commonly prescribed medicine for type 2 diabetes. Low metformin usage is a significant concern that warrants further investigation to identify the underlying contributing factors. • What questions does this prompt? • Why is the use significantly lower in people aged 25–44 years? Is this appropriate? • Are there any barriers or misconceptions regarding metformin use?

Indicator #3	**People with diabetes regularly receiving vildagliptin**
Numerator	People with diabetes dispensed vildagliptin in three or four quarters in the relevant year
Denominator	Count of distinct master NHIs identified as having diabetes as per the VDR
By variables	For single map analysis: By year (2019–2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other) and Health NZ district of domicile. For PHO analysis: By year (2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other), PHO most recently enrolled with (for the relevant year), PHO group (small, medium, medium–large and large).
Data source	Pharmaceutical Collection VDR
Code	410325 vildagliptin 410425, 410426 vildagliptin with metformin hydrochloride
Rationale	Understanding variation in dispensing these medicines is important for optimising diabetes care and ensuring patients receive the most appropriate treatments.
Commentary	Description:

	This indicator shows the number and percent of people with diabetes receiving vildagliptin regularly. Regular use was defined as vildagliptin dispensed in three or four quarters in a year. Why is this indicator important? Vildagliptin is recommended for patients who have not achieved sufficient lowering of HbA1c levels with metformin and are not eligible for funded treatment with empagliflozin or dulaglutide. Understanding variation in dispensing these medicines is important for optimising diabetes care and ensuring patients receive the most appropriate treatments. What questions does this prompt? • How do districts with similar ethnic composition compare? • How do PHOs with similar populations compare?

Indicator #4	**People with diabetes regularly receiving empagliflozin**
Numerator	People with diabetes dispensed empagliflozin in three or four quarters in the relevant year
Denominator	Count of distinct master NHIs identified as having diabetes as per the VDR
By variables	For single map analysis: By year (2019–2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other) and Health NZ district of domicile. For PHO analysis: By year (2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other), PHO most recently enrolled with (for the relevant year), PHO group (small, medium, medium–large and large).
Data source	Pharmaceutical Collection VDR
Code	413725, 413726 empagliflozin 413825, 413826, 413827, 413828 empagliflozin with metformin hydrochloride
Rationale	Sodium-glucose co-transporter 2 (SGLT-2) inhibitors such as empagliflozin are available since February 2021 and are fully funded for the treatment of people with poorly controlled type 2 diabetes despite treatment who are at high risk of cardiovascular disease or have renal complications. Understanding variation in dispensing these newer medicines is important for optimising diabetes care and ensuring patients receive the most appropriate treatments.
Commentary	Description: This indicator shows the number and percent of people with diabetes receiving empagliflozin regularly. Regular use was defined as empagliflozin dispensed in three or four quarters in a year. Why is this indicator important?

	Sodium-glucose co-transporter 2 (SGLT-2) inhibitors, such as empagliflozin have been available since February 2021 and are fully funded for the treatment of people with poorly controlled type 2 diabetes despite treatment who are at high risk of cardiovascular disease or have renal complications. Understanding variation in dispensing these newer medicines is important for optimising diabetes care and ensuring patients receive the most appropriate treatments. What questions does this prompt? • How do districts with similar ethnic composition compare? • How do PHOs with similar populations compare?

