THE NEW ZEALAND MEDICAL JOURNAL
Vol 119 No 1245 ISSN 1175 8716

Web-based assessment of cardiovascular disease risk in routine primary care practice in New Zealand: the first 18,000 patients (PREDICT CVD-1)

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Abstract

Aim To describe the cardiovascular disease (CVD) risk factor status of approximately 18,000 patients profiled in routine primary care practice by PREDICT-CVD, a web-based clinical decision support program for assessing and managing CVD risk.

Methods Between 2002 and 2005, 31,241 CVD risk assessments of 18,260 patients were undertaken in ProCare, a large primary care organisation in Auckland.

Results Baseline risk assessments were completed for 10,374 (57%) men and 7886 (43%) women. The mean age was 56 years (range 17 to 94 years), Of those assessed, 11% were of Pacific and 7% of Māori ethnicity. Risk assessment was more likely in men under the age of 65 years. In the over 65 year age group, women were more likely to be risk assessed. The overall prevalence of diabetes and smoking in this cohort was 14% and 13% respectively. A history of a previous CVD event increased with age in both men and women. Above the age of 75 years, 36% reported a previous cardiovascular event, most commonly ischaemic heart disease. The patients assessed represented 6% of men and 4% of women in the enrolled ProCare population over 35 years of age.

Conclusions General practitioners and practice nurses using PREDICT-CVD targeted patients according to national guideline age and gender recommendations. PREDICT-CVD is a practical and effective tool for systematically generating standardised patient CVD risk factor profiles during routine primary care practice. When implemented widely, PREDICT will enable primary care organisations to monitor the CVD risk burden and management in their practice populations using a nationally standardised evidence-based approach.

Cardiovascular disease (CVD) is the leading cause of hospital admissions and mortality in New Zealand.[1] For over 10 years, New Zealand cardiovascular guidelines have recommended that clinical management of CVD risk should be based primarily on patients' absolute CVD risk. This clinical risk is estimated using a Framingham Heart Study prediction equation that requires information on age, gender, blood pressure, total and HDL cholesterol, smoking, and diabetes status.[2]

Paper-based CVD risk assessment charts were widely distributed to general practitioners from the mid 1990s to help them estimate patients' clinical risks of CVD.[2,3] However a national survey of general practitioners undertaken in 1999 indicated that the charts were underutilised.[4] As part of a programme to increase risk assessment and management, a web-based clinical decision support system, PREDICT-CVD, was developed.

PREDICT-CVD systematically assesses an individual's absolute risk by using the Framingham risk equation using continuous data and automatically saving this in a standard structured way directly into the patient medical record. These features make it superior to the paper-based charts that provide the 'best-fit' using categorical cut-

offs, can be interpreted variably and require the extra step of documentation which maybe idiosyncratic, quantitative or narrative. This paper reports on over 18,000 baseline CVD risk assessments that were undertaken using PREDICT-CVD.

Methods

PREDICT-CVD—PREDICT-CVD was implemented as an opportunistic CVD risk assessment and management programme under the name of 'Prompt' in ProCare in August 2002.[6] ProCare is a large Auckland primary care organisation with approximately 485 general practitioners serving over 650,000 patients.

The PREDICT-CVD program was integrated with the most commonly used practice management software (MedTech). The integration allowed systematically coded CVD risk data to be automatically extracted from the electronic medical record and populate the PREDICT-CVD template. Where required data were not pre-populated, they were entered by the general practitioner or practice nurse. These risk profiles were then sent via secure Internet connection and within seconds the clinician received the patient's estimated 5 year CVD risk as well as evidence-based risk management recommendations based on national guidelines.

When PREDICT-CVD was used, an electronic CVD risk factor profile was stored anonymously for each patient. From these profiles, we identified a baseline record from the first recorded risk assessment for each patient.

Data and definitions—Data collection commenced in June 2002. The data extract for these analyses included all assessments until August 2005. Demographic data such as age (years), gender and ethnicity (if coded), and some CVD risk factor data were automatically transferred to the PREDICT input template.

Family history of CVD was defined as having a first-degree relative (parent or sibling) with premature ischaemic cardiovascular disease (defined as coronary heart disease or ischaemic stroke before the age of 55 years for men or before the age of 65 years for women). Diabetes was defined as type 1, type 2, or type unknown. History of CVD was defined as having a personal history of ischaemic heart disease (IHD), stroke or transient ischaemic attack (TIA), peripheral vascular disease (PVD), percutaneous transluminal coronary angioplasty (PTCA), and/or a coronary artery bypass graft (CABG).

