



## Performance of Framingham cardiovascular risk scores by ethnic groups in New Zealand: PREDICT CVD-10

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### Abstract

**Aim** To compare the calibration performance of the original Framingham Heart Study risk prediction score for cardiovascular disease and an adjusted version of the Framingham score used in current New Zealand cardiovascular risk management guidelines for high and low risk ethnic groups.

**Methods** Since 2002 cardiovascular risk assessments have been undertaken as part of routine clinical care in many New Zealand primary care practices using PREDICT, a web-based decision support programme for assessing and managing cardiovascular risk. Individual risk profiles from PREDICT were electronically and anonymously linked to national hospital admissions and death registrations in January 2008. Calibration performance was investigated by comparing the observed 5-year cardiovascular event rates (deaths and hospitalisations) with predicted rates from the Framingham and New Zealand adjusted Framingham scores. Calibration was examined in a combined 'high risk' ethnic group (Māori, Pacific and Indian) and a European 'low risk' ethnic group. There was insufficient person-time follow-up for separate analyses in each ethnic group. The analyses were restricted to PREDICT participants aged 30–74 years with no history of previous cardiovascular disease.

**Results** Of the 59,344 participants followed for a mean of 2.11 years (125,064 person years of follow-up), 1,374 first cardiovascular events occurred. Among the 35,240 European participants, 759 cardiovascular events occurred during follow-up, giving a mean observed 5-year cumulative incidence of 4.5%. There were 582 events among the 21,026 Māori, Pacific and Indian participants, corresponding to a mean 5-year cumulative incidence rate of 7.4%. For Europeans, the original Framingham score overestimated 5-year risk by 0.7–3.2% at risk levels below 15% and by about 5% at higher risk levels. In contrast, for Māori, Pacific, and Indian patients combined, the Framingham score underestimated 5-year cardiovascular risk by 1.1–2.2% in participants who scored below 15% 5-year predicted risk (the recommended threshold for drug treatment in New Zealand), and overestimated by 2.4–4.1% the risk in those who scored above the 15% threshold. For both high risk and low risk ethnic groups, the New Zealand adjusted score systematically overestimated the observed 5-year event rate ranging from 0.6–5.3% at predicted risk levels below 15% to 5.4–9.3% at higher risk levels.

**Conclusion** The original Framingham Heart Study risk prediction score overestimates risk for the New Zealand European population but underestimates risk for the combined high risk ethnic populations. However the adjusted Framingham score used in New Zealand clinical guidelines overcompensates for this underestimate, resulting

in a score that overestimates risk among the European, Māori, Pacific and Indian ethnic populations at all predicted risk levels. When sufficient person years of follow-up are available in the PREDICT cohort, new cardiovascular risk prediction scores should be developed for each of the ethnic groups to allow for more accurate risk prediction and targeting of treatment.

There are major disparities in cardiovascular disease between ethnic groups in New Zealand and well-targeted risk factor management using accurate cardiovascular risk prediction tools have the potential to ameliorate these inequalities. Age-specific death rates are two to three times higher for Māori compared with non-Māori in those aged less than 75 years.<sup>1</sup> Cardiovascular disease prevention and management and the reduction of health inequalities have been identified as priorities in the New Zealand Health Strategy,<sup>2</sup> He Korowai Oranga (Māori Health Strategy)<sup>3</sup> and the Primary Health Care Strategy.<sup>4</sup>

New Zealand guidelines for cardiovascular disease risk management use risk prediction tools derived by Anderson et al,<sup>5</sup> from the Framingham Heart Study, based on data collected over 30 years ago on about 5,000 mainly white middle-class North Americans. Increasingly questions are being raised about Framingham's accuracy in the 21<sup>st</sup> century and there are particular concerns about its validity for Māori, Pacific and South Asian people; socioeconomically deprived, older people; people with diabetes; and, those with cardiovascular disease or who are already on treatment.

While a previous study had suggested that the Framingham scores were reasonably valid for New Zealand Europeans,<sup>6</sup> the scores were modified by the New Zealand Guidelines Group to compensate for the influence of other potential risk factors. The adjustments included a once only upward adjustment of 5% in 5-year risk for: people of Māori; Pacific or Indian subcontinent (also known as South Asian) ethnicity groups, people with a family history of premature coronary heart disease or ischaemic stroke; patients with diabetes plus microalbuminuria; type 2 diabetes for at least 10 years or type 2 diabetics who have an HbA1c consistently at 8% or over; or, people with the metabolic syndrome.

