Summary of Central Regional Data for Acute Cardiac Events

The report includes data on Māori and non-Māori first admitted acutely to hospitals within the Central Region for acute coronary syndrome, 2000-2008.

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Copyright Statement

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Key findings

In the Central Region cohort study of individuals with a first hospital admission of acute coronary syndrome (ACS) during the period 2000-2008, we found:

- Māori were significantly less likely than non-Māori to receive diagnostic procedures (the first of angiogram or percutaneous coronary intervention (PCI)) and PCI.

- There was no significant difference between Māori and non-Māori in the receipt of coronary artery bypass and graft (CABG).

- A small amount of the disparity in procedure receipt was explained by differences between Māori and non-Māori in comorbidities, neighbourhood deprivation, and whether initially admitted to a centre where the procedure was offered.

- Disparities in procedure receipt are driven by what is happening in the first days following admission and continue thereafter.

- Procedure receipt in the Central Region increased significantly between 2000 and 2008, but the increase in access to procedures was greater for non-Māori, which resulted in the widening of disparities.

Introduction

This report presents data on the receipt of cardiac procedures by a cohort of Māori and non-Māori first admitted to hospital with acute coronary syndrome in the Central region during the period 2000-2008.

This project is part of a wider project examining inequalities in health care between Māori and non-Māori (Unequal Treatment) led by Te Rōpū Rangahau Hauora a Eru Pōmare (the Eru Pōmare Māori Health Research Centre at the University of Otago, Wellington). The project is funded by the Health Research Council and is part of the Health Inequalities Research Programme. Central TAS funded the purchase of the data from the New Zealand Health Information Service. The Central Region project is a partnership between Central TAS and Te Rōpū Rangahau Hauora a Eru Pōmare.

The project follows on from an initial analysis of national data on Māori and non-Māori access to cardiac procedures during the years 1996-2004.

This second stage of the project involves conducting national and regional analyses for the period 2000-2008. Central TAS approached Te Rōpū Rangahau Hauora a Eru Pōmare to analyse the data for the Central region and its DHBs as part of their cardiac care programme.

Preliminary findings were presented to a meeting of the Central Region Cardiac Network on September 24th 2010, after consultation with the Central Region Project Steering Group.

Aim of the research

To investigate whether there are ethnic disparities in receipt of cardiac revascularisation procedures in a cohort of Māori and non-Māori from the Central region first admitted to hospital with acute coronary syndrome (ACS) between 2000 and 2008.

Summary of methods

This is a retrospective cohort study of Māori and non-Māori inpatients who were admitted to hospital for the first time with a primary diagnosis of ACS during the period 2000 and 2008. The patients were all residents of Hawkes Bay, MidCentral, Whanganui, Wairarapa, Hutt Valley, Capital and Coast, and Nelson-Marlborough health districts at the time of first admission. Only patients with acute routine admissions were included. Patients admitted from waiting lists, elective admissions, arranged admissions or transferred from other hospitals were not included in the cohorts, unless these followed an acute routine admission.

Patients were followed from the time of first admission for receipt of the following cardiac procedures: angiography, percutaneous coronary intervention (PCI), and coronary artery bypass and graft (CABG). Proportional hazards modelling was used to compared differences in procedure receipt, including time to receipt, between Māori and non-Māori, adjusted for age, sex, principal diagnosis, comorbidities recorded as secondary diagnoses on the index admission, whether the admitting hospital conducted the procedure in consideration, and neighbourhood deprivation of the patient's residence. Patients were censored on receipt of the relevant procedure, death, or December 31st 2008, depending which was first.

Patients were classified as Māori if coded as Māori on the initial hospital admission, and otherwise classified as non-Māori.

The original study was informed by a clinical reference group and the current study by the Central Region Project Steering Group.

Findings

Description of the Central Region study participants

There were 17,435 people aged over 18 years of age first admitted to a public hospital within the Central region district health boards (DHBs) with Acute Coronary Syndrome between the years 2000-2008, in a routine acute admission, and therefore included in the cohort study.

Of these, 1,403 (8.1%) were identified as Māori and the remaining 16,032 were classified in the study as non-Māori.

Less than half of the individuals included in the cohort study were female (41.5%).