Indicator #5	**People with diabetes regularly receiving GLP-1 agonists**
Numerator	People with diabetes dispensed GLP-1 agonists in three or four quarters in the relevant year
Denominator	Count of distinct master NHIs identified as having diabetes as per the VDR
By variables	For single map analysis: By year (2019–2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other) and Health NZ district of domicile. For PHO analysis: By year (2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other), PHO most recently enrolled with (for the relevant year), PHO group (small, medium, medium–large and large).
Data source	Pharmaceutical Collection VDR
Code	414925 dulaglutide 417325 Liraglutide
Rationale	Glucagon-like peptide-1 (GLP-1) receptor agonists such as dulaglutide have been available since September 2021 and liraglutide from March 2023 and they are fully funded for the treatment of people with poorly controlled type 2 diabetes despite treatment who are at high risk of cardiovascular disease or have renal complications. Understanding variation in dispensing these newer medicines is important for optimising diabetes care and ensuring patients receive the most appropriate treatments.
Commentary	Description: This indicator shows the number and percent of people with diabetes receiving GLP-1 agonists regularly. Regular use was defined as GLP-1 Agonists dispensed in three or more quarters in a year. Why is this indicator important? Glucagon-like peptide-1 (GLP-1) receptor agonists such as dulaglutide are available since September 2021 and liraglutide from March 2023 and fully funded for the treatment of people with poorly controlled type 2 diabetes

	despite treatment who are at high risk of cardiovascular disease or have renal complications. Understanding variation in dispensing these newer medicines is important for optimising diabetes care and ensuring patients receive the most appropriate treatments. What questions does this prompt? • How do districts with similar ethnic composition compare? • How do PHOs with similar populations compare?

Indicator #6	**People with diabetes regularly receiving sulfonylureas**
Numerator	People with diabetes dispensed sulfonylureas in three or four quarters in the relevant year
Denominator	Count of distinct master NHIs identified as having diabetes as per the VDR
By variables	For single map analysis: By year (2019–2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other) and Health NZ district of domicile. For PHO analysis: By year (2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other), PHO most recently enrolled with (for the relevant year), PHO group (small, medium, medium–large and large).
Data source	Pharmaceutical Collection VDR
Code	156701, 156702 glibenclamide 156801 gliclazide 156901 glipizide
Rationale	Understanding variation in dispensing these medicines is important for optimising diabetes care and ensuring patients receive the most appropriate treatments.
Commentary	Description: This indicator shows the number and percent of people with diabetes receiving sulfonylureas (glibenclamide, gliclazide and glipizide) regularly. Regular use was defined as sulfonylureas dispensed in three or four quarters in a year. Sulfonylureas are recommended for patients who have not achieved sufficient lowering of HbA1c levels with metformin and are not eligible for funded treatment with empagliflozin or dulaglutide. Other options include Vildagliptin or Pioglitazone. Why is this indicator important? Understanding variation in dispensing these medicines is important for optimising diabetes care and ensuring that patients receive the most appropriate treatments.

	What questions does this prompt? • How do districts with similar ethnic composition compare? • How do PHOs with similar populations compare?

Indicator #7	**People with diabetes regularly receiving insulin in the relevant year**
Numerator	People with diabetes dispensed insulin in three or four quarters in the relevant year
Denominator	Count of distinct master NHIs identified as having diabetes on the VDR
By variables	For single map analysis: By year (2019–2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other) and Health NZ district of domicile. For PHO analysis: By year (2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other), PHO most recently enrolled with (for the relevant year), PHO group (small, medium, medium–large and large).
Data source	Pharmaceutical Collection, Health NZ VDR
Medicines	119201, 119202 Insulin lispro 164801, 164803 Insulin neutral 164903, 164904 Insulin isophane 165502 Inj crystalline human 100 u per mL 165501 Inj human 100 u per mL 378325, 378326, 378327 Insulin aspart 385725, 385726, 385727 Insulin glargine 388225, 388226 Insulin lispro with insulin lispro protamine 390825, 390826, 390827 Insulin glulisine 398227 Insulin aspart with insulin aspart protamine 630002, 630003 Insulin isophane with insulin neutral
Rationale	Understanding the reasons behind variations in regular insulin use is important as it can give some insights into differences in the quality of care received by people with diabetes. It helps to develop strategies that promote effective diabetes management, ensure equitable access to insulin therapy when needed and enhance patient outcomes. Some reasons for variation in insulin usage include diabetes type, patient acceptance, adherence and physician preferences.
Commentary	Description: This indicator shows the number and percent of people with diabetes who are dispensed insulin regularly. Regular use was defined as insulin dispensed in three or four quarters in a year.