An additional adjustment was applied to patients whose predicted cardiovascular risk was mild or moderate (i.e. less than 15% 5-year risk) but were known to have isolated high blood pressure (greater than or equal to 170/100 mmHg) or high cholesterol (total cholesterol or TC:HDL ratio greater than or equal to 8); these people were categorised as being at 15% 5-year risk—New Zealand's recommended threshold for drug treatment eligibility<sup>7</sup>.

PREDICT, a web-based clinical decision support programme, provides cardiovascular risk assessment and management advice for practitioners and patients in both primary and secondary care settings. Since 2002, PREDICT has been implemented mainly in primary health organisations (PHOs) and mostly in the Auckland and Northland regions. It has now been used in routine clinical practice over 100,000 times. With PHO permission, PREDICT has been simultaneously generating a large anonymised patient cohort with systematic and uniformly collected cardiovascular risk profile data<sup>8</sup> that is able to be linked to national hospital discharge data and death registrations.

The aim of the current analyses was to examine the performance of risk prediction using the Framingham scores (original and adjusted) for different ethnic groups in this community-based New Zealand cohort.

## Methods

**PREDICT** is a web-based real-time decision support programme that has been integrated with most of the commonly used practice management systems (PMS) software in New Zealand primary care. The programme is delivered as a window within the patient medical record in the same manner as other templates within the PMS. The integration allows coded cardiovascular risk data to be automatically extracted from a patient's electronic medical record and imported to the PREDICT web template.

To calculate a predicted 5-year cardiovascular risk, a completed risk profile is sent via a secure internet connection to a central server. Within seconds the decision support engine returns the patient's New Zealand adjusted Framingham 5-year cardiovascular risk score as well as evidence-based risk management recommendations derived from the cardiovascular risk management guidelines.

Whenever PREDICT is used, an electronic risk profile is stored anonymously for each patient. With the permission of health providers, this profile is linked to an encrypted National Health Index number (eNHI) and made available to the University of Auckland.

Approximately twice a year the New Zealand Health Information Directorate (NZHID) access the NHI and the eNHI from the PREDICT server via a highly secure password protected website. NZHID identify all hospital discharges and deaths among PREDICT participants from the National Minimum Dataset and send these data with the eNHI to the University of Auckland. We then link the exposure and outcome data by matching the anonymised eNHI numbers.

**Data and definitions**—The data extracts for these analyses included all PREDICT first assessments from August 2002 until December 2008 from nine consenting PHOs that collectively provide primary care services to 96% of the Northland region (population approximately 150,000) and 58% of the greater Auckland region (population 1.34 million).

**Ethnicity coding**—Due to limited person-time follow-up in each of the high risk ethnic populations in New Zealand (i.e., Māori, Pacific and Indian peoples), ethnicity was categorised into: a combined high risk ethnic group including anyone who identified as being of Māori, Pacific or Indian ethnicity; a low risk European group; and, Other.

Māori were defined according to the Ethnicity Data Protocols for the Health and Disability Sector<sup>9</sup> as having Level 2 code 21; Pacific peoples as codes 31 to 37 and Indian as code 43 (i.e., Indian and Fijian Indian). European included Level 2 codes 10, 11 and 12. As Level 2 codes do not permit the separation of other high risk South Asian ethnic groups (e.g., Pakistani, Sri Lankan, Bangladeshi) from lower risk East Asian ethnicities (e.g., Korean, Japanese), these groups were combined with all Other Level 2 codes and included in the 'Other' group.

Detailed data definitions have been published previously<sup>8</sup>. In the original Framingham Heart Study<sup>5</sup> cardiovascular disease was defined as the composite endpoint of coronary heart disease (including angina pectoris, stroke or transient ischaemic attack, intermittent claudication, congestive heart failure, or death due to these reasons). In this study, a history of cardiovascular disease was defined as a personal history of ischaemic heart disease, stroke or transient ischaemic attack, peripheral vascular disease, percutaneous coronary intervention and/or coronary artery bypass graft.

