

**Atlas of Healthcare Variation:**

**Methodology | Diabetes**

**June 2024**

### 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 New Zealand) district of domicile; where more than one domicile was recorded, the most recent value was selected.
* Ethnicity data presented is 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 persons of the following ethnicities: European (including New Zealand European), MELAA (Middle Eastern, Latin American and African), other Asian and Other. Where people report different ethnic groups at different timepoints, the most recent value is selected.
* Rates are not age standardised; this means our prevalence rates are different to those on the Health New Zealand diabetes dashboard (<https://tewhatuora.shinyapps.io/virtual-diabetes-register-web-tool/>).
* For all indicators, individuals with missing values for any of the variables of interest (age, gender, ethnicity and district) are excluded completely. For instance, if there are any missing values for age, they are excluded from all analyses. This approach ensures a consistent denominator throughout the analyses.
* Since we aggregate data for the numerator and denominator separately for Indicator #1, we use demographic information from the Virtual Diabetes Register (VDR) for the numerator and from the Primary Health Organisation (PHO) Enrolment Collection for the denominator. For Indicators #2‒12, demographic information is taken from the VDR. For Indicator #13, demographic information is from the National Minimum Dataset (NMDS).
* For PHO analyses, we analysed Indicator #1 to determine the size of diabetic population each PHO serves. Then we categorised them into small (< 3,000), medium (3,000‒5,000), medium‒large (5,000‒10,000) and large (> 10,000).

### Data sources

VDR, Health New Zealand. See [Appendix 1](#app1) for more details about the VDR.

Pharmaceutical Collection, Health New Zealand.

NMDS, Health New Zealand.

PHO Enrolment Collection, Health New Zealand.

### Exclusions

* People who died during the year
* People not enrolled in a PHO

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| **Standard deviation** |
| Data is presented as standard deviation from the mean.  Standard deviation is a statistical measure of variation from a mean. Assuming that recorded instances are normally distributed (ie, they are in the usual ‘bell-shaped curve’), 68 percent of all recorded instances would be expected to be within one standard deviation either side of the mean and 95 percent within two standard deviations. |

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| **Confidence intervals** |
| Data for each Health New Zealand 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 New Zealand 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 New Zealand 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’. |

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| **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 (2018‒22), 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 New Zealand district of domicile.  For PHO analysis: By year (2022), 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 | 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 (Coppell et al 2013; Health New Zealand 2023). It is estimated that about 307,000 people are diagnosed with diabetes. Diabetes disproportionately affects Pacific peoples, Indian and Māori populations when compared with European/other ethnic groups (Health New Zealand 2023). Children and young people are increasingly being diagnosed with type 2 diabetes, in part related to increasing obesity rates (Sjardin et al 2018).  Understanding variation in the prevalence of diabetes is crucial for long-term health care planning. It helps to 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 (eg, medical treatment) and indirect (eg, productivity losses). Understanding variation in prevalence can help estimate the economic burden and plan for health care expenditure accordingly.  It should be noted that 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 the Health New Zealand VDR web tool. However, we acknowledge that some population groups are more likely to be unenrolled compared to others. For more information on access to primary care by demographics, please see [www.tewhatuora.govt.nz/for-health-providers/primary-care-sector/primary-health-organisations/enrolment-with-a-general-practice-and-primary-health-organisation](http://www.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 New Zealand 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? |

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| **Indicator #2:** | People with diabetes regularly[[1]](#footnote-2) 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 (2018‒22), 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 New Zealand district of domicile.  For PHO analysis: By year (2022), 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 New Zealand  VDR |
| Medicines | 179401 & 179402 metformin hydrochloride  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. |
| 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 more 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 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? |

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| **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 (2018‒22), 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 New Zealand district of domicile.  For PHO analysis: By year (2022), 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 that 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 more quarters in a year.  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? |

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| **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 (2018‒22), 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 New Zealand district of domicile.  For PHO analysis: By year (2022), 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 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 that 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 more quarters in a year.  Why is this indicator important?  Sodium-glucose co-transporter 2 (SGLT-2) inhibitors such as empagliflozin are available since February 2021 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 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? |

