



Risk factors for type 2 diabetes in postmenopausal New Zealand women: a cross-sectional study

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Abstract

Aim To describe the diabetes risk profile of 3377 postmenopausal New Zealand women.

Methods Participants took part in a face-to-face interview with a research nurse. Medical history, lifestyle information, height, weight, and random capillary blood glucose were recorded. Risk scores for type 2 diabetes were later calculated for each participant using a modified diabetes 'risk analysis' tool developed by the United States Diabetes Prevention Program (DPP).

Results 157 women had diagnosed diabetes (4.4%) and were not therefore included in the risk analysis. Over half of the women (1843 of 3377) were at 'high risk' for the development of type 2 diabetes when assessed using the DPP diabetes risk analysis tool; 38.6% of participants were overweight, 25.6% were obese, 32.5% were physically inactive, 16.9% had a family history of diabetes, and 6.5% had random capillary blood glucose recordings of 7.5 mmol/L or greater.

Conclusion Risk factors for type 2 diabetes are prevalent in this group of postmenopausal New Zealand women. To appropriately target lifestyle modification programmes, these findings (in conjunction with recent evidence that lifestyle modification can reduce diabetes onset) highlight an urgent need to identify those women with risk factors before they develop type 2 diabetes.

Diabetes has risen to alarming levels in New Zealand and internationally, and is associated with significant morbidity and mortality¹ as well as personal and economic costs.² Healthcare costs relating to type 2 diabetes in New Zealand are estimated to be NZ\$398 million in 2006/07, increasing to NZ\$1066 million by the year 2021.²

A combination of genetic and behavioural or 'lifestyle' factors appear to contribute to the aetiology of type 2 diabetes.³ Non-modifiable risk factors for diabetes include family history of diabetes, ethnicity, and age.⁴ In New Zealand, diabetes is more prevalent in Maori and Pacific people than in European, and is often first diagnosed in middle age.⁵ Lifestyle risk factors such as obesity and physical inactivity are believed to be the primary modifiable determinants of the disease,³ and are independently associated with an increased risk for diabetes.⁶⁻⁸ A diet high in saturated fats and low in fibre has also been recognised as a risk factor for type 2 diabetes,⁹ and smoking appears to confer a small increased risk.⁶

Type 2 diabetes is preceded by a period of impaired glucose tolerance (IGT) and/or impaired fasting glucose (IFG).¹⁰ These 'pre-diabetes' conditions (IGT and IFG) increase in prevalence with age, with estimated rates of 15.7% and 4.5% respectively in Australian women aged 55-64 years.¹¹ Large randomised controlled trials involving intensive lifestyle intervention programs in Finland, China, and the United

States have demonstrated that increasing physical activity and diet modification can effectively reduce the onset of diabetes by up to 58% in individuals with IGT.^{3,12,13} Research in New Zealand has also been carried out to develop culturally appropriate lifestyle-intervention strategies for groups at high-risk for type 2 diabetes.¹⁴⁻¹⁷

Historically, there has been a strong focus on the identification of individuals with cardiovascular risk factors in primary care. Although diabetes will often be detected during a cardiovascular risk assessment, the recent trials confirming the ability to reduce diabetes by reducing risk factors give impetus to focussing on diabetes risk independently of cardiovascular risk. Given the strong evidence in favour of diabetes risk reduction through lifestyle modification, it is important to determine the best way to identify those individuals who would most benefit from lifestyle changes, and to determine the best way to quantify the degree of risk in those individuals.

Given that up to 50% of diabetes cases may go undiagnosed,¹¹ the estimated 4.3% of 45–64 year old New Zealand women diagnosed with diabetes in 1996–1997¹⁸ is likely to be an underestimate of the true prevalence of the disease. The prevalence of risk factors for diabetes has not been well documented for women in this age group, nor has a diabetes risk profile been presented to date.

Several assessment tools have been developed to ascertain ‘diabetes risk scores’ for patients by taking into account various demographic, lifestyle, and clinical variables.^{19,20} A web-based tool was developed by the US based Diabetes Prevention Program (DPP) that allows individuals to self-assess diabetes risk based on age, weight, ethnicity, gestational diabetes, family history of diabetes, blood glucose level and physical inactivity.²⁰ The present study will describe the prevalence of risk factors and calculate diabetes risk scores using data collected from postmenopausal New Zealand women during the recruitment process for an international clinical trial and a national observational study.

Methods

Study population—Between January 2000 and November 2002, 7035 women were invited from 24 general practices in four regions of New Zealand to attend an interview with a research nurse.

Recruitment method—Participants were sent a letter from their general practitioner that invited them to an appointment with a research nurse to discuss their health, menopause, and a long-term trial involving hormone replacement therapy. Eligibility criteria for invitation included: female, age between 49 and 69 years, current patient at participating practices, and no menstrual period in the previous 26 weeks.