The mean age for Māori in the cohort was 58.6 years, and for non-Māori was 69.4 years. This age difference will be partly driven by the difference in age structure of the Māori and non-Māori populations.

Māori males were on average 7 years younger than females in the cohort study.

DHB residents admitted with ACS

There were differences in the number of study participants by DHB, which will largely reflect the size of the DHB populations. There were 3,405 individuals in the study who resided in the region of Hawkes Bay DHB, 3,468 residents from MidCentral, 1,669 from Whanganui, 899 from Wairarapa, 2,292 from Hutt Valley, 3,256 from Capital and Coast, and 2,362 from Nelson-Marlborough (Table 1).

There were also large differences between the DHBs in the percentage of admissions with ACS which were for Māori patients. In Hawkes Bay and Whanganui, 13.3% and 12.3% respectively of the residents admitted with ACS were Māori, compared with only 5.1% and 2.8% respectively in Capital and Coast and Nelson-Marlborough.

For all DHBs, less than half of ACS admissions were for females. When we consider Māori ACS admissions, 44.4% were for females compared to 41.3% for females out of the non-Māori admissions.

The average age at admission for Māori was lower than that for non-Māori for all DHBs.

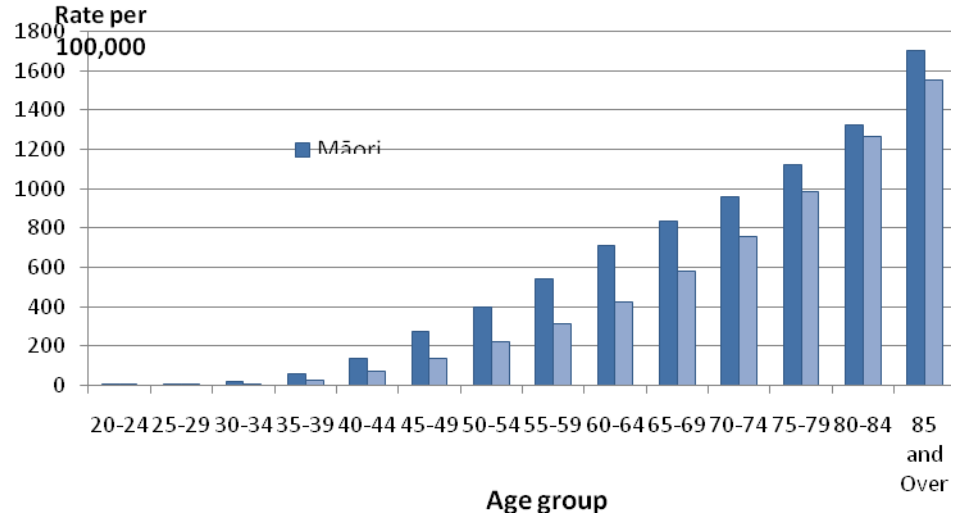
Table 1: Demographics of Central region DHB residents with Acute Coronary Syndrome admissions, 2000-2008

ACS admissions of Central region residents		Māori admissions		Female admissions				Mean age	
				Māori		Non-Māori		Māori	Non-Māori
		N	%	N	%	N	%	Yrs	Yrs
Hawkes Bay	3405	453	13.3	220	48.6	1278	43.3	60.1	70.4
MidCentral	3468	236	6.8	100	42.4	1411	43.7	57.3	69.8
Whanganui	1669	205	12.3	96	46.8	622	42.5	58.0	69.8
Wairarapa	899	90	10.0	33	36.7	331	40.9	59.7	68.6
Hutt Valley	2292	172	7.5	61	35.5	828	39.1	57.0	67.3
Capital and Coast	3256	166	5.1	72	43.4	1197	38.7	57.9	69.0
Nelson Marlborough	2362	67	2.8	35	52.2	930	40.5	56.9	70.2
All Central Region	17351	1389	8.1	617	44.4	6597	41.3	58.6	69.4

The rate of ACS admissions increases by age for both Māori and non-Māori, which means that both Māori and non-Māori have higher rates of admissions in the older ages groups (Figure 1). Within each age band Māori have a higher rate of ACS admissions, with a bigger difference between Māori and non-Māori in the younger age groups.

