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## Ethnic and gender differences in the use of coronary artery revascularisation procedures in New Zealand

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### Abstract

**Aims.** To examine ethnic and gender variations in the use of coronary artery revascularisation procedures in New Zealand and to determine whether the introduction of priority scores affected intervention trends.

**Methods.** Analysis of the National Minimum Database for coronary artery bypass graft (CABG) and percutaneous transluminal coronary angioplasty (PTCA) intervention rates for New Zealand Pacific, Maori and other men and women aged 40 years and over during the decade 1990-1999.

**Results.** Coronary artery revascularisation rates were lower in women than in men in all ethnic groups and in Pacific and Maori men compared with other New Zealand men. Compared to all men, the mean age-standardised CABG and PTCA intervention rate ratios in all women were 0.34

and 0.36. Compared to other New Zealand men, the mean age-standardised CABG and PTCA intervention rate ratios were 0.64 and 0.25 in Pacific and 0.40 and 0.29 in Maori men respectively. Compared to other New Zealand women, the rate ratios for CABG and PTCA were 0.73 and 0.21 in Pacific and 0.74 and 0.43 in Maori women respectively. Introducing priority scores was neither associated with reduced cardiac procedures nor significantly reduced variation in procedures across all ethnic groups.

**Conclusions.** Although Pacific and Maori peoples had higher rates of coronary artery disease morbidity and mortality, revascularisation rates were lower in both groups. Strategies beyond the use of priority scores are needed to address ethnic and gender disparities in coronary artery revascularisation procedures in New Zealand.

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Coronary artery disease is the leading cause of morbidity and mortality in New Zealand adults. It contributes to about 40% of all deaths and 11% of all hospitalisations each year.<sup>1</sup> Hospital admissions for congestive heart failure alone are estimated to cost at least \$50 million or 1% of the total health annual budget.<sup>2</sup> Coronary artery bypass grafting (CABG) and percutaneous transluminal coronary angioplasty (PTCA) are well-established methods of myocardial revascularisation which, when applied to suitable individuals can significantly reduce morbidity and mortality associated with coronary artery disease.<sup>3,4</sup> The recent increase in use of coronary artery stents has improved the safety and success rate of these procedures and increased the range of people who can benefit from cardiovascular interventions.<sup>5,6</sup>

Mortality from coronary artery disease in New Zealand declined by 3-9% each year during the 1990s. This decline, however, was slower than in other developed countries during the same time period.<sup>1</sup> About half the coronary artery disease mortality rate decline in New Zealand has been attributed to medical therapies and half to reductions in major risk factors.<sup>7</sup>

Risk factors for heart disease are more prevalent among Pacific and Maori peoples compared with other New Zealanders.<sup>8</sup> The Auckland Coronary Artery and Stroke (ARCOS) Study found that morbidity rates from coronary artery disease were similar in all ethnic groups<sup>9</sup> but other studies have shown that hospitalisation rates were higher among Pacific and Maori peoples compared with other New

Zealanders.<sup>10,11</sup> Pacific and Maori peoples have higher mortality rates from coronary artery disease and the rate of decline in mortality rates has been slower compared with other New Zealanders.<sup>9</sup> Despite the higher burden of illness from coronary artery diseases, Pacific and Maori peoples are lower users of preventive and primary health care services. Per capita consultation rates with general practitioners and uptake of preventive services are lower among Pacific and Maori peoples compared with other New Zealanders.<sup>12,13</sup>

In 1996, in order to ensure consistency and transparency in prioritising patients for surgery, the New Zealand government introduced numerical scores based on the individual's biological and social risk factors for coronary artery disease.<sup>14</sup> To date, observational studies examining utilisation rates of coronary artery revascularisation procedures in New Zealand have not included data on patient ethnicity.<sup>15,16</sup> This study examines ethnic and gender patterns in coronary artery revascularisation procedures and investigates whether introducing priority scores affected intervention rates. The findings may assist policy development, service planning, quality assessment and monitoring activities designed to reduce disparities in the use of health care services between Pacific, Maori and other New Zealanders.

## Methods

The New Zealand Health Information Service (NZHIS) National Minimum Database (NMDS) contains information on all public and private hospitalisations in the country coded according to the International Classification of Disease Version 9 (ICD9). We obtained data from the NMDS for all coronary artery bypass graft (ICD 361) and percutaneous transluminal coronary angioplasty (ICD 360) events reported from 1990 to 1999. All people who received one or more CABG procedures during the study period were counted once. Similarly, all people who received one or more PTCA procedures were counted once. People who received both a CABG and a PTCA procedure were counted once for each procedure.