Cardiovascular risk factors used in the risk scores included: age, sex, diagnosis of diabetes, smoking status (smoker, non-smoker, or past smoker who quit more than 12 months ago), systolic blood pressure (mmHg) and total cholesterol:HDL ratio. Valid ranges for the physiological parameters were determined *a priori* according to population-based data from New Zealand epidemiological surveys and Diagnostic MedLab, New Zealand's largest community based pathology laboratory. Records that contained values outside of the valid ranges (less than 1%) were removed for the analyses.

**Cardiovascular risk assessment**—From the participant risk profiles, we identified and excluded those participants who had a previous cardiovascular event, diabetes plus nephropathy or a diagnosed genetic lipid disorder (15,058 individuals, 20.2% of PREDICT cohort). For all others, we calculated their baseline 5-year cardiovascular risk using the Framingham score. We then calculated the New Zealand adjusted 5-year cardiovascular risk score according to the New Zealand Guideline Group adjustment and classification criteria<sup>7</sup> as previously noted.

Data on some of the risk adjustment factors (related to metabolic syndrome and diabetes) were not available for 57% of the cohort. This is because the first version of PREDICT was developed prior to the publication of the 2003 guidelines<sup>7</sup> and this earlier PREDICT module was used up to 2006. Patients were categorised by 5-year predicted risk of a cardiovascular event: <5%, 5-<10%, 10-<15%, 15-<20%, ≥20%, using both the original Framingham score and the New Zealand adjusted Framingham score.

**Outcome assessment**—Outcome data were extracted from the NZHID databases of deaths and public hospital discharges for all patients with a baseline PREDICT risk assessment. First cardiovascular events that occurred after the baseline PREDICT assessments were used in these analyses. The primary outcomes included ICD-coded cardiovascular hospital discharges and deaths listed in Table 1.

**Table 1. Number of first ischaemic cardiovascular events in 30–74 year old participants with no history of cardiovascular disease, August 2002–December 2008**

Outcomes	ICD-10-AM codes	Number of first events (N)*
Coronary heart disease  Cardiac arrest or sudden cardiac death	I20–I25 (except I252) Acute coronary syndromes, chronic ischemic heart diseases E1053, E1153, E1453 Coronary heart disease I461 Sudden cardiac death, so described R96 Other sudden death, cause unknown R98 Unattended death 3530400–3530501 Coronary angioplasty or stent 3531000–531005 Percutaneous coronary intervention	770
Coronary procedures	3849700–3850304, 9020100–9020103 Coronary artery bypass 3863700 Re-operation for reconstruction of occluded coronary artery 3845619 Other intrathoracic procedures on arteries of heart without cardiopulmonary bypass 3865308 Other intrathoracic procedures on arteries of heart with cardiopulmonary bypass 3850500 Open coronary endarterectomy I63 Cerebral infarction I64 Stroke, not specified as haemorrhage or infarction I66 Occlusion and stenosis of cerebral arteries, not resulting in cerebral infarction I678 Other specified cerebrovascular diseases I693 Sequelae of cerebral infarction I694 Sequelae of stroke, not specified as haemorrhage or infarction I698 Sequelae of other and unspecified cerebrovascular diseases	301
Ischaemic cerebrovascular disease	G45 (except G453), G46 Transient ischaemic attack I670 Dissection of cerebral arteries, nonruptured I671 Cerebral aneurysm, nonruptured	1098
Peripheral arterial disease	I65 Occlusion and stenosis of precerebral arteries I71 Aortic aneurysm and dissection (other arterial dissection) I72 Other aneurysm I74 Arterial embolism and thrombosis	120

	1739 Peripheral vascular disease, unspecified 17021, 17022, 17023, 17024 Intermittent claudification, gangrene, or diabetic peripheral angiopathy with or without gangrene	
Peripheral procedures	330–331 Repair aneurysm 3270000–3276318 Artrial bypass graft 3350000–3355400 Endarterectomy and patch graft artery 3380000–3380612 Embolectomy/thrombectomy 3531200–3531501 Arterial atherectomy 3855000–3857101, 3857200, 3870600, 3870601, 3871200 (Repair/replacement of aorta) 9023000 Embolectomy or thrombectomy of other artery 9022900 Other endarterectomy	38
<b>Total</b>		<b>2327</b>

\*One person may have multiple ICD codes for a first cardiovascular event.