The ten year difference in average age of ACS presentation is likely to be a combination of the higher rate of ACS admission for Māori compared to Māori within the younger age bands, as well differences in age structure of the populations (the Māori population has a greater percentage of younger people).

Figure 1: National rates of people first admitted to hospital with ACS (routine acute admissions only) by age, 2000-2008



Comorbidities

The following table of comorbidities was developed by a Clinical Reference Group for the project, and is intended to include conditions that may influence the chance of an individual receiving an angiogram, PCI or coronary artery bypass and graft (CABG) (Table 2).

Table 2: Comorbid conditions as a secondary diagnosis on the primary admission for acute coronary syndrome, Central region cohort

Comorbidity	Māori (N= 1403)		Non-Māori (N=16032)		Relative rate
	N	%	N	%	RR (95 %CI)
Heart failure	233	16.6	2549	15.9	1.04 (0.92 - 1.18)
Peripheral vascular	31	2.2	390	2.4	0.91 (0.63 - 1.30)
Chronic pulmonary*	90	6.4	802	5.0	**1.28 (1.04 - 1.58)**
Rheumatological	8	0.6	91	0.6	1.00 (0.49 - 2.07)
Diabetes mellitus*	415	29.6	2320	14.5	**2.04 (1.87 - 2.23)**
Renal failure*	135	9.6	1013	6.3	**1.52 (1.28 - 1.81)**
Any Cancer	30	2.1	357	2.2	0.96 (0.66 - 1.39)
Obesity*	117	8.3	406	2.5	**3.29 (2.70 - 4.02)**
Dementia^	13	0.9	289	1.8	**0.51 (0.30 - 0.89)**
Other mental health	45	3.2	506	3.2	1.02 (0.75 - 1.37)
Smoking history	341	24.3	4266	26.6	0.91 (0.83 - 1.01)
Smoking*	548	39.1	2830	17.7	**2.21 (2.06 - 2.38)**
Number of comorbid conditions (excluding smoking and smoking history)					
No comorbidities^	680	48.5	9879	61.6	**0.79 (0.74 - 0.83)**
1 comorbidity*	428	30.5	4133	25.8	**1.18 (1.09 - 1.29)**
2 comorbidities*	214	15.3	1549	9.7	**1.58 (1.38 - 1.80)**
3+ comorbidities*	81	5.8	471	2.9	**1.97 (1.56 - 2.47)**

***Significantly higher in Māori
^Significantly lower in Māori

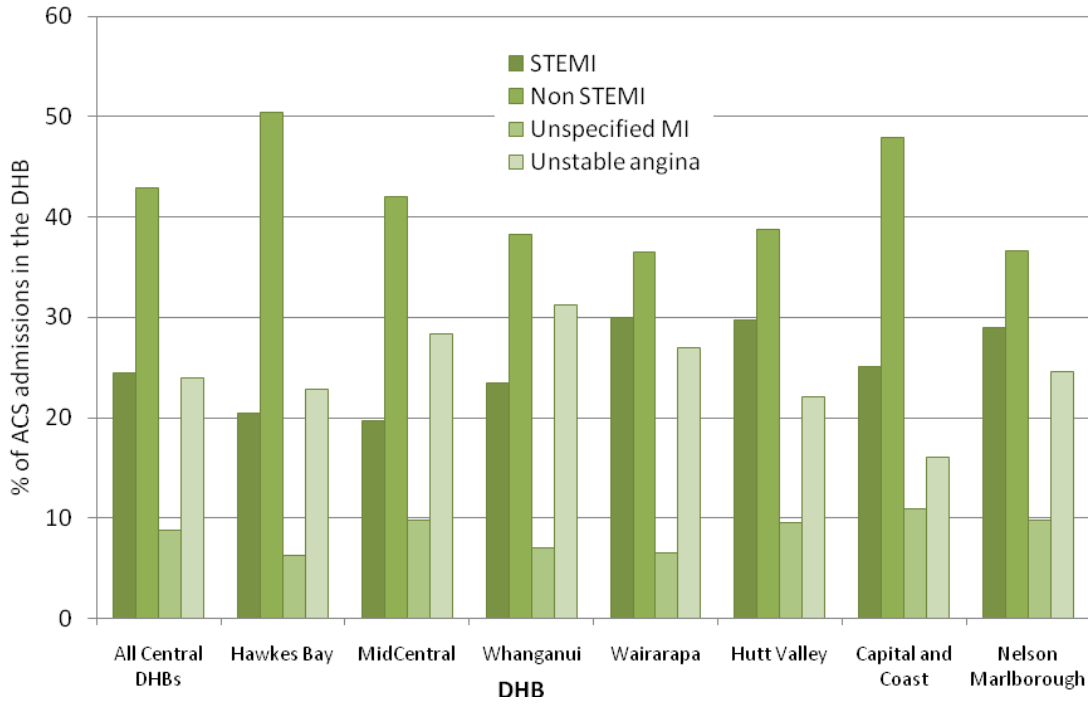
In the Central cohort, Māori patients were more likely than non-Māori to have chronic pulmonary disease, diabetes mellitus, renal failure, obesity, and smoking, and less likely to have dementia recorded as a secondary diagnosis than non-Māori in the cohort.