We calculated procedure rates using the 'usually resident' annual population estimates aged 40 years and over provided by Statistics New Zealand for Maori and the total New Zealand population. Information on the Pacific population was available for 1991 and 1996. Estimates of the Pacific population for the intervening years were calculated from the census data assuming linear population growth. Assuming linear population growth is subject to error because the Pacific population is among the fastest growing groups in the country. Error is likely to underestimate actual Pacific population growth and reduce intervention rate even further.

We obtained mortality rates from the ARCOS study in Pacific, Maori and other New Zealanders aged 35-64 years for 1990-1992<sup>9</sup> and calculated coronary artery revascularisation rates for people aged 40 years and over for the period 1990-1999. Comparing intervention rates in the later part of the 1990s with mortality data from the early part of the decade in different age groups is subject to error associated with different rates of decline in mortality across ethnic groups.

Ethnicity for both numerator and denominator data was self-defined. Patients who nominated more than one ethnic category including Maori, were included in the Maori group for analysis. Patients who self-identified themselves as both Pacific and other non-Maori ethnicity were included in the Pacific peoples group. Rates were calculated for each ethnic group by summing the number of people with each procedure on an annual basis in the ten-year period and dividing by the population of adults 40 years and over for each ethnic group during the same period. As ethnic differences in event rates may result from differences in the age distribution of the population, rates were standardised using Segi's World population. To examine the impact of priority scores on coronary artery revascularisation rates, we compared CABG and PTCA growth rates between 1990 and 1995 with those for 1995 and 1999 for each ethnic group. Because these rates are derived from the entire population and not a sample, we did not perform statistical tests of comparison.

## Results

During the decade 1990-1999, 10 413 CABG procedures were performed on men and 3500 in women in New Zealand. Of these, 155 were performed on Pacific men, 56 in Pacific women, 321 in Maori men and 166 in Maori

women. During the same period, 9419 PTCA procedures were performed on men and 4248 in women. Of these, 70 were in Pacific men, 23 in Pacific women, 232 in Maori men and 120 in Maori women.

CABG intervention rates per 100 000 population were 32.9 in Pacific men, 20.5 in Maori men and 51.2 in other New Zealand men. CABG intervention rates were 10.6 in Pacific women, 10.7 in Maori women and 14.5 in other New Zealand women. PTCA intervention rates were 12.1 in Pacific men, 13.9 in Maori men and 48.1 in other New Zealand men. PTCA intervention rates were 3.4 in Pacific women, 7.2 in Maori women and 16.6 in other New Zealand women.

Figure 1 shows age-standardised coronary artery disease mortality rates between 1990 and 1992, CABG and PTCA intervention rates between 1990 and 1999 for New Zealand men by ethnic group and Figure 2 shows the same information for women. Mortality rates were lowest in other New Zealand men and women and highest in Maori men and women. Mortality rates, CABG and PTCA intervention rates were lower in women than in men across all ethnic groups. CABG rates were lower in Pacific and Maori men compared with other New Zealand men (rate ratios were 0.64 and 0.40 respectively) and in Pacific and Maori women compared with other women (rate ratios 0.73 and 0.74 respectively). PTCA rate ratios were 0.25 in Pacific and 0.29 in Maori men compared with other men and 0.21 in Pacific and 0.43 in Maori women compared with other New Zealand women. Ethnic differences in PTCA intervention rates were more marked than ethnic differences in CABG intervention rates.

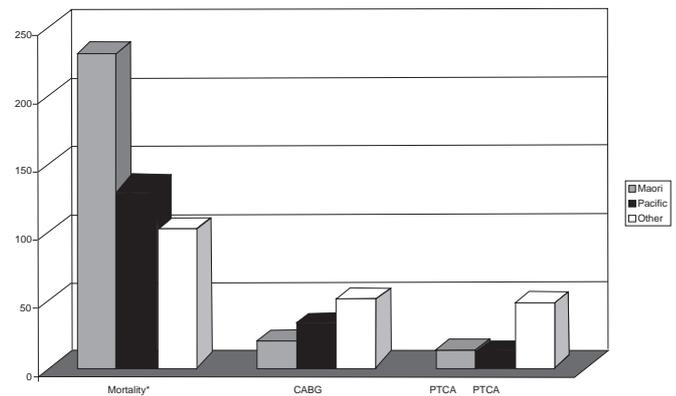


Figure 1. Age standardised mortality (1990-1992), CABG and PTCA intervention rates (1990-1999) per 100 000 population by ethnic group, New Zealand Males. CABG = coronary artery bypass graft. PTCA = percutaneous transluminal coronary angioplasty. \*From Bell et al.<sup>9</sup>