	Note: Insulin is also used to treat gestational diabetes, and therefore women dispensed insulin around the time of birth have not been included. Why is this indicator important? Insulin is a critical component of diabetes management. It is increasingly being used to maintain good glycaemic control in people with type 2 diabetes and is the primary treatment for people with type 1 diabetes. Wide variations in insulin usage indicate disparities in care. What questions does this prompt? • How much variation can be explained by the prominent type of diabetes? • Are there any barriers or misconceptions regarding insulin use? • What are the factors that influence insulin use decisions among different patient populations?

Indicator #8	**People with diabetes regularly receiving any hypoglycaemic medication in the relevant year**
Numerator	People with diabetes dispensed any hypoglycaemic medication in three or four quarters in the relevant year
Denominator	Count of distinct master NHIs identified as having diabetes as per the VDR
By variables	For single map analysis: By year (2019–2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other) and Health NZ district of domicile. For PHO analysis: By year (2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other), PHO most recently enrolled with (for the relevant year), PHO group (small, medium, medium–large and large).
Data source	Pharmaceutical Collection VDR
Medicines	179401, 179402 metformin hydrochloride 124701, 124702 acarbose 414925 dulaglutide 417325 Liraglutide 413725, 413726 empagliflozin 413825, 413826, 413827, 413828 empagliflozin with metformin hydrochloride 156701, 156702 glibenclamide 156801 gliclazide 156901 glipizide

	119201, 119202 insulin lispro 164801, 164803 insulin neutral 164903, 164904 insulin isophane 165502 inj crystalline human 100 u per mL 165501 inj human 100 u per mL 378325, 378326, 378327 insulin aspart 385725, 385726, 385727 insulin glargine 388225, 388226 insulin lispro with insulin lispro protamine 390825, 390826, 390827 insulin glulisine 398227 insulin aspart with insulin aspart protamine 630002, 630003 insulin isophane with insulin neutral 380025, 380026, 380027 pioglitazone 410325 vildagliptin 410425, 410426 vildagliptin with metformin hydrochloride
Rationale	Analysing variation in hypoglycaemic medication usage can offer insights into several aspects of diabetes management, including health care access and quality, provider practices, patient preferences, health literacy, adherence and tolerability. This information is valuable for designing targeted interventions to improve diabetes care and reduce disparities in health care delivery.
Commentary	Description: This indicator shows the number and percent of people with diabetes receiving any hypoglycaemic medication regularly. Regular use was defined as hypoglycaemic medication dispensed in three or four quarters in a year. Why is this indicator important? Analysing variation in hypoglycaemic medication usage can offer insights into several aspects of diabetes management, including health care access and quality, provider practice, patient preferences, health literacy, adherence and tolerability. This information is valuable for designing targeted interventions to improve diabetes care and reduce disparities in health care delivery. What questions does this prompt? • How do districts with similar ethnic composition compare? • How do PHOs with similar populations compare?

Indicator #9	**People with diabetes aged 25 years or over regularly receiving an ACEI or ARB in the relevant year**
Numerator	People with diabetes receiving an ACEI or ARB in three or four quarters in a year
Denominator	Count of distinct master NHIs identified as having diabetes on the VDR