Practitioners entered data for current cardiovascular risk factors; smoking (smoker, non-smoker, or past smoker who quit smoking more than 12 months ago), systolic and diastolic blood pressure (mmHg) and total cholesterol:HDL ratio. Additional data including height, weight, full lipid profile, and CVD-related medications were entered by practitioners only when they sought to use PREDICT's management advice which required completing a second data template. (Management data are not reported in this paper.)

For these analyses, ethnicity was categorised in five groups: New Zealand Māori, Pacific, Indian, other Asian and European, and other. Ethnic specific analyses will be reported in a separate paper.

To compare the PREDICT-CVD population with the Auckland population, gender and age distributions were obtained from the 2001 Census Auckland population from Statistics New Zealand. The ProCare population profile was also obtained as at July 2004/2005 for comparative purposes.

Data were analysed using SPSS 13.0 and SAS 9.1 statistical software. Means, prevalences, and standard deviations were calculated for the different risk factors.

The PREDICT project was approved by the Auckland Ethics Committee (AKY/03/12/314).

PREDICT software platform is owned by Enigma Publishing Ltd (PREDICT is a trademark of Enigma Publishing Ltd).

MedTech (patient management system) is a registered trademark of MedTech Global.

Results

Between 2002 and 2005, 31,241 CVD risk assessments were conducted. Each patient had a baseline assessment (18,260) and some had follow-up assessments. These analyses use the baseline assessments of which 92% were completed by 323 general

practitioners and 8% by 60 practice nurses. Of the general practitioners using PREDICT-CVD, 41% assessed fewer than 10 patients and 32% more than 50 patients.

Baseline assessments were conducted for 10,374 (57%) men and 7886 (43%) women. The mean age of the assessed population was 56 years (standard deviation: 12 years), ranging from 17 to 94 years. Six hundred (3%) of the patients assessed were aged under 35 years (401 men, 199 women) and 98 (1%) aged over 85 years (34 men, 64 women). Most patients were of European and other ethnicity (75%), with 7% Māori, 11% Pacific, 3% Indian, and 4% other Asian ethnicity.

Tables 1 and 2 describe the demographic characteristics and CVD risk factor prevalences for men and women by age group. As a proportion of those risk assessed by age group, men were more likely than women to be risk assessed under the age of 65 years, and women above the age of 65 years.

Overall the prevalence of diabetes was 14%. Diabetes prevalence was lowest in the youngest age categories and gradually increased with age to 23% in those aged over 75 years. History of a previous CVD event increased with age in both men and women. Above the age of 75 years, 36% reported a previous cardiovascular event, most commonly ischaemic heart disease.

The reporting of a family history of CVD was highest in the youngest age category. In men, the prevalence dropped from 31% reported in the youngest age category to 14% in the oldest age category. A similar range was observed in women, with a family history prevalence of 29% to 19% in the oldest age category.

The prevalence of smoking overall was 13%. In women under 35 years, 18% were current smokers, which decreased with age to 4% in those over 75 years. In men, the highest prevalence of smoking was 18% reported in the 35–44 age category, decreasing to 5% in those over 75 years. In both men and women, mean systolic blood pressure increased with age group from 128 mmHg to 140 mmHg in men and from 123 mmHg to 143 mmHg in women.

For men, mean total cholesterol:HDL ratio was 5.1 in those under 35 years and decreased with age, while in women under 35 years the mean ratio was 3.9 which remained fairly constant across the age categories.

Table 3 compares the age and gender distributions of PREDICT-CVD patients over 35 years with the ProCare and Auckland population. The age and gender distribution of the Auckland and ProCare populations are similar. The age distribution of the PREDICT-CVD population showed some differences compared to the age distribution of the Auckland and ProCare populations. Risk assessments were conducted predominantly in men and women aged 45–74 years. People under 45 and over 75 years were under-represented in the patients assessed.

Overall, 6% of all men and 4% of all women over 35 years in the ProCare populations were risk assessed, with greater proportions of middle-aged people than either younger or older people (Figure 1).

Table 1. Demographic characteristics and CVD risk factors in men (proportions and means with standard deviation)