Data collection and analysis Data were collected by research nurses in face-to-face interviews that took place at the patient’s general practice or at a nearby specialist medical centre. The interviews were conducted as part of the joint recruitment process for the ‘Women’s International Study of long Duration Oestrogen after Menopause’ (WISDOM)^{21,22} and recruitment to ‘The observational study of mid-life New Zealand women’.

Interviews took approximately 1 hour and informed consent was obtained for all participants. Data collected included sociodemographic information, medical history, lifestyle information—and clinical recordings that included height, weight, and random capillary blood glucose. Interview data were entered directly into a laptop-based computer program and with the exception of clinical recordings, all data collected were based on patient self-report. Data were imported into Microsoft Access97 tables and then into the statistical package Epi-Info 6.04b for calculation of frequencies.

Risk factor definitions Height was measured in centimetres (cm) using wall-mounted Tollot S/M standardised measure, with the patient standing, bare-foot with their head in the horizontal ‘Frankfurt plane position’. Weight was measured in kilograms (kg) to the nearest gram using Salter bathroom scales with the patient lightly clothed and bare-foot.

Individuals with a BMI of 25.0–29.9 kg/m² were classed as overweight, and those with a BMI of >30kg/m² were classed as obese.²³ Participants were classified as ‘physically inactive’ if they reported having exercised ‘rarely/never’; ‘less than once a week’; ‘once a week’; or ‘2-3 times per week’ when interviewed by the research nurse. Individuals who reported having a mother, father, or sibling with a history of diabetes were regarded as ‘having a family history of diabetes’. Non-fasting capillary blood glucose levels were measured by the research nurse using an Accu-chek[®] Advantage blood glucose meter and an Accu-chek[®] softclix pro pen. Ethnicity was self-defined using the 1996 New Zealand census question for interviews carried out up until March 1 2002 after which date the 2001 census question was used.

The DPP risk analysis tool calculates scores by totalling the number of points accumulated for each risk factor that the individual has (Table 2). The DPP website advises individuals with a score of 4 or less that they are probably at low risk for having diabetes, but not to forget about it—especially if they are Hispanic, African American, Native American, Asian American, or a Pacific Islander.

Individuals with a score of 6 or more are advised that only a doctor can determine if they have diabetes, and are given information on free screening by the DPP at the University of Washington, or are advised to see a doctor to find out for sure.²⁰ Minor modifications were made to the DPP risk analysis tool used in the present study as patients were not asked at recruitment if they had been told they have a high blood sugar level (awarded 6 points). Elevated random capillary blood glucose recordings were used in place of this measure; individuals with a reading equal to 7.5mmol/L or above were awarded 6 points. Patients were asked about any children weighing greater than 9 pounds at birth but not if they had diabetes during pregnancy. In addition to the ethnic groups regarded as ‘high risk’ in the DPP analysis, individuals identifying themselves as Maori in the present study were also allocated 3 points based on the higher rate of diabetes for New Zealand Maori.

Results

Of the 7035 women invited to participate in the study, 569 (8.1%) were not eligible because they were still having periods, 515 (7.3%) did not reply to the invitation, and 2417 (34.4%) declined participation for ‘other’ reasons. A total of 3534 women who met initial eligibility criteria (54.7%) attended an interview. At the time of recruitment, 157 participants (4.4%) had diagnosed diabetes so were excluded from this diabetes risk analyses. Participants had a mean age of 59.7 years, 39.3% had a tertiary qualification, and the majority (82.8%) of the respondents identified themselves as New Zealand European. Table 1 displays the characteristics of the study population.

Diabetes and risk factor prevalence Using the modified DPP risk analysis tool, 54.6% of the women in this sample were regarded as being at ‘high risk’ for the development of type 2 diabetes (Table 2). Age and overweight were the most common risk factors in this group of women. Only 19.2% of the sample had ‘age’ as their sole risk factor (with a DPP risk score of 1 or 3). Risk scores and frequencies are presented in Table 3. Of those interviewed, 38.6% were overweight and 25.6% obese, 32.5% were physically inactive, 16.9% had a family history of diabetes, and 6.5% had capillary blood glucose levels of 7.5 mmol/L or greater so were referred to their general practitioner for follow-up.