By variables	For single map analysis: By year (2019–2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other) and Health NZ district of domicile. For PHO analysis: By year (2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other), PHO most recently enrolled with (for the relevant year), PHO group (small, medium, medium–large and large).
Data source	Pharmaceutical Collection, Health NZ VDR
Medicines	ACEI: 2794 benazepril, 2841 captopril, 2770 cilazapril, 2711 enalapril maleate, 2797 lisinopril, 2806 perindopril, 2772 quinapril, 1031 trandolapril, 4164 ramipril ACEI with diuretics: 2840 captopril with hydrochlorothiazide; 1127 cilazapril with hydrochlorothiazide; 2708 enalapril with hydrochlorothiazide; 2795 lisinopril with hydrochlorothiazide; 3749 quinapril with hydrochlorothiazide ARB: 1254 candesartan cilexetil, 1061 losartan potassium ARB with diuretics: 1068 losartan with hydrochlorothiazide; 3788 losartan with hydrochlorothiazide 4105 entresto (sacubitril with valsartan)
Rationale	Variation in ACEI and ARB use can occur in clinical practice due to disparities in the prevalence of diabetes-related renal and cardiovascular complications in different populations. Understanding and addressing variation in ACEI and ARB use is essential for optimising patient care, improving medication adherence and achieving better health outcomes for individuals with cardiovascular and renal conditions.
Commentary	Description: This indicator shows the number and percent of people with diabetes receiving angiotensin converting enzyme inhibitor (ACEI) or an angiotensin receptor blocker (ARB) in three or four quarters in the relevant year. Why is this indicator important? Intensive management of blood pressure and microalbuminuria are recommended to prevent progression of renal disease in diabetes. ACEIs and ARBs are first-line treatments for raised blood pressure and/or microalbuminuria. What questions does this prompt? • Do rates reflect the incidence of microalbuminuria? • In your local area, how many patients with microalbuminuria are receiving either an ACEI or ARB? • How do Health NZ districts with a similar case-mix compare?

Indicator #10	People with diabetes admitted one or more times to hospital with diabetic ketoacidosis
Numerator	People with diabetes admitted to hospital with primary diagnosis of diabetic ketoacidosis ICD10 Codes: E101, E111, E131, E141
Denominator	Count of distinct master NHIs identified as having diabetes on the VDR
Data source	NMDS VDR PHO enrolment collection
By variables	For single map analysis: By year (2019–2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other) and Health NZ district of domicile. For PHO analysis: By year (2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other), PHO most recently enrolled with (for the relevant year), PHO group (small, medium, medium–large and large).
Rationale	Understanding the reasons behind variations in the prevalence of diabetic ketoacidosis is crucial for improving diabetes management and preventing this life-threatening condition.
Commentary	Description: This indicator shows the number and percent of people with diabetes admitted to hospital with the primary diagnosis of diabetic ketoacidosis one or more times in the relevant year. Note: This indicator does not include people who were treated in the emergency department (ED). The decision to admit depends on the severity and cause. It is recommended that Health NZ districts analyse their ED attendances. Why is this important? Diabetic ketoacidosis is a potentially life-threatening complication of diabetes that occurs mainly in people with type 1 diabetes but also sometimes in those with type 2 diabetes. It can occur in previously undiagnosed diabetes or as an effect of illness or poor compliance with insulin therapy. Diabetic ketoacidosis should be a rare event, with a single occurrence being a marker of care quality. What questions does this prompt? • Where admission rates are consistently low, what might this be due to? • Where admission rates are consistently high, what might this be due to? • Are psychosocial services available in the Health NZ district, particularly for young people?

	• In each Health NZ district, how many patients present to ED with diabetic ketoacidosis as a primary diagnosis?

Indicator #11	**People with diabetes admitted to hospital with hypoglycaemia**
Numerator	People with diabetes admitted to hospital with a primary diagnosis of hypoglycaemia ICD10 codes: E1064, E1164, E1364, E1464
Denominator	Count of distinct master NHIs identified as having diabetes on the VDR
Data source	NMDS VDR
By variables	For single map analysis: By year (2019–2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other) and Health NZ district of domicile. For PHO analysis: By year (2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other), PHO most recently enrolled with (for the relevant year), PHO group (small, medium, medium–large and large).
Rationale	Understanding the factors contributing to variations in hypoglycaemia prevalence is essential for tailoring diabetes care, promoting patient education and implementing proactive measures to prevent this potentially life-threatening condition.
Commentary	Description: This indicator shows the number and percent of people with diabetes who are admitted to hospital with hypoglycaemia as the primary diagnosis one or more times in the relevant year. Note: This indicator does not include people who were treated in the emergency department. While the decision to admit depends on the severity and cause, different hospitals may have different admission policies, which may lead to variation in rates. We recommend Health NZ districts analyse their ED attendances. Why is this important? Hypoglycaemia (low blood sugar) occurs in people with diabetes as a complication of treatment with insulin or oral medication. Hypoglycaemia should be a rare event, with a single occurrence being a marker of care quality. What questions does this prompt? • Where admission rates are consistently low, what might this be due to? • Where admission rates are consistently high, what might this be due to?