Māori in the Central region cohort were less likely to be recorded as having no comorbid conditions, and more likely to have multiple (2 or 3+) comorbidities recorded compared to non-Māori in the cohort.

Primary ACS diagnoses

Figure 2 demonstrates the distribution of ACS diagnoses within the Central region cohort by DHB. The pattern is largely consistent between individual DHBs, and that of the total Central cohort (all Central region DHBs combined). The largest group of diagnoses is non-ST elevated myocardial infarction (non-STEMI) contributing 36-51%. The smallest contributor is myocardial infarction (MI) with the type unspecified, contributing between 6-11%. ST elevated myocardial infarction (STEMI) and unstable angina make the second and third largest contributors, with some variation in the order of these by DHB.

Figure 2: Distribution of primary diagnoses for people first admitted with ACS, by Central DHB



Comparing the odds of each diagnosis, for Māori compared to non-Māori adjusting for age and sex (Figure 3), Māori were significantly less likely to have a diagnosis of STEMI and more likely to have a diagnosis of non-STEMI and MI unspecified. There was no significant difference between Māori and non-Māori for the diagnosis of unstable angina.[1]

[1] There was a significant difference in the distribution of principal diagnoses (unadjusted) between Māori and non-Māori in the total cohort (chi-squared = 21.2 df=3 p=0.0001), as well as for males and females analysed separately.

Figure 3: Māori/non-Māori odds ratios for ACS Diagnosis for Central region, adjusted for age and sex, 2000-2008

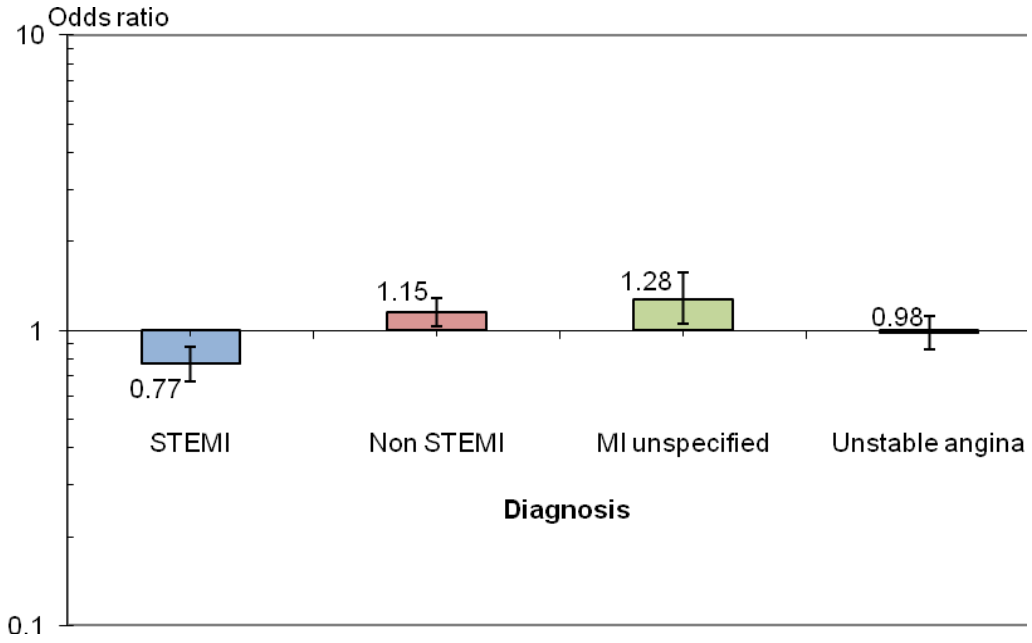


Table 3 shows the crude number (not adjusted for age) of people with each diagnosis in the total Māori and non-Māori cohorts, and by sex. STEMI was a more common diagnosis for males than females and unstable angina less common.