Cardiovascular hospitalisations included both primary and secondary cardiovascular discharge diagnoses. Mortality data from 2002–2005 were available and accepted if the underlying coded cause of death included any of the Table 1 outcomes as the primary cause. More recent deaths (2006–2008) were not formally ICD-coded by NZHIS but available in text form. These events were identified and coded by two of the authors (SW and TR) following the development of systematic coding rules and discussion with experienced coders.

**Analyses**—All analyses were conducted using SAS Version 9.1. Calibration was examined by plotting the observed 5-year cumulative incidence by ethnicity against the Framingham and New Zealand adjusted cardiovascular 5-year risk score categories. The annual incidence was estimated, within ethnic groups and categorisations of the risk scores, by dividing the number of cases by accumulated person-time. To derive an observed 5-year cumulative incidence, the well-known incidence  $I$  to cumulative incidence  $C$  formula  $C = 1 - e^{-I \times T}$  was used with  $T = 5$ –years. The formula assumes a constant annual incidence rate over the 5-year period. Since the incidence rate is low, the above formula gives a 5-year cumulative incidence that is very close to five times the annual incidence rate.

**Ethical approval**—The cohort study and research process were approved by Northern Region Ethics Committee Y in 2003 (AKY/03/12/314) with subsequent application and approval by the national Multi Region Ethics Committee in 2007 (MEC/07/19/EXP).

## Results

The PREDICT dataset included a total of 59,344 people, aged 30–74 years without prior cardiovascular disease or cardiovascular risk equivalent diagnoses, followed for a mean of 2.11 years per person providing 125,064 person years of follow-up. Of the 1374 first major cardiovascular events, 13.2% were deaths and the remainder were hospitalisations. There were 1,341 cardiovascular events identified during follow-up of the 56,266 European, Māori, Pacific and Indian participants who comprised 59.4%, 14.3%, 17.0% and 4.1% of the total cohort respectively (Table 2).

Cardiovascular event rates were higher for men than women and rose with age. Among the 35,240 European participants, 759 cardiovascular events were identified giving a mean observed 5-year cardiovascular risk of 5.3% for men and 3.5% for women. There were 582 cardiovascular events identified during follow-up of the 21,026 combined Māori, Pacific and Indian participants giving mean 5-year event rates of 7.7% in men and 7.0% in women. When analysed separately, Māori had the highest observed 5-year cumulative incidence (8.3%) of all the ethnic groups for both men and women followed by Pacific (7.1%).

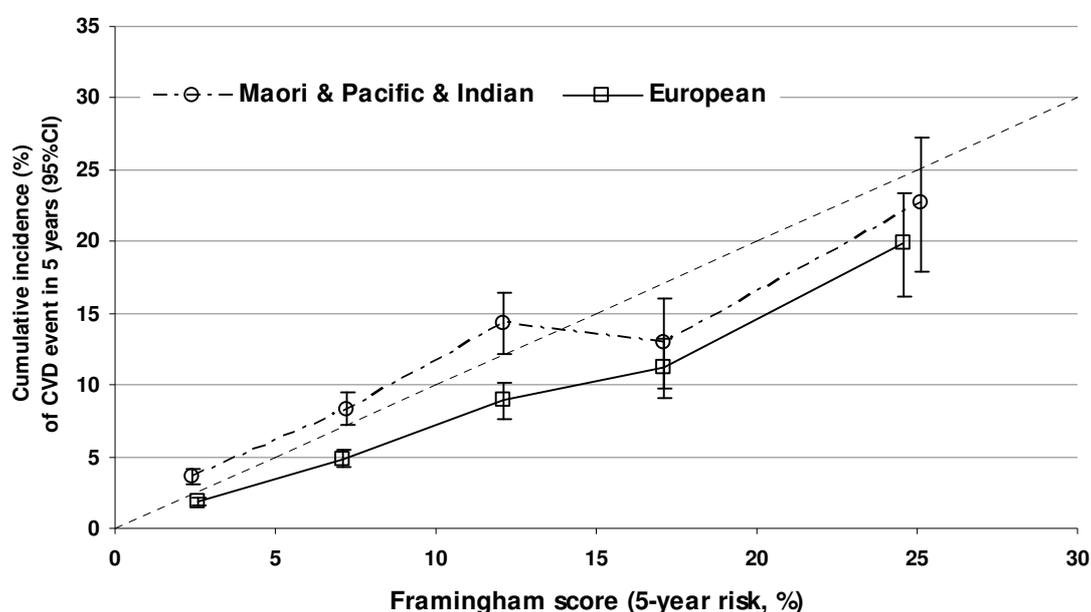
**Table 2. Number of cardiovascular events, cumulative incidence rates and mean predicted risk scores of the 30–74 year old participants without prior cardiovascular diseases stratified by age, sex and ethnicity (low and high risk ethnic groups), August 2002–December 2008**