Use of coronary artery revascularisation procedures increased in all ethnic groups but CABG and PTCA event rates were lower in Pacific and Maori peoples throughout the study period. Ethnic differences in PTCA intervention rates narrowed slightly towards the latter half of the study period but differences in CABG event rates remained constant throughout.

Table 1 shows CABG and PTCA annual rate of growth in intervention rates by ethnic group per 100 000 population before and after the introduction of priority scores. The rate of change in CABG interventions decreased in Pacific peoples but increased among Maori and other New Zealanders while the rate of change for PTCA interventions increased in Pacific and other New Zealanders but decreased slightly among Maori. Introducing priority scores was neither associated with a decrease in the overall use of cardiac procedures nor a significant reduction in the differential use of the procedures across all ethnic groups.

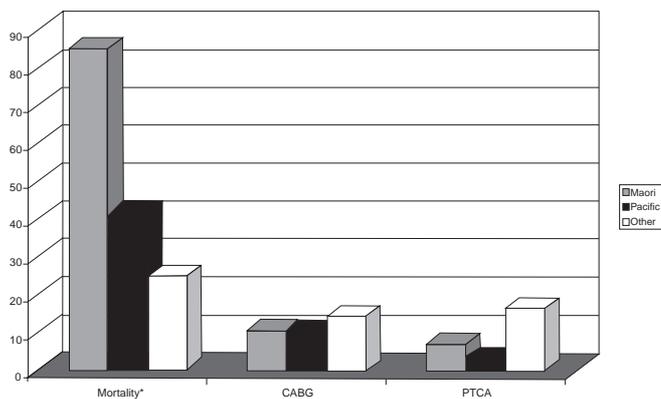


Figure 2. Age standardised mortality (1990-1992), CABG and PTCA intervention rates (1990-1999) per 100 000 population by ethnic group, New Zealand Females. CABG = coronary artery bypass graft. PTCA = percutaneous transluminal coronary angioplasty. \*Adapted from Bell et al.<sup>9</sup>

**Table 1. Coronary artery bypass graft (CABG) and percutaneous transluminal coronary angioplasty (PTCA) interventions annual rate of change per 100 000 population by ethnic group before and after the introduction of priority scores, New Zealand 1990 - 1999.**

	Pacific	Maori	Other
<b>CABG</b>			
Before Scores (1990-1995)	2.68 (26.0)	0.40 (4.0)	0.20 (0.6)
After Scores (1995-1999)	0.52 (2.0)	1.78 (14.0)	0.96 (3.0)
<b>PTCA</b>			
Before Scores (1990-1995)	1.02 (17.0)	1.20 (34.0)	0.14 (0.5)
After Scores (1995-1999)	1.56 (27.0)	1.86 (20.0)	1.02 (3.0)

Figures in brackets denote % annual growth rates relative to the baseline for each ethnic group. Baseline for before scores is the mean rate for 1990 and 1991. Baseline for after scores is the mean rate for 1995 and 1996.

## Discussion

Significant ethnic and gender differences in coronary artery revascularisation intervention rates were apparent in New Zealand throughout the 1990s. Intervention rates were lowest in Pacific and Maori peoples despite higher coronary artery disease mortality and morbidity rates. Given the lower overall coronary artery revascularisation intervention rates in New Zealand compared with other OECD nations, our findings suggest that substantial numbers of Pacific and Maori men and women from all ethnic groups may not have received necessary cardiac care. The findings may also partly explain the slower rate of decline in coronary artery mortality rates in New Zealand compared with other OECD nations.

