The development and validation of a 'Virtual Diabetes Registry' (VDR) for monitoring diabetes prevalence and the quality of diabetes care in New Zealand

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Introduction/Objective

Significant prevalence of diabetes led Ministry of Health (MOH) of New Zealand to set targets for each local District Health Board* (DHB) to meet. The percentage of free annual diabetes checks is defined to be a measure of access to good quality care for Diabetes Mellitus (DM) patients. It monitors the level of HbA1c (a measure of diabetes management) and fasting lipid test (a measure of Cardiovascular Disease (CVD) risk). It requires an accurate method to track the number of people diagnosed with DM for the denominator to evaluate the programme and to use as evidence for public health policies. New Zealand wished to establish a database where wide ranging information on individuals can be located so that it can reveal these indicators. The Ministry has established the national Virtual Diabetes Registry (VDR) by combining and filtering various sources of health information. There have been continuous improvements in relation to its specificity as well as maintaining sensitivity by collaborating with local primary health organisations. The enrichment and the beauty of the VDR is in combining many data sources and the data base can be merged with other sources of data to look at implication of diabetes in particular cohorts.

*DHB: The organisation responsible for ensuring the provision of publicly funded health and disability support services for the population of a specific geographic area.

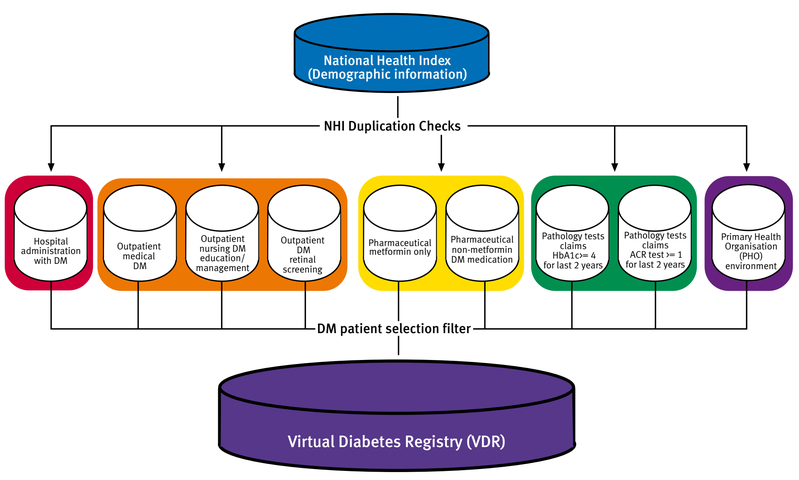
Methods

Five major national databases were used:

- hospital admissions coded for DM
- outpatient attendances for DM and DM retinal screening
- prescriptions of specific anti-diabetic therapies
- laboratory orders for HbA1c
- primary health organisation enrolments.

The algorithm was progressively modified to improve sensitivity and specificity, and validated against primary care registers.

Diagram 1



- Primary data, linked by the National Health Index (NHI) number, were available from six databases at the New Zealand Ministry of Health.
- Logical strategies devised to overcome data problems.
- The final 'list' was checked against the National Mortality Collection to remove deceased patients.

Table 1

Database used	Dates used	Basic capture criterion (ICD codes and Purchase Codes)	Problem(s)	Solution(s)
Hospital admissions	July 1999–Dec 2009	Any admission coded for DM in any diagnosis 'E10' 'E11', 'E13', 'E14', 'O241' ~ 'O243'	Known undercoding of diabetes	Rely on capture elsewhere
Outpatient data – medical	Jul 2003–Dec 2009	Any DM specialist visit - purchase code 'M20004' or 'M20005'	Some endocrinology out patients included	Require a further criterion if this is only evidence
Outpatient data nursing	Jul 2003–Dec 2009	Any DM Education/ Management visit 'M20006'		
Retinal screening database	July 2003–June 2009	Any episode of retinal screening for DM 'M20007'	Limited data and geographically variable	Rely on capture elsewhere; now improving
Pharmaceutical claims	Jan 2008–Dec 2009	Any prescription for DM-related drug (Metformin, SU, insulin, glucagon)	Coding errors Metformin for PCOS, Gest DM etc	Require 2 scrips For women aged 12–45 require other evidence
Pathology test claims	Jan 2008–Dec 2009	4 or more HbA1c tests within this 2 year period	Non-diabetic patients having CV risk checks	If this only evidence require ACR test also
NHI master index	Jan 2010 data	All	Duplicate NHI numbers	Run duplication check with latest master table
National death index	Jan 2010 data	Death before 31 Dec 2009		To exclude deceased patients

DM = diabetes mellitus; SU = sulfonylurea; PCOS = polycystic ovarian syndrome; CV = cardiovascular, ACR = albumin/creatinine ratio

Only Primary Health Organisation (PHO) enrolled patients are examined for a fair comparison and targets to be provided to DHBs and this represents a reduction of about 5% from the notional national population.