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| **Indicator #5:** | People with diabetes regularly receiving dulaglutide |
| Numerator | People with diabetes dispensed dulaglutide 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 (2018‒22), 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 New Zealand district of domicile.  For PHO analysis: By year (2022), 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 |
| Rationale | Glucagon-like peptide-1 (GLP-1) receptor agonists such as dulaglutide are available since September 2021 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 that patients receive the most appropriate treatments. |
| Commentary | Description:  This indicator shows the number and percent of people with diabetes receiving dulaglutide regularly. Regular use was defined as dulaglutide 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 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 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? |

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| **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 (2018‒22), 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 New Zealand district of domicile.  For PHO analysis: By year (2022), 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 | 156702 glibenclamide  156801 gliclazide  156901 glipizide |
| Rationale | Understanding variation in dispensing these medicines is important for optimising diabetes care and ensuring that 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 more quarters in a year.  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? |

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| **Indicator #7:** | People with diabetes regularly2 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 |
| Data source | Pharmaceutical Collection, Health New Zealand  VDR |
| By variables | For single map analysis: By year (2018‒22), 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 New Zealand district of domicile.  For PHO analysis: By year (2022), 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). |
| 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 insulin 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 dispensed insulin regularly. Regular use was defined as insulin dispensed in three or more 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 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? |

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| **Indicator #8:** | People with diabetes regularly[[2]](#footnote-3) 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 (2018‒22), 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 New Zealand district of domicile.  For PHO analysis: By year (2022), 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  413725 & 413726 empagliflozin  413825, 413826, 413827 & 413828 empagliflozin with metformin hydrochloride  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 more 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? |

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| **Indicator #9:** | People with diabetes aged 25 years or over regularly receiving an ACEI or ARB in the relevant year |
| 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 |
| 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 |
| Data source | Pharmaceutical Collection, Health New Zealand  VDR |
| By variables | For single map analysis: By year (2018‒22), 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 New Zealand district of domicile.  For PHO analysis: By year (2022), 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). |
| 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 New Zealand districts with a similar casemix compare? |

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| **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 (2018‒22), 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 New Zealand district of domicile.  For PHO analysis: By year (2022), 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). It should be noted that the decision to admit depends on the severity and cause. It is recommended that Health New Zealand 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 occur 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 New Zealand district, particularly for young people? * In each Health New Zealand district, how many patients present to ED with diabetic ketoacidosis as a primary diagnosis? |

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| **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 (2018‒22), 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 New Zealand district of domicile.  For PHO analysis: By year (2022), 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. It is recommended that Health New Zealand 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 New Zealand district, particularly for young people? * In each Health New Zealand district, how many patients present to ED with hypoglycaemia as a primary diagnosis? |

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| **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 (2018‒22), 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 New Zealand district of domicile.  For PHO analysis: By year (2022), 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 |   Primary lower-limb cancer   |  |  | | --- | --- | | **Clinical code** | **Clinical code description** | | C40.2 | Malignant neoplasm of long bones of lower limb | | C40.3 | Malignant neoplasm of short bones of lower limb | | C43.7 | Malignant melanoma of lower limb, including hip | | C49.2 | Malignant neoplasm of connective and soft tissue of lower limb, including hip | |  |  | |
| Commentary | 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 on 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? |

|  |  |
| --- | --- |
| **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 (2018‒22), 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 New Zealand district of domicile.  For PHO analysis: By year (2022), 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 to the total medical-surgical bed-days is important for several reasons, 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 to 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 New Zealand 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 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. |

### References

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### Appendix 1: Detailed information on VDR methodology (December 2022)

The VDR counts individuals who had any of the following.

1. Publicly funded hospital discharges between 2013 and 2022, with any of the following diagnosis codes (ICD-10-AM version 6):

* 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.

1. 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 2020 and 2022.
2. Publicly funded pharmaceuticals dispensed within the community on two or more occasions between 2021 and 2022. 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 two weeks after the birth discharge date of the birth event have not been included.

1. Four or more HbA1c, glycosylated haemoglobin lab tests (lab test code BG2) and two or more ACR tests (lab test code BP8) between 2021 and 2022.

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.

1. Regular use was defined as medication dispensed in three or four quarters during a year. [↑](#footnote-ref-2)
2. Regular use was defined as medication dispensed in three or four quarters during a year. [↑](#footnote-ref-3)