Our findings are similar to those of a study in the northern region of the North Island where coronary artery revascularisation rates were lower among Pacific and Maori peoples compared with other New Zealanders.<sup>17</sup> Ethnic and gender differences in coronary artery revascularisation rates in New Zealand were also consistent with findings reported from other countries. In the USA, many studies have shown that women and minority groups are less likely to undergo invasive cardiovascular procedures for coronary artery disease even after adjusting for co-morbidities and contraindications to procedures.<sup>18,19,20</sup> Secondary prevention strategies with proven benefits, including revascularisation, were significantly underused in women, especially in minority groups.<sup>21</sup> Gender differences were partly attributed to women having a higher incidence of complications and risk of operative death after CABG than men.<sup>22</sup> Studies suggest that underuse of coronary artery revascularisation procedures is common, and between 22-

41% of patients where expert panels deemed the intervention appropriate and necessary did not undergo the procedure.<sup>23</sup> Ethnic differences were due mainly to underuse of these procedures in minority groups.<sup>24</sup> As profound as the racial and ethnic differences are in the US, they are less than those found in this New Zealand study.

There is insufficient information in the NMDS to explain ethnic and gender differences in invasive cardiology procedures in New Zealand. Variations in coronary artery revascularisation procedures may be due to ethnic and gender differences in coronary artery disease prevalence and severity; patients' health seeking behaviour; preferences for cardiac procedures or medical treatment; physician practice styles, and patient-doctor interaction. Higher prevalence of diabetes and early onset of cardiac disease among Maori and Pacific peoples may influence the choice of treatment with respect to medical, angioplasty or coronary artery bypass grafting. Higher morbidity and mortality rates among New Zealand's ethnic minority populations suggests that ethnic differences in disease prevalence are unlikely explanations for lower coronary artery revascularisation intervention rates in these groups. On the other hand, Maori and Pacific peoples are low users of primary care and preventive services. Since elective CABG and PTCA interventions are dependent on referrals from primary care, lower rates of revascularisation procedures may be a result of poor access or use of primary care services by New Zealand's ethnic minority groups. Studies elsewhere have shown that women and ethnic minority groups with coronary artery disease are less likely to be referred for assessment and treatment.<sup>25,26</sup> It was also unclear whether Maori and Pacific peoples referred for cardiology assessment received timely diagnostic and treatment procedures. Co-morbidities, contraindications to procedures and patient refusal to accept invasive medical treatment are other possible reasons for the observed differences. Discrimination against ethnic minorities has been suggested as a possible reason for ethnic disparities in the use of these procedures in the USA.<sup>27</sup> Discrimination might exist in New Zealand as well. Referral patterns, patient characteristics and in-hospital processes-of-care issues are useful areas for further research to determine if lower CABG and PTCA rates in Pacific and Maori peoples are due to factors operating outside, within the hospital, or both. Studies are also needed to determine if ethnic disparities in the use of coronary artery revascularisation procedures in New Zealand are due to underuse in Pacific and Maori peoples, overuse in other New Zealanders, or both.

After priority scores were introduced, CABG intervention rates increased at a faster rate in Maori and other New Zealanders but decreased in Pacific peoples. PTCA intervention rates increased at a faster rate in Pacific and other New Zealanders but decreased slightly among Maori. Increasing use of PTCA relative to CABG procedures was a worldwide phenomenon and unlikely to be related to the introduction of priority scores in New Zealand. While coronary artery revascularisation rates have improved in New Zealand over time, availability of these procedures remains limited for all New Zealanders. Strategies beyond the use of priority scores are needed to address ethnic and gender disparities in the use of coronary artery revascularisation procedures in New Zealand. Consideration should be given to improving cardiac surgical capacity for the whole country as well as supporting effective heart disease prevention programmes targeted at Pacific and Maori peoples.

Underuse of appropriate coronary artery revascularisation procedures is now regarded as a failure to provide recommended standards of care and problems with the overall quality of care within the health system.<sup>28</sup> Furthermore, as quality of care initiatives gain momentum,

cardiology intervention rates may be suitable indicators for monitoring equity in the use of health care services in the country. Ethnic disparities in the use of these procedures may provide useful information on the progress being made on the government's programme to reduce health disparities between various groups in New Zealand.

Our study findings should be interpreted with care because of its observational nature and lack of detailed information about patient characteristics and health system factors that may help explain the disparities identified. Under-reporting and misclassification of Maori and Pacific peoples is a recurring problem which may affect the validity of these figures.<sup>29</sup> However, a liberal definition of Pacific and Maori peoples would inflate population numbers and lower intervention rates even further. Despite these limitations, our study findings showed significant ethnic and gender differences in the use of coronary artery revascularisation procedures in New Zealand. Further research should be conducted to determine the reasons for the differences in the use of coronary artery revascularisation procedures.

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