Table 1. Characteristics of 3377 postmenopausal New Zealand women

| Characteristics | Total sample | |
|--------------------------------|--------------|------|
| | n | % |
| Age band (years) | | |
| 49–54 | 701 | 20.8 |
| 55–59 | 974 | 28.8 |
| 60–64 | 862 | 25.5 |
| 65–69 | 840 | 24.9 |
| Education | | |
| Tertiary | 1328 | 39.3 |
| Non-tertiary | 1677 | 49.7 |
| Other/not known | 372 | 11.0 |
| Ethnicity | | |
| NZ European | 2796 | 82.8 |
| Maori | 72 | 2.1 |
| Pacific | 27 | 0.8 |
| Asian | 65 | 1.9 |
| Other European | 172 | 5.1 |
| Other* | 181 | 5.4 |
| Not known | 64 | 1.9 |
| NZDep scores | | |
| 1 to 4 | 2299 | 68.1 |
| 5 to 6 | 511 | 15.1 |
| 7 to 10 | 430 | 12.7 |
| No score available | 137 | 4.1 |
| Parity | | |
| >1 term pregnancy | 3015 | 89.3 |
| Body mass index (BMI) | | |
| BMI average kg/m ² | 27.4 | – |
| BMI 25–29.9 kg/m ² | 1304 | 38.6 |
| BMI 30+ kg/m ² | 863 | 25.6 |
| BMI Not known | 61 | 1.8 |
| Smoking status | | |
| Never smoked | 1998 | 59.2 |
| Past smoker | 1025 | 30.4 |
| Current smoker | 352 | 10.4 |
| Not known | 2 | 0.1 |
| Physically inactive | | |
| Exercise rarely or never | 148 | 4.4 |
| Exercise less than once a week | 104 | 3.1 |
| Exercise once a week | 178 | 5.3 |
| Exercise 2–3 times a week | 667 | 19.8 |

*Includes 1 African American and 4 Hispanic women.

Table 2. Diabetes risk factors and risk scores for 3377 postmenopausal New Zealand women

| Risk factor | Points allocated in DPP risk analysis | Total sample | |
|--|---------------------------------------|--------------|------|
| | | n | % |
| 45 to 64 years old | 1 | 2537 | 75.1 |
| 65 years or older | 3 | 840 | 24.9 |
| Under 65 years old and physically inactive | 3 | 828 | 24.5 |
| Overweight (BMI \geq 25) | 3 | 2167 | 64.2 |
| Random blood glucose >7.5 mmol/L* | 6 | 219 | 6.5 |
| Baby \geq 9 pounds at birth | 6 | 625 | 18.5 |
| Family history of diabetes [†] | 3 | 570 | 16.9 |
| Ethnicity [‡] | 3 | 104 | 3.1 |
| Diabetes Risk Score | | | |
| Low risk at present | 1 to 5 | 1534 | 45.4 |
| High risk at present | 6 or more | 1843 | 54.6 |

*Used as surrogate measure in place of the statement 'I have been told I have a high blood sugar level' used in the DPP risk analysis; [†]Parent(s), sister, or brother with diabetes; [‡]Includes Hispanic, African American, American Indian, Asian American, Pacific people, and Maori.

Table 3. Diabetes risk score frequencies calculated for 3377 postmenopausal New Zealand women

| DPP risk score | Frequency of score | % | DPP risk classification |
|----------------|--------------------|------|-------------------------|
| 1 | 439 | 13.0 | Low risk |
| 3 | 210 | 6.2 | |
| 4 | 885 | 26.2 | |
| 6 | 342 | 10.1 | High risk |
| 7 | 642 | 19.0 | |
| 9 | 120 | 3.6 | |
| 10 | 324 | 9.6 | |
| 12 | 117 | 3.5 | |
| 13 | 192 | 5.7 | |
| 15 | 34 | 1.0 | |
| 16 | 38 | 1.1 | |
| 18 | 15 | 0.4 | |
| 19 | 17 | 0.5 | |
| 21 | 2 | 0.1 | |

Discussion

Risk factors for type 2 diabetes are prevalent in this group of postmenopausal New Zealand women, with more than half of the participants at 'high risk' for developing type 2 diabetes when scored using the DPP risk analysis tool. There was a high proportion of modifiable risk factors for type 2 diabetes in this group, with nearly two-thirds of participants classed as 'overweight' or 'obese', and one-third as 'physically inactive'. There has been emphasis on the high rates of diabetes in Maori and Pacific people in New Zealand, but the current findings highlight the high prevalence of risks for diabetes in this large group of predominantly New Zealand European women.

Although participants in the present study were not drawn from a random sample, they represent approximately half of all 49–69 year old women enrolled at the participating practices. This study population has similar rates of physical inactivity, overweight and obesity to those reported in New Zealand population data,^{24,25} but a higher proportion of women have a tertiary education than the national average for this age group.²⁶

The percentage of women with diagnosed diabetes in this study was similar to national rates observed in 1996/97. The fact that up to half of all diabetes cases go undiagnosed means that women with undetected diabetes are likely to have been included in the risk analysis presented here. A limitation of the present study is the use of random capillary blood glucose tests as a surrogate measure of raised blood sugar. Finger-prick tests are often used in clinical practice as an opportunistic screening tool to detect raised blood sugars, but day-to-day variability in recordings means they are not used for differential diagnosis of diabetes in New Zealand.²⁷ The percentage of women with raised capillary blood sugars reported here might therefore be an over- or an underestimate of underlying abnormalities.

Diabetes itself is irreversible, but recent evidence has shown that lifestyle or behavioural risk factors predisposing an individual to diabetes are not.^{3,12,13} The challenge for health professionals now is not only to identify and effectively manage current diabetics, but also to identify those individuals at risk for developing disease, and providing appropriate advice regarding lifestyle modification. Targeting diabetes risk separately from cardiovascular disease is also important as a means of addressing the current alarming rise in diabetes and pre-diabetic syndromes.

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