Variables	Participants(n)	Events (n)	Total person years follow-up (years)	Observed 5-year cumulative incidence (%)	95% Confidence Interval	Mean predicted Framingham 5-year risk (%)	95% Confidence Interval	Mean New Zealand adjusted Framingham 5-year risk (%)	95% Confidence Interval
<b>All</b>	59344	1374	125064	5.3	(5.1–5.6)	6.3	(6.2–6.3)	9.4	(9.4–9.5)
<b>Sex</b>									
Women	26412	519	54990	4.6	(4.2–5.0)	5.1	(5.0–5.1)	8.4	(8.4–8.5)
Men	32932	855	70074	5.9	(5.5–6.3)	7.2	(7.1–7.2)	10.3	(10.2–10.3)
<b>Age group</b>									
30–44 years	10600	87	24229	1.8	(1.4–2.1)	2.3	(2.3–2.4)	6.6	(6.5–6.6)
45–54 years	19460	294	41620	3.5	(3.1–3.9)	4.7	(4.6–4.7)	8.2	(8.1–8.2)
55–64 years	19104	529	39599	6.5	(5.9–7.0)	7.5	(7.5–7.6)	10.3	(10.2–10.3)
65–74 years	10180	464	19616	11.2	(10.2–12.1)	11.0	(10.9–11.1)	13.3	(13.2–13.5)
<b>Ethnic group</b>									
Low risk (European)	35240	759	81776	4.5	(4.2–4.8)	6.3	(6.3–6.4)	8.4	(8.3–8.4)
High risk combined (Māori, Pacific, Indian)	21026	582	37980	7.4	(6.8–7.9)	6.2	(6.1–6.3)	11.6	(11.5–11.7)

The number of events occurring in Indian people was small and there was substantial imprecision around cumulative incidence estimates. Calibration for each of the individual high risk ethnic groups is not presented in this paper due to insufficient person-time follow-up.

Figures 1 and 2 show the relationship between observed and predicted event rates for European compared to the combined Māori, Pacific and Indian participants using both the Framingham score (Figure 1) and New Zealand adjusted Framingham score (Figure 2). For Europeans, the observed risks were more closely aligned to the risks predicted by the Framingham score compared to the adjusted score.

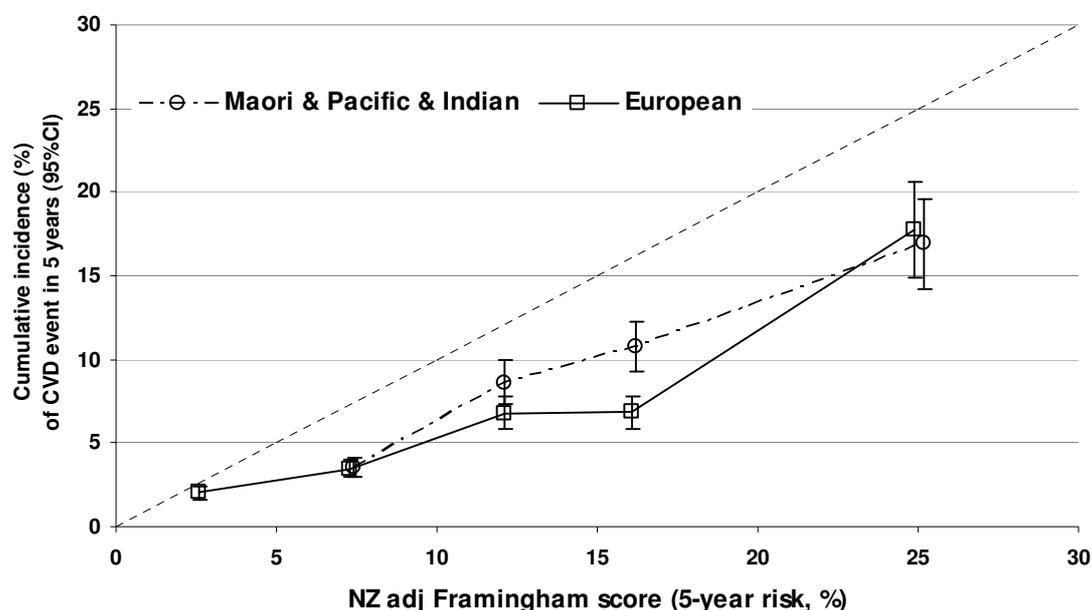
**Figure 1. Calibration (relationship between observed and predicted events) of the Framingham scores for European and Māori, Pacific and Indian ethnic groups**