Table 3: Distribution of principal ACS diagnoses for Māori and non-Māori first admissions, 2000-2008, Central region

	Māori N=1403		Non-Māori N=16032	
Principal diagnosis	n	%	n	%
Total				
STEMI	321	22.8	3951	24.6
Non-STEMI	596	42.5	6883	42.9
Unspecified MI	120	8.6	1423	8.9
Unstable angina	366	26.1	3775	23.6
Females	***N=628***		***N=6606***	
STEMI	116	18.5	1328	20.1
Non-STEMI	264	42.0	2814	42.6
Unspecified MI	52	8.3	634	9.6
Unstable angina	196	31.2	1830	27.7
Males	***N=775***		***N=9426***	
STEMI	205	26.5	3623	27.8
Non-STEMI	332	42.8	4069	43.2
Unspecified MI	68	8.8	789	8.4
Unstable angina	170	21.9	1945	20.6

Revascularisation procedures

With the potential for angioplasty to be both diagnostic (angiogram) and therapeutic, in looking at the time to procedures we divide our interventions into:

Diagnostic procedures
Time from admission to the first of angiography or angioplasty, censoring those who have received CABG (given that an angiogram post CABG is for a different purpose)

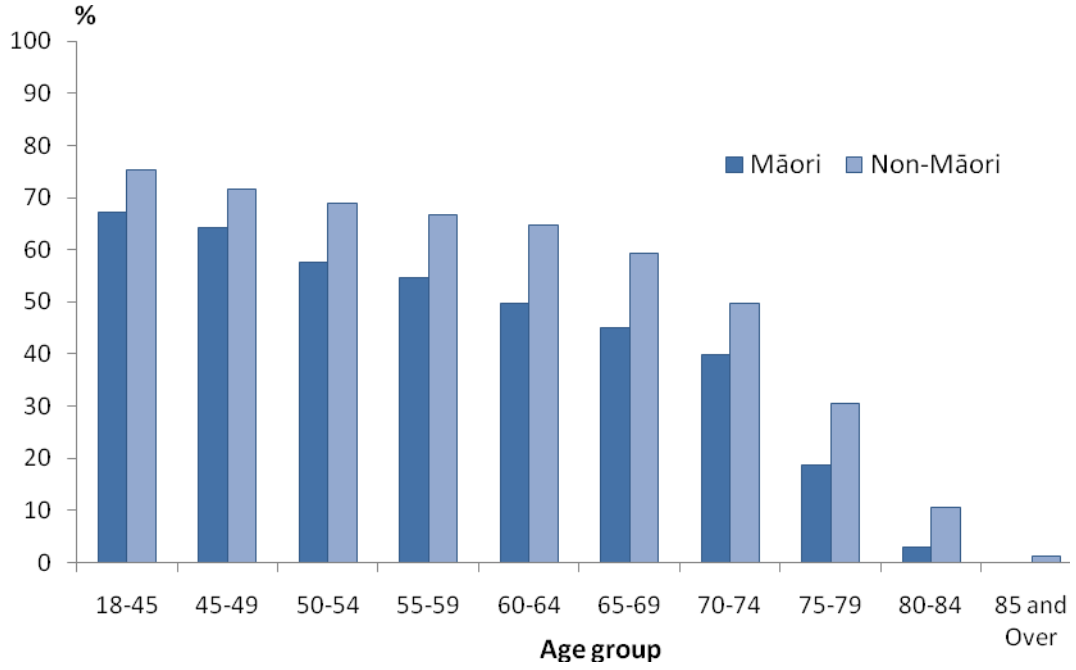
Therapeutic procedures
1. time from admission to angioplasty censoring after receipt of CABG
2. time from admission to CABG censoring after receipt of angioplasty.