Results

Prevalence

- Initial estimation without the corrections: 210,679 (4.88%) people with diabetes as at 31 Dec 2009 among a New Zealand population of 4,315,355.
- The corrected method yielded a final estimate of 189,256 (4.39%) people with diabetes.

The number of individuals detected by each database used alone and exclusively by each method is given in Table 2.

Table 2

Changes made → / Detection source ↓	Initial extraction	Outpatient criteria modification – excluding Northland fundus screening data for 2003/04 for data quality issues	Pharmaceutical data criteria modification excluding female patients age 12–45 with metformin only without other evidence of diabetes	Outpatient criteria modification excluding patients only with diabetes specialist/ endocrinology only events	Lab criteria modification ACR tests added for patients only with HbA1c
Total Detection	210,679	201,623	198,068	193,129	189,256
Inpatient	103,058	95,085	95,085	95,085	95,085
Outpatient – diabetes specialist clinic	34,361	34,361	34,263	29,324	29,324
Outpatient – diabetes education and management clinic	68,533	62,336	62,336	62,336	62,336
Outpatient – retinal screening	102,287	102,287	102,287	102,287	102,287
Community pharmaceutical dispense – DM medication without Metformin	89,348	89,348	89,348	89,348	89,348
Community pharmaceutical dispense – Metformin only	109,995	109,995	106,440	106,440	106,440
LAB HbA1c>=4 in two years	84,610	84,610	84,610	84,610	80,737
LAB HbA1c>=4 and ACR>=1 in two years	N/A	N/A	N/A	N/A	4,637

- Validation through local PHOs is being improved to the development method.
- An apparent excess of individual coded based on frequent measurement of HbA1c.
- The modified equation is more specific but likely to be less sensitive and to be an underestimate.

Prevalence Rates

Figure1

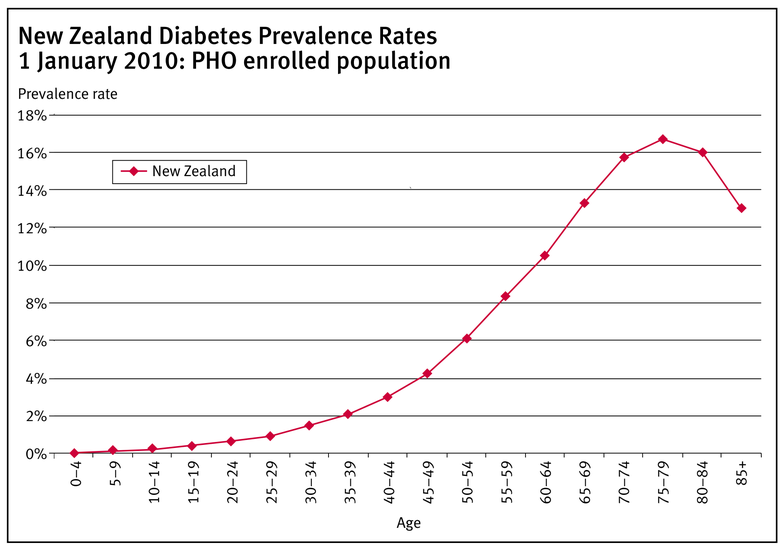
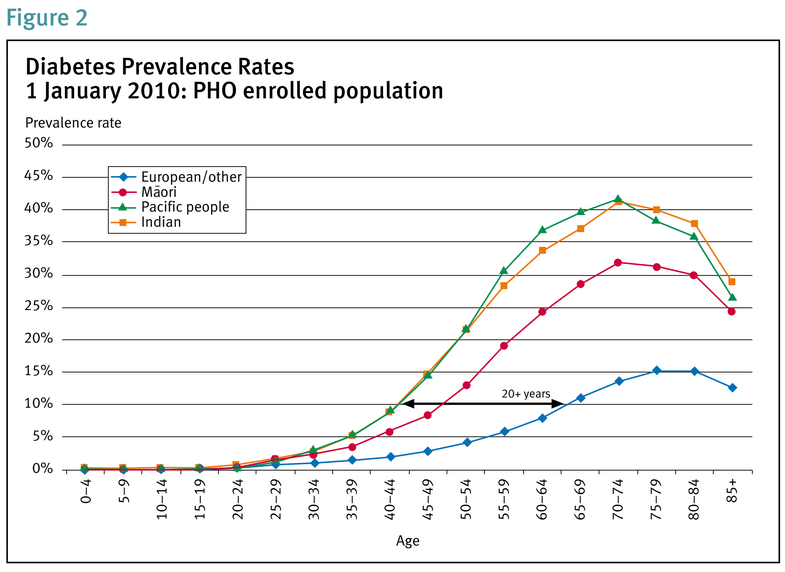