In this low risk ethnic group, the Framingham score overestimated 5-year cardiovascular risk by 0.7–3.2% at risk levels below 15% and about 5–6% at higher risk levels; whereas, the New Zealand adjusted score overestimated their risk by 0.6–5.3% at lower risk levels and by about 7–9% at risk levels above 15%. In contrast, in the combined high risk group of Māori, Pacific and Indian patients, the Framingham score underestimated observed risk by 1.1–2.2% in people classified below the 15% 5-year predicted risk.

At risk levels above 15%, the Framingham score overestimated risk by 2.4–4.1% in these peoples. The New Zealand adjusted scores for Māori, Pacific and Indian patients reversed the cardiovascular risk underestimation resulting in their predicted 5-year risk being overestimated to about the same degree as that for Europeans.

**Figure 2. Calibration (relationship between observed and predicted events) of the New Zealand adjusted Framingham scores for European and Māori, Pacific and Indian ethnic groups**



## Discussion

Our findings, based on a large community cohort using a comprehensive and systematically collected dataset, have demonstrated that the original Framingham score overestimates risk for New Zealand's European population but underestimates risk for the ethnic populations collectively considered to be at higher risk of cardiovascular disease, that is, Māori, Pacific and Indian peoples.

Adjustments made to the Framingham risk score by the New Zealand Guideline Group cardiovascular team have successfully addressed the underestimation of risk for these 'high risk' ethnic groups. However it appears that the adjustment was too great, with the New Zealand modified Framingham score now over-estimating risk in both Europeans and the combined high risk ethnic group population.

The 5-year cumulative incidence of cardiovascular events was significantly higher for Māori and Pacific peoples compared to Europeans. This difference would be even greater if adjusted for age, as the high risk ethnic group populations have younger age profiles than the European population. Therefore our findings support the national guidelines recommendations to risk assess patients of Māori and Pacific ethnicity 10 years earlier than Europeans.

This study is the first of its kind in New Zealand to generate cardiovascular risk profiles and prediction scores within routine primary care practice on a large scale and link these risk profiles to cardiovascular outcomes through electronic linkage to national health databases using encrypted NHI numbers. The much larger QRISK

project in the United Kingdom has linked risk factors and cardiovascular outcomes by extracting data from primary care databases.

The PREDICT programme has enabled us to compare the performance of the original Framingham score with the New Zealand adjusted score in the primary care setting where risk prediction tools are used most often and where most treatment decisions should be made on the basis of risk assessment.

The entire cohort comprised approximately 14% of eligible people enrolled in the Primary Health Organisations using PREDICT between 2002 and 2006 in the Auckland and Northland regions. While this is not a representative sample of a resident population, the spectrum of disease and pattern of observed risk levels is similar to New Zealand population estimates in 2005<sup>10</sup>. Furthermore, a valid risk prediction equation is not dependent on having a representative sample population but requires a participant population with sufficient heterogeneity of risk profiles.

Misclassification of ethnicity is an important concern for a study of this kind. A recent validation study based on the PREDICT dataset found that ethnicity in the primary care record agreed with self-identified ethnicity in only two thirds of the sample participants<sup>11</sup>. Fortunately the clinical impact of this misclassification on cardiovascular risk assessment and management was modest because about half of the misclassification occurred between ethnic groups classified in the same high risk category.

Another limitation comes from ethnicity coding protocols that aggregate East Asian (Japanese and Korean) and several South Asian ethnic groups (e.g., Pakistani, Sri Lankan, and Bangladeshi) into one Level 2 code. Both general practice PMS systems and the NMDS routinely capture Level 2 ethnicity codes. Unless the protocol is amended, cardiovascular risk prediction research will only include a proportion of high risk South Asian peoples.