Rates of procedures

Figure 4 shows the proportion of Māori and non-Māori in the Central cohort (ie. only those first admitted to hospital with acute coronary syndrome in a routine acute admission) who received a diagnostic imaging procedure any time after they were admitted, by age group. There are two key findings demonstrated in this graph. Firstly, the chance of receiving an angiogram decreases with age. Secondly, within each age group, Māori patients were less likely than non-Māori patients to receive an angiogram, after being admitted with ACS.

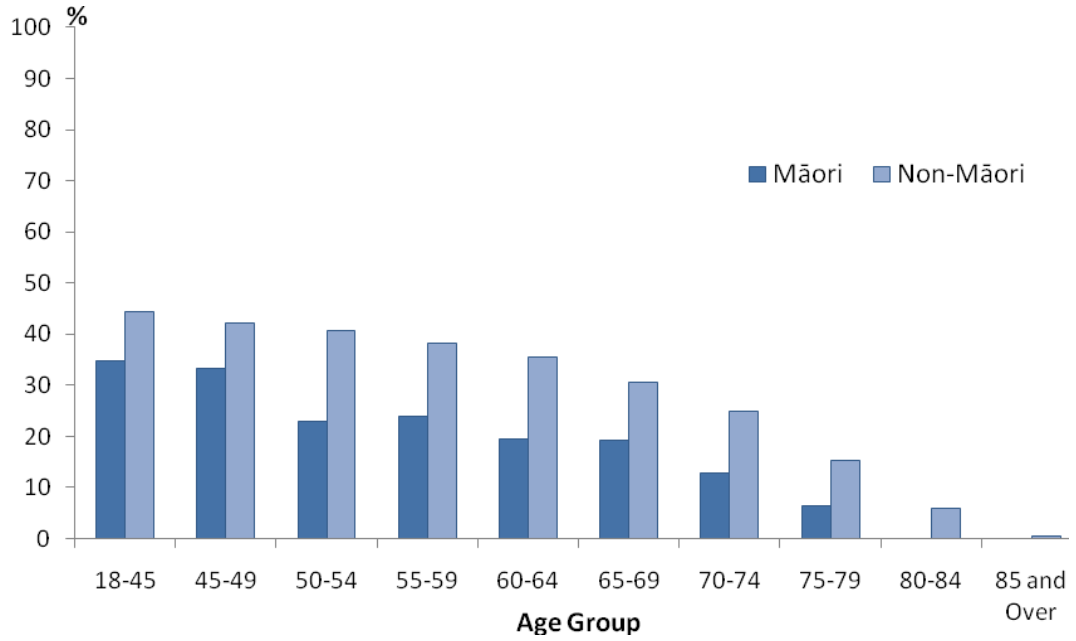
Because there is a relationship between age and procedure receipt we will later adjust for age in the hazard ratios in order to compare the chances of procedure receipt for Māori patients compared to non-Māori patients of the same age and sex.

Figure 4: Proportion receiving diagnostic imaging procedures after admission, 2000-2008, by age group, Central region



The proportions of Māori and non-Māori receiving PCI following admission with ACS are lower than the proportions receiving diagnostic imaging. However, the pattern of PCI receipt for Māori compared to non-Māori is similar to diagnostic procedures in that the chance of receiving PCI decreases with age for both Māori and non-Māori and within each age group Māori patients were less likely than non-Māori patients in the cohort to receive PCI (Figure 5).

Figure 5: Proportion receiving PCI after admission, 2000-2008, by age group, Central region