Figure 2

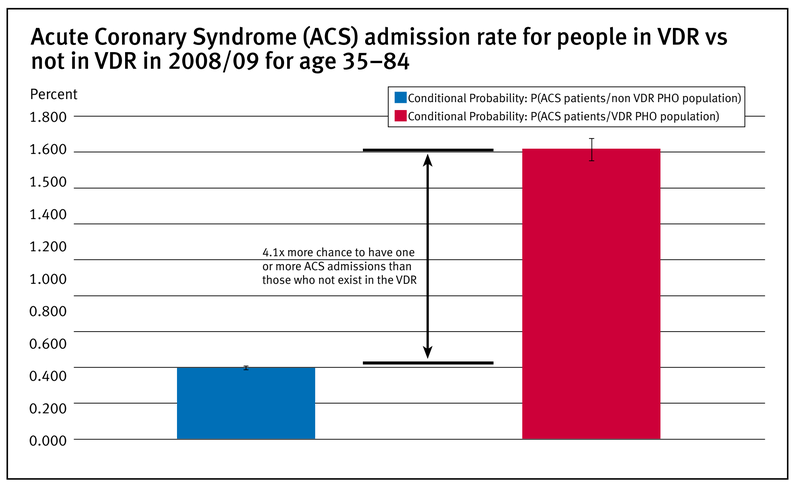


Diabetes prevalence rates for different ethnicities based on diabetes population of European/Other= 126,330 Māori=24,566; Pacific people=9,616; Indian= 8,942.

- A DM prevalence shows clear difference between European/other versus non-European/other ethnicity.
- Indian and Pacific people have the highest diabetes prevalence rate.

Figures 1 to 2 are obtained by the direct results of VDR to draw an overall conclusion for each age group. This has already proved to be an invaluable analysis for policy development and strategic plans.

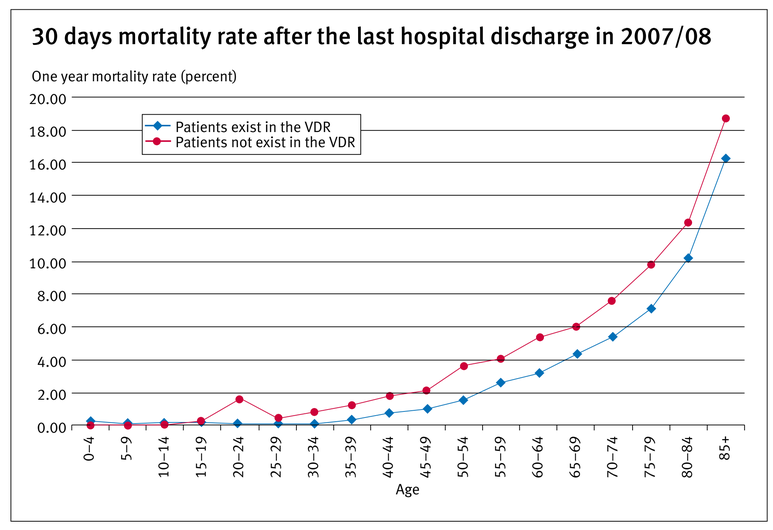
Figure 3



The graph has been obtained by calculating the conditional probabilities in financial year 2008/09 for the ages between 35 and 84.

- A person with no record in the VDR has 0.393% chance of having one or more of ACS related admissions in comparison to 1.613% for a person exists in the VDR.
- A patient with diabetes has 4.1 times the risk of developing ACS than a person without diabetes

Figure 4



The mortality rate 30 days after the last hospital discharge for patients existing in the VDR and not existing in the VDR based on 518,834 patients discharged from hospital admission.

- The mortality rate of the patients existing in the VDR are higher than those not in VDR from the twenties onwards.

Figures 3 and 4 are examples of statistical analysis available because of the stablishment of the VDR. The VDR enabled not only the overall conclusion to be drawn but very specific comparison analysis between certain groups of population to be made.

Conclusions

- Superior method involves the whole diabetes population in comparison to sampling used in other national surveys.
- The central authority monitors and local primary care organizations can monitor.
- Very accurate and robust: reveals the true representation.
- The VDR is the best option to monitor diabetes prevalence unless a national diabetes registry is established.
- The VDR is invaluable for monitoring national prevalence and supporting clinical quality improvements.
- The VDR is readily applicable to other areas to investigate the co-relation between the two or amongst many other factors.

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New Zealand Society NZSSD for the Study of Diabetes

New Zealand Diabetes Foundation