Other limitations include the lack of some data on the newer cardiovascular risk assessment variables (metabolic syndrome and additional diabetic factors) that were only introduced into PREDICT after the 2003 cardiovascular risk guidelines were published. Had these data been included overestimation of risk at the higher end of the risk distribution would likely have occurred. Other limitations include short follow-up time requiring extrapolation to 5-year event rates and imprecision of risk estimates in some ethnic groups due to small amounts of data.

Unlike the Framingham Heart Study, which prospectively collected data based on biannual visits that included echocardiography, a weakness of the PREDICT cohort study is that outcomes are based on admissions to public hospitals and deaths meaning some incident cardiovascular events may be missed. For example events that are treated in private hospitals (e.g., for stenting or bypass procedures) are not included in the NHI-linked national hospitalisation datasets. Also undiagnosed events in the community and other events that do not result in admission to public hospitals may be missed.

Examples include silent myocardial infarction, new stable angina, mild congestive heart failure, TIA or stroke especially in the very old who may be admitted to private geriatric hospitals. Had these events been 'captured' by the PREDICT cohort study it is likely that Framingham may have overestimated events in Europeans to a smaller

degree than that observed, whereas for the combined Maori, Pacific and Indian group the observed underestimation of events by Framingham may have been even greater.

In addition, we included the first 4 years of events. This would be expected to result in a small overestimate of risk in our cohort as we observed a modest increase in cardiovascular events in the first year after risk assessment (data not shown). Therefore these preliminary findings must be interpreted with caution.

The calibration of cardiovascular risk scores is primarily determined by the background cardiovascular risk of a population to which the risk prediction score is applied<sup>12-14</sup> and secondarily to the risk factor profile of the population<sup>15, 16</sup>. In the United Kingdom, Brindle et al<sup>17</sup> found that the 10-year risk of coronary heart disease and cardiovascular disease was highest for men of Pakistani and Bangladeshi origin and lowest for Chinese women.

Cappuccio et al<sup>18</sup> compared predicted cardiovascular risk in white, African and South Asian ethnic groups concluding that risk is underestimated in people of South Asian and African origin. Another study found that adding 10 years to age was the simplest way of adjusting for an assumed 79% greater risk among South Asians<sup>19</sup>. A novel web-based ETHRISK<sup>20</sup> calculator that uses cross-sectional data for ethnic minority populations in the United Kingdom has been developed but requires validation against prospective data.

Other large local or regional combined cohorts such as SCORE<sup>21</sup> (Systematic Coronary Risk Evaluation), ASSIGN<sup>22</sup> (ASessing cardiovascular risk using SIGN guidelines) and QRISK<sup>23</sup> have shown that it is possible to improve on Framingham prediction scores for the general population but most lack sufficient data on high risk non-European ethnic populations.

Over or underestimation of an individual's true cardiovascular risk and poor sensitivity of a score to identify and target patients for treatment have important implications for clinical practice and the ability of practitioners to deliver equitable care. The systematic underestimation of the risk among Māori, Pacific and Indian peoples and overestimation of the risk among European people will increase cardiovascular health inequalities, adversely affect equitable access to healthcare resources, and undermine clinical guidelines and national policies that seek to reduce ethnic health disparities.

We have shown that a simple adjustment for ethnicity addressed the underestimation of risk that occurred when the Framingham risk score was applied to Māori, Pacific and Indian people in New Zealand. However the adjustment was relatively crude and the New Zealand adjusted score appears to overestimate cardiovascular risk in these ethnic groups when considered as a combined category.

More evaluation is required to test the validity of our preliminary estimates and to investigate the question of heterogeneity in risk between each ethnic group - particularly for Māori as the indigenous people and Treaty partner in New Zealand. Analyses of specific ethnic groups will require additional person-time follow-up. Fortunately the PREDICT cohort is growing rapidly with several thousand new participants added per month. The more detailed analyses that will follow are expected to contribute the necessary context, and population-specific evidence, to New Zealand guidelines to improve clinical care in the future.

Finally, this study highlights large inequities in cardiovascular event rates between ethnic groups in New Zealand stressing the need for those in primary care to systematically prioritise cardiovascular risk assessment screening to Māori, Pacific and Indian peoples. The availability of more accurate cardiovascular risk prediction scores that account for differences in risk between groups will enable better targeting of intensive preventive care and management, and help reduce the unacceptable inequities in cardiovascular disease and its risk factors.

**Competing interests:** None known.

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