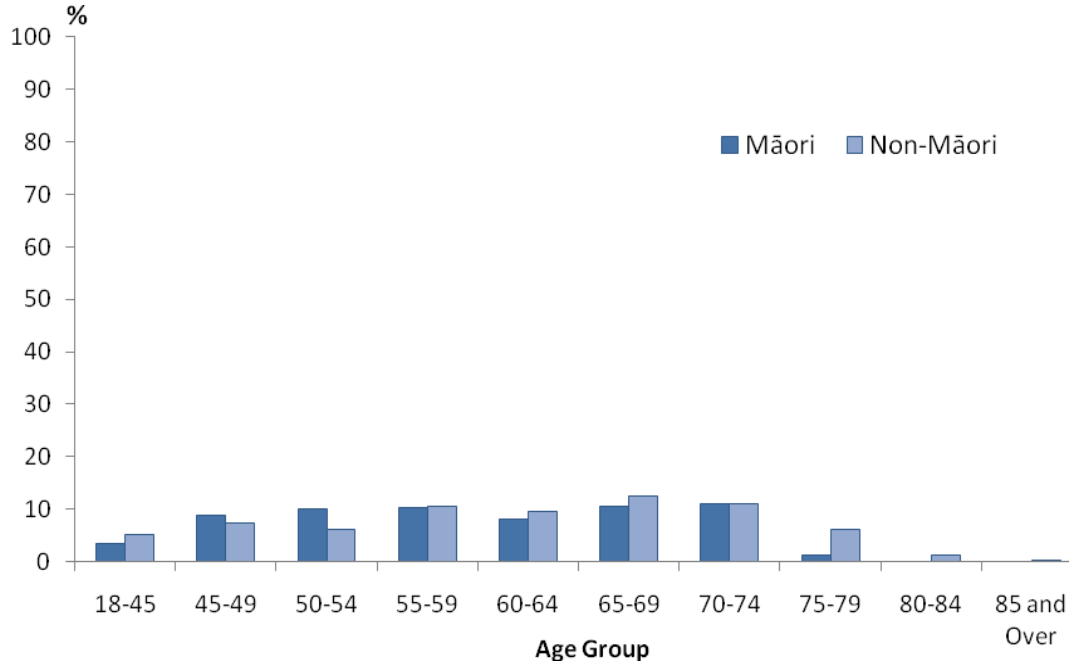


The proportion of Māori and non-Māori patients in the Central region cohort who received CABG any time after admission is lower than the proportion who received diagnostic procedures or PCI. The pattern by age is also different from the patterns for diagnostic procedures or PCI, with less of a clear gradient by age (Figure 6).

Among Māori the chance of receiving CABG was fairly constant between the ages 50 -74 years, and dropped off steeply from age 70 years. Among non-Māori the chances of receiving CABG were highest at ages 55-74 years, and dropped off steeply from 75 years on.

There was no consistent pattern of lower or higher receipt of CABG by Māori or non-Māori across the age groups (except from age 75 and over).

Figure 6: Proportion receiving CABG after admission, 2000-2008, by age group, Central region



There are a number of important differences between the Māori and non-Māori populations presenting acutely with ACS which may impact on the relative chances of receiving a procedure. These factors include the type of acute coronary syndrome that the patients in the cohort were admitted with, if the hospital they were admitted to offered the procedure, the number and type of comorbid conditions they have, and the socioeconomic status of the patient.

Figure 7 presents the relative chance of procedure receipt for Māori compared to non-Māori, any time after first admission during the period 2000-2008, initially taking into account age, sex, and principal diagnosis (STEMI anterior wall, STEMI other, non-STEMI, unspecified MI, unstable angina).

Looking at the first bar for each of the procedures, we can see that Māori patients in the cohort were significantly less likely than non-Māori patients of the same age, sex, and diagnosis, to receive a diagnostic procedure (72% as likely as non-Māori) or PCI (62% as likely as non-Māori). There was no significant difference between Māori and non-Māori of the same age, sex and diagnosis in the receipt of CABG, although the Māori chances were 8% lower.