	• Are psychosocial services available in the Health NZ district, particularly for young people? • In each Health NZ district, how many patients present to ED with hypoglycaemia as a primary diagnosis?

Indicator #12	**People with diabetes having a lower-limb amputation**
Numerator	People with diabetes recorded as having a lower-limb amputation Procedure (ICD10) Codes: 4433800, 4435800, 9055700, 4436100, 4436400, 4436401, 4436101, 4437000, 4437300, 4436700, 4436701, 4436702.
Denominator	Count of distinct master NHIs identified as having diabetes on the VDR
Data source	NMDS VDR
By variables	For single map analysis: By year (2019–2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other) and Health NZ district of domicile. For PHO analysis: By year (2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other), PHO most recently enrolled with (for the relevant year), PHO group (small, medium, medium–large and large).
Rationale	Monitoring variations in amputation rates serves as an indicator of the quality and effectiveness of health care services, especially diabetes management. Many lower-limb amputations are preventable through early detection, proper management of diabetes and timely interventions for foot ulcers and vascular issues. Understanding variations can help identify areas where preventive measures and interventions need to be strengthened.
Exclusions	Trauma

Clinical code	**Clinical code description**
S78	Traumatic amputation of hip and thigh
S88	Traumatic amputation of lower leg
S98	Traumatic amputation of ankle and foot
T05.3	Traumatic amputation of both feet
T05.4	Traumatic amputation of one foot and other leg [any level, except foot]
T05.5	Traumatic amputation of both legs [any levels]
T05.6	Traumatic amputation of upper and lower limbs, any combination [any level]
T13.6	Traumatic amputation of lower limb, level unspecified

<table>
<tr><td></td><td>Primary lower-limb cancer
<table>
<tr><th>Clinical code</th><th>Clinical code description</th></tr>
<tr><td>C40.2</td><td>Malignant neoplasm of long bones of lower limb</td></tr>
<tr><td>C40.3</td><td>Malignant neoplasm of short bones of lower limb</td></tr>
<tr><td>C43.7</td><td>Malignant melanoma of lower limb, including hip</td></tr>
<tr><td>C49.2</td><td>Malignant neoplasm of connective and soft tissue of lower limb, including hip</td></tr>
</table></td></tr>
<tr><td>Commentary</td><td>Description:
This indicator shows the number and percent of people with diabetes undergoing a lower-limb amputation.
Note:
Cancer and trauma amputations with following clinical codes (ICD-10-AM-VI) were excluded.
Only one amputation per person in the VDR is reported in this indicator.
Why is this important?
Diabetes is a major cause of non-traumatic amputations and is a strong indicator of the quality of care. Wide variation in rates may highlight disparities.
What questions does this prompt?
• Where amputation rates are low, what might this be due to?
• Where amputation rates are high, what might this be due to?</td></tr>
</table>

Indicator #13	**Proportion of medical-surgical bed-days for people with diabetes**
Numerator	Number of medical-surgical bed-days occupied by people with diabetes (from VDR) Note: Non-casemix events were excluded, using the PU = EXCLU filter. This removes events that are funded differently or not funded, for example, error diagnostic related groups, non-treated patients (boarders or cancelled operations), mental health events, disability and some health of older people events, such as rest home or respite care events.
Denominator	Total number of occupied bed-days for medical and surgical discharges
Data source	NMDS VDR
By variables	For single map analysis: By year (2019–2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other) and Health NZ district of domicile. For PHO analysis: By year (2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and