Variables	Total n=10,374	<35 years n=401	35-<45 n=1911	45-<55 n=3213	55-<65 n=2869	65-<75 n=1512	75+ years n=468
Men – proportion of total (%)	57	67	70	61	52	50	43
Ethnicity							
European & other (%)	77	73	67	74	82	81	88
New Zealand Māori (%)	6	5	9	8	5	5	2
Pacific (%)	10	8	14	10	8	9	7
Indian (%)	3	9	6	4	2	2	1
Other Asian (%)	4	5	4	4	3	3	2
Medical history							
Diabetes mellitus (%)	14	8	7	11	16	20	24
CVD event (%)	12	2	3	7	13	27	41
IHD (%)	9	1	2	5	11	20	31
Stroke or TIA (%)	3	1	1	1	2	7	11
PVD (%)	2	-	< 0.5	1	1	4	7
PTCA/CABG (%)	4	1	1	2	5	8	10
Family history CVD (%)	25	31	30	29	22	16	14
Risk factor							
Smoking (%)	14	16	18	16	13	10	5
Mean(SD) systolic blood pressure (mmHg)	134 (18)	128 (16)	129 (16)	132 (17)	136 (18)	139 (18)	140 (21)
Mean (SD) diastolic blood pressure (mmHg)	82 (11)	82 (11)	83(11)	84 (11)	83 (10)	80 (10)	78 (10)
Mean (SD) total cholesterol:HDL ratio	4.5 (1.3)	5.1 (1.7)	4.9 (1.4)	4.6 (1.3)	4.3 (1.2)	4.1 (1.2)	3.9 (1.2)

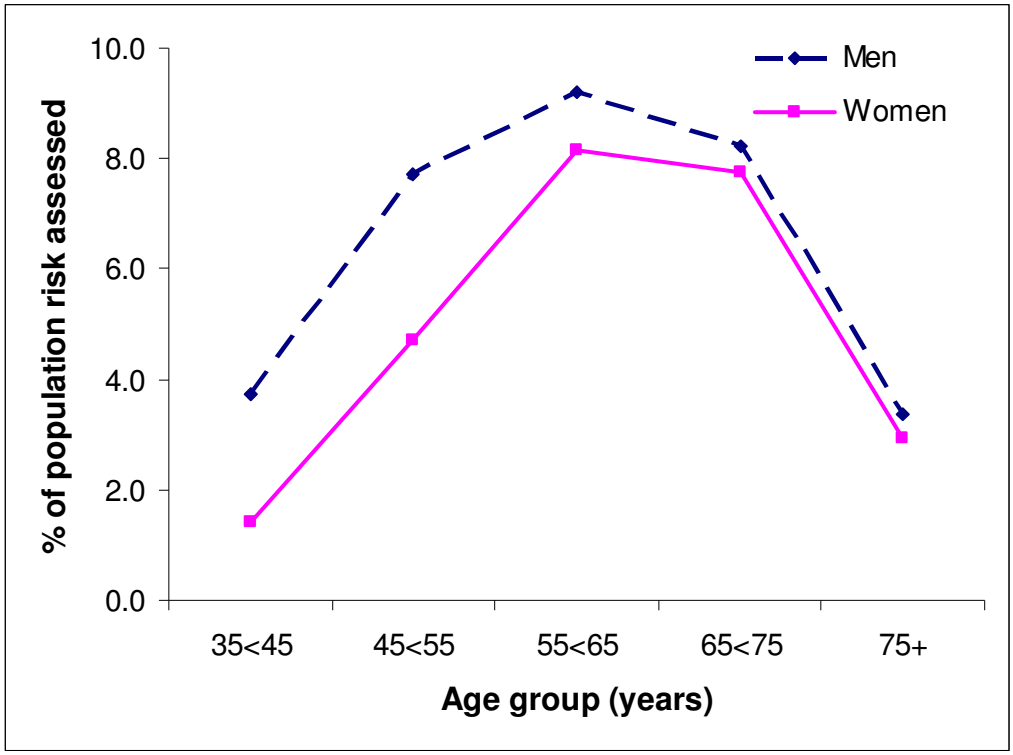
Table 2. Demographic characteristics and CVD risk factors in women (proportions and means with standard deviations)

Variables	Total n=7886	<35 years n=199	35-<45 n=808	45-<55 n=2080	55-<65 n=2642	65-<75 n=1530	75+ years n=627
Women – proportion of total (%)	43	33	30	39	48	50	57
Ethnicity							
European & other (%)	74	64	62	67	77	79	89
New Zealand Māori (%)	7	9	10	10	6	6	3
Pacific (%)	13	17	17	15	12	12	5
Indian (%)	2	5	4	3	2	1	1
Other Asian (%)	4	5	7	5	3	2	2
Medical history							
Diabetes mellitus (%)	15	14	14	14	15	17	22
CVD event (%)	10	2	3	4	8	17	32
IHD (%)	7	1	2	3	5	12	23
Stroke or TIA (%)	3	-	1	1	2	5	8
PVD (%)	2	1	<0.5	<0.5	2	3	5
PTCA/CABG (%)	2	1	1	1	2	2	3
Family history CVD (%)	28	29	29	31	29	25	19
Risk factor							
Smoking (%)	11	18	17	15	11	7	4
Mean(SD) systolic blood pressure (mmHg)	135 (19)	123 (17)	127 (17)	132 (18)	136 (19)	142 (20)	143 (21)
Mean(SD) diastolic blood pressure (mmHg)	81 (10)	78 (13)	81 (11)	82 (11)	81 (10)	81 (10)	79 (10)
Mean (SD) total cholesterol:HDL ratio	3.9 (1.2)	3.9 (1.5)	4.0 (1.3)	3.9 (1.2)	3.9 (1.2)	3.8 (1.1)	3.6 (1.1)