	European/other), PHO most recently enrolled with (for the relevant year), PHO group (small, medium, medium–large and large).
Rationale	Studying the variation in the number and proportion of medical-surgical bed-days in people with a diagnosis of diabetes compared with the total medical-surgical bed-days is important as it provides valuable insights into the health care burden, health care planning, resource allocation and quality improvement.
Commentary	Description: This indicator shows the number and proportion of medical-surgical bed-days in people with any diagnosis of diabetes compared with total medical-surgical bed-days. Note: This indicator has been amended to include a filter that removes non-case mix events. This excludes some events that are included in NMDS, such as mental health, rest-home hospital and events related to the health of older people. The exclusion of these events improves comparability between Health NZ districts. Why is this important? This indicator highlights the effect diabetes in the community has on hospital bed utilisation rates. What questions does this prompt? • What is the impact of co-morbidity on admissions in people aged 45 years and older? • Where rates are low, what might this be due to? • Where rates are high, what might this be due to? • How do similar PHOs compare? • How might high rates of admissions be affected by more intensive support for primary health care management? • How does bed-days usage correlate with other indicators of diabetes care, such as HbA1c monitoring?
Comments	Health speciality code of Disability (D), Medical (M) and Surgical (S). Notes when interpreting this indicator: Admissions in people with diabetes for any other reason are included. Some admissions may be completely unrelated to their diabetes. This indicator is dependent on two factors: the underlying prevalence of diabetes and the frequency of medical-surgical bed-day use of people with diabetes compared with the general population by different age groups. This effect of age could be addressed by age standardisation. In the Atlas, it is possible to stratify by age, so the effect on bed occupancy can be examined.

Indicator #14	People with diabetes having regular HbA1c monitoring, percent
Numerator	People with diabetes recorded as having one or more HbA1c tests in a year
Denominator	Virtual diabetes register population identified as having diabetes
Data source	Laboratory Claims collection, PHO enrolment Collection, VDR
Code	BG2 - glycosylated haemoglobin, plasma HbA1c test
By variables	For single map analysis: By year (2019–2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other) and Health NZ district of domicile. For PHO analysis: By year (2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other), PHO most recently enrolled with (for the relevant year), PHO group (small, medium, medium–large and large).
Note	Laboratory claims data for several districts between 2019 and 2024 was incomplete. To maintain data quality and ensure reliable analysis, districts with data incompleteness of two or more consecutive months have been excluded from the dataset. So, the resulting New Zealand-level rates may not fully reflect true national performance. For more details, see Table 1.
Rationale	Regular monitoring of HbA1c is essential for maintaining good glycaemic control and reducing the risk of diabetes-related complications. Tracking trends and variations in HbA1c over time provides valuable insights into treatment effectiveness and highlights opportunities for improvement at both individual and population levels.
Commentary	Description This indicator shows the number and percent of people with diabetes having regular HbA1c monitoring. Regular monitoring was defined as one or more tests in a year. Note: The data represents community laboratory test claims only. Districts that provide community tests in the hospital may not report these tests, so it is possible there is undercounting of actual tests in some districts. Local data analysis is recommended to explore these results. Also, note that some districts with incomplete data during the 2019–2024 period were excluded from analyses. Why is this important? Regular monitoring of HbA1c is vital to ensure good glycaemic control and reduce the likelihood of complications developing. What questions does this prompt? • Do areas with lower rates of HbA1c testing have higher complication rates? • Where rates of testing are high, what might this be due to?

Indicator #15	**People with diabetes having regular screening for renal disease (ACR), percent**
Numerator	People with diabetes recorded as having one or more ACR tests in a year
Denominator	Virtual diabetes register population identified as having diabetes
Data source	Laboratory Claims collection, PHO enrolment Collection, VDR
Code	BP8 – microalbumin, early morning urine
By variables	For single map analysis: By year (2019–2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other) and Health NZ district of domicile. For PHO analysis: By year (2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other), PHO most recently enrolled with (for the relevant year), PHO group (small, medium, medium–large and large).
Note	The laboratory claims data for several districts between 2019 and 2024 was incomplete. To maintain data quality and ensure reliable analysis, districts with data incompleteness of two or more consecutive months have been excluded from the dataset. So, the resulting New Zealand-level rates may not fully reflect true national performance. For more details, see Table 1.
Rationale	ACR is the test of choice to identify proteinuria in people with diabetes and possible kidney disease, with proteinuria being the cardinal sign of kidney disease. Regular screening is important to allow early detection and treatment of renal disease.
Commentary	Description This indicator shows the number and percent of people with diabetes having regular screening for renal disease. Regular screening was defined as one or more albumin: creatinine ratio (ACR) test in a year. The data is presented by year, age and ethnic group. Note: The data represents community laboratory test claims. Districts that provide community tests in the hospital may not report these tests, meaning it is possible there is undercounting of actual tests in some districts. Local data analysis is recommended to explore these results. Also, some districts with incomplete data during the 2019–2024 period were excluded from analysis. Why is this important? ACR is the test of choice to identify proteinuria in people with diabetes and possible kidney disease, with proteinuria being the cardinal sign of kidney disease. Regular screening is important to allow early detection and treatment of renal disease. What questions does this prompt? • Where rates of ACR testing are low, what might this be due to? • Where rates of testing are high, what might this be due to?

	• Is there a correlation between rates of monitoring HbA1c and ACR? • Are low rates of testing correlated with complication rates?

Indicator #16	**People with diabetes having regular monitoring for renal disease (eGFR), percent**
Numerator	People with diabetes recorded as having one or more eGFR tests in a year
Denominator	Virtual diabetes register population identified as having diabetes
Data source	Laboratory Claims collection, PHO enrolment Collection, VDR
Code	BR1 - serum creatinine
By variables	For single map analysis: By year (2019–2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other) and Health NZ district of domicile. For PHO analysis: By year (2024), age group (0–14 years, 15–24 years, 25–44 years, 45–64 years, 65–74 years and 75+ years), gender (female and male), ethnic group (Māori, Pacific peoples, Indian and European/other), PHO most recently enrolled with (for the relevant year), PHO group (small, medium, medium–large and large).
Note	Laboratory claims data for several districts between 2019 and 2024 was incomplete. To maintain data quality and ensure reliable analysis, districts with data incompleteness of two or more consecutive months has been excluded from the dataset. So, the resulting New Zealand-level rates may not fully reflect true national performance. For more details, see Table 1.
Rationale	Glomerular filtration rate is the best measure of overall kidney function and is used to diagnose chronic kidney disease. Regular monitoring of kidney function is important to assess whether there is disease progression.
Commentary	Description This indicator shows the number and percent of people with diabetes having regular eGFR (estimated glomerular filtration rate) monitoring. Regular monitoring was defined as one or more eGFR tests in a year. The data is presented by year, age and ethnic group. Note: The data represents community laboratory test claims. Districts that provide community tests in the hospital may not report these tests, so it is possible there is undercounting of actual tests in some districts. We recommend local data analysis to explore these results. Also, some districts with incomplete data during the 2019–2024 period were excluded from the analysis. Why is this important? Glomerular filtration rate is the best measure of overall kidney function and is used to diagnose chronic kidney disease. Regular monitoring of

	kidney function is important to assess whether there is disease progression. What questions does this prompt? • Where rates of testing are low, what might this be due to? • Where rates of testing are high, what might this be due to? • Are low rates of testing correlated with complication rates?