Table 3. Age and gender distribution of PREDICT-CVD patient population over 35 years compared with ProCare and Auckland population

Variable	PREDICT-CVD	ProCare	Auckland
Men	n=9973	n=156,272	n=258,852
35<45	19.2%	32.8 %	34.8%
45<55	32.2%	26.7%	27.8%
55<65	28.7%	19.9%	18.2%
65<75	15.2%	11.7%	11.5%
75+	4.7%	8.9%	7.7%
Women	n=7687	n=174,966	n=287,589
35<45	10.5%	32.9%	33.7%
45<55	27.1%	25.2%	26.3%
55<65	34.4%	18.5%	17.0%
65<75	19.9%	11.3%	11.4%
75+	8.1%	12.1%	11.6%

Figure 1. Percentage of ProCare population assessed, by age and gender



Discussion

This paper reports the initial clinical data generated from a large-scale pilot of a web-based CVD risk assessment and management programme designed for use in routine primary care. Over 18,000 patients were risk assessed, representing 6% and 4% respectively of all men and women over 35 years in the ProCare population. However only a sample of ProCare practices participated in PREDICT-CVD because MedTech patient management software was a requirement for this version of PREDICT.

The decision to risk assess was appropriately driven by age over 45 years and by the presence of risk factors such as diabetes, smoking and family history of CVD. This is consistent with the New Zealand CVD risk management guidelines recommendations that all men over 45 years and all women over 55 years should be risk assessed, but 10 years earlier if patients have known risk factors or are of Māori, Pacific, or Indian sub-continent ethnicity.

Few patients above the age of 75 years were risk assessed, despite their high CVD risk. Benefits from therapy accrue at any age and older people are more likely to benefit in absolute terms because of their higher cardiovascular risk. It is possible that many of these patients had already been risk assessed using other risk prediction tools and were being treated. Furthermore, many older patients have multiple comorbidities and it is important to take into account patient preferences and the balance of risk and benefits from treatment. All these factors may influence the decision to use PREDICT-CVD.

The prevalence of CVD risk factors in the New Zealand population has been described previously in several cross-sectional surveys.[8-10] However large cross-sectional studies are expensive and time-consuming, and the results can be highly influenced by response rates and selection bias.

Although the primary goal of PREDICT-CVD is assessing and managing CVD risk, if implemented nationally, it could also provide a continuously updated CVD risk profile of the middle-aged and older New Zealand population. Data generated by PREDICT-CVD could rapidly become more representative of the New Zealand population and provide locally and nationally relevant information on the burden and management of CVD risk. This is feasible because about 80% of the New Zealand population over 15 years visit their general practitioner annually.[7]

This study has demonstrated that PREDICT-CVD can be used to collect CVD risk factor data systematically in routine primary care practice. At present, the patients included are too highly selected to represent either the population of the primary care organisation (ProCare), or the population of Auckland. A new electronic decision support module, PREDICT CVD-Diabetes, has since been developed that includes individually-tailored management for both diabetes and CVD risk.

Some district health boards are planning to implement this updated programme. New Zealand will then have a comprehensive CVD and diabetes risk assessment and management system incorporating a high quality standardised data repository. Moreover, using a one-way encrypted National Health Index number, it will be possible to link individual risk factor profiles from PREDICT with national data on hospital admissions and deaths. These linked data will enable the generation of New Zealand-specific risk prediction equations that will eventually replace currently used equations derived from a North American population.

Conflict of interest statement: The authors state that no conflicts of interest exist.

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Acknowledgements: The authors are grateful to ProCare staff, affiliated GPs and practice nurses, and their patients.

PREDICT-CVD was developed by a collaboration of clinical epidemiologists at the University of Auckland; IT specialists at Enigma Publishing Ltd (a private provider of online health knowledge systems); and a group of clinicians and support staff from ProCare Health Ltd, Counties Manukau District Health Board, National Heart Foundation, New Zealand Guidelines Group, and the Ministry of Health.

This study was funded by the Health Research Council of New Zealand and Susan Wells is the recipient of a National Heart Foundation Research fellowship.

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