Table1: Laboratory claims data completeness (2019–2024)

Health district	2019	2020	2021	2022	2023	2024
Auckland	Y	Y	Y	Y	Y	Y*
Bay of Plenty	Y	Y	Y	Y	Y	Y*
Canterbury	Y	Y	Y	N	Y*	Y
Capital & Coast	Y	Y	Y	Y	Y	Y
Counties Manukau	Y	Y	Y	Y	Y	Y*
Hawke's Bay	Y	Y	Y	Y	N	Y
Hutt	Y	Y	Y	Y	Y	Y
Lakes	Y*	Y	Y	Y	Y	Y
Midcentral	Y	Y	Y	N	N	N
Nelson Marlborough	Y	Y	Y	Y	Y	Y
Northland	Y	Y	Y	Y	Y	N
South Canterbury	Y	Y	Y	N	Y	Y
Southern	Y	Y	Y	Y	Y	Y
Tairāwhiti	Y	Y	N	N	Y*	Y
Taranaki	Y	Y	Y	Y	Y	Y
Waikato	N	Y	Y	Y	Y	Y*
Wairarapa	Y	Y	Y	Y	Y	Y
Waitematā	Y	Y	Y	Y	Y	Y*
West Coast	Y	Y	Y	Y	N	N
Whanganui	Y	Y	Y	N	N	N

***** Indicates a drop in data volumes for less than 2 months.

References

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Appendix 1: Detailed information on VDR methodology (December 2024)

The VDR counts individuals who had any of the following.

1. Publicly funded hospital discharges between 2015 and 2024, with any of the following diagnosis codes (ICD-10-AM version 8).
    - E10 – Type 1 diabetes mellitus
    - E11 – Type 2 diabetes mellitus
    - E12 – Malnutrition-related diabetes mellitus
    - E13 – Other specified diabetes mellitus
    - E14 – Unspecified diabetes mellitus
    - O240 – Pre-existing diabetes mellitus, Type 1, in pregnancy
    - O241 – Pre-existing diabetes mellitus, Type 2, in pregnancy
    - O242 – Pre-existing diabetes mellitus, other specified type, in pregnancy
    - O243 – Pre-existing diabetes mellitus, unspecified, in pregnancy

Note: Admissions with a code for gestational diabetes are not included.

2. Diabetes ‘education and management’ (purchase unit code of M20006) or diabetes retinal (fundus) screening (purchase unit code of M20007) within the outpatient collection (NNPAC) between 2022 and 2024.
3. Publicly funded pharmaceuticals dispensed within the community on two or more occasions between 2023 and 2024. Pharmaceuticals with the following chemical IDs are included.
    - 1192 insulin lispro
    - 1247 acarbose
    - 1567 glibenclamide
    - 1568 gliclazide
    - 1569 glipizide
    - 1570 glucagon hydrochloride
    - 1648 insulin neutral
    - 1649 insulin isophane
    - 1655 insulin zinc suspension
    - 1794 metformin hydrochloride
    - 2276 tolazamide
    - 2277 tolbutamide
    - 3739 rosiglitazone
    - 3783 insulin aspart

- 3800 pioglitazone
- 3857 insulin glargine
- 3882 insulin lispro with insulin lispro protamine
- 3908 insulin glulisine
- 3982 insulin aspart with insulin aspart protamine
- 4103 vildagliptin
- 4104 vildagliptin with metformin hydrochloride
- 4137 empagliflozin
- 4138 empagliflozin with metformin hydrochloride
- 4149 dulaglutide
- 6300 insulin isophane with insulin neutral
- 4173 liraglutide.

Note: Metformin is also used to treat polycystic ovary syndrome in women aged 12–45 years. Women who are dispensed metformin within this age group have not been included within the VDR. Likewise, because insulin is also used to treat gestational diabetes, women dispensed insulin within 5 months before and 2 weeks after the birth discharge date of the birth event have not been included.

4. Four or more HbA1c, glycosylated haemoglobin lab tests (lab test code BG2) and two or more ACR tests (lab test code BP8) between 2023 and 2024.

Note: To avoid unintentionally including people with gestational diabetes, the VDR does not include women who had lab HbA1c tests within 9 months before the birth event.