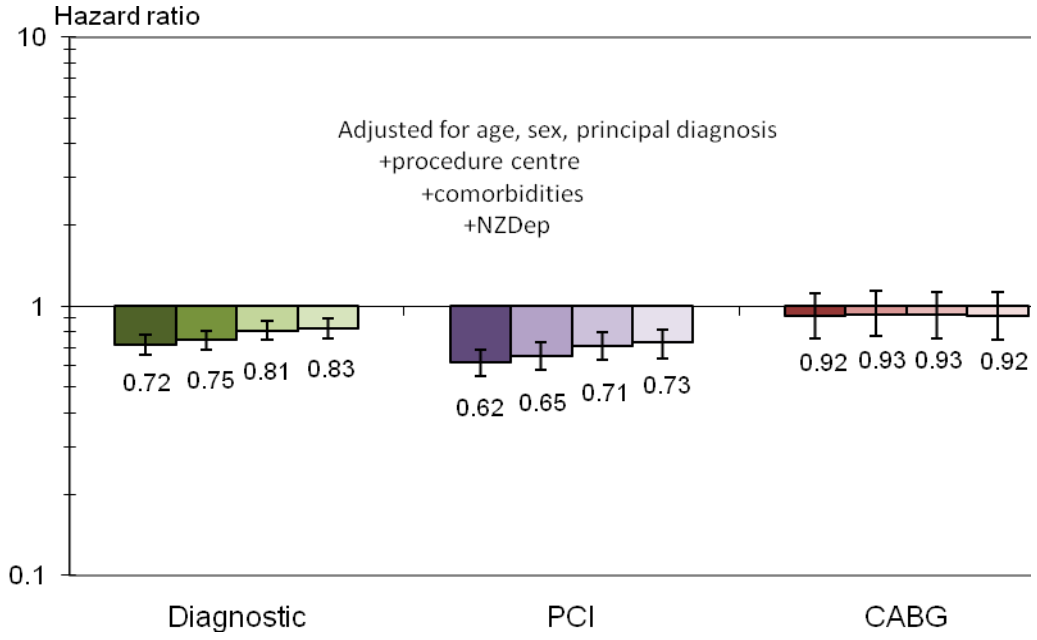
In addition to adjusting for age, sex and diagnosis, the second bar for each procedure also adjusts for procedure centre, which is whether the hospital of initial admission provided the procedure in consideration (diagnostic, PCI or CABG). For both diagnostic procedure and PCI, the second bar is slightly closer to one, and therefore shows that the type of hospital that Māori are first admitted to, accounts for a very small proportion of the difference in chances of procedure receipt. However, Māori patients still had significantly lower chances of receiving diagnostic procedures (75% as likely as non-Māori) and PCI (65% as likely as non-Māori), once we adjusted for the type of hospital they were first admitted to.

In addition to the factors listed above, the third bar for each procedure takes into account the higher rate of comorbid conditions among Māori patients in the cohort. Comorbidities accounted for part of the difference in chances of receiving diagnostic procedures and PCI, but even after taking those into account, Māori chances of receiving a diagnostic procedure after admission were 19% lower and PCI 29% lower than that of non-Māori patients of the same age, sex, ACS diagnosis, admitted to the same type of hospital, and with the same pattern of comorbid conditions.

The final bar for each of the procedures additionally takes into account socioeconomic deprivation (in addition to the other factors already discussed). Deprivation explains some of the difference in diagnostic procedure and PCI receipt for Māori compared to non-Māori, however, after taking into account all these factors, Māori chances of receiving diagnostic procedures and PCI were still significantly lower than those of non-Māori patients of the same age, sex, hospital of first admission, comorbid conditions, and neighbourhood deprivation level.

The relative chance of receiving CABG for Māori patients in the cohort compared to non-Māori patients in the cohort, any time after admission, were 8% lower for Māori patients compared to non-Māori patients, this difference was not significant. Hospital type, comorbidities, and deprivation made little difference.

Figure 7: Māori/non-Māori adjusted hazard ratios for procedure receipt after admission, 2000-2008, Central region



We looked at the relative chance of procedure receipt for Māori compared to non-Māori adjusted for age, sex, and diagnosis for each DHB in the Central Region to see if there was any particular DHB that stands out (Figure 8).

For diagnostic procedures the hazard ratios for each DHB were similar to that for the Central region and there were no significant differences between DHBs. (This may be due to the small numbers which means we don't have the statistical power to detect differences between DHBs).

For PCI, Māori had lower chances of receipt than non-Māori in most DHBs, although the hazard ratios did not reach statistical significance in Nelson Marlborough, MidCentral or Wairarapa. There were no significant differences between DHBs.

There was no consistent pattern of differential receipt of CABG between Māori and non-Māori, and no significant differences between the Central DHBs. Whanganui was the only DHB to show significantly lower relative chances of receiving CABG for Māori compared to non-Māori.

Figure 8: Māori/non-Māori adjusted hazard ratios for procedure receipt after admission, 2000-2008, by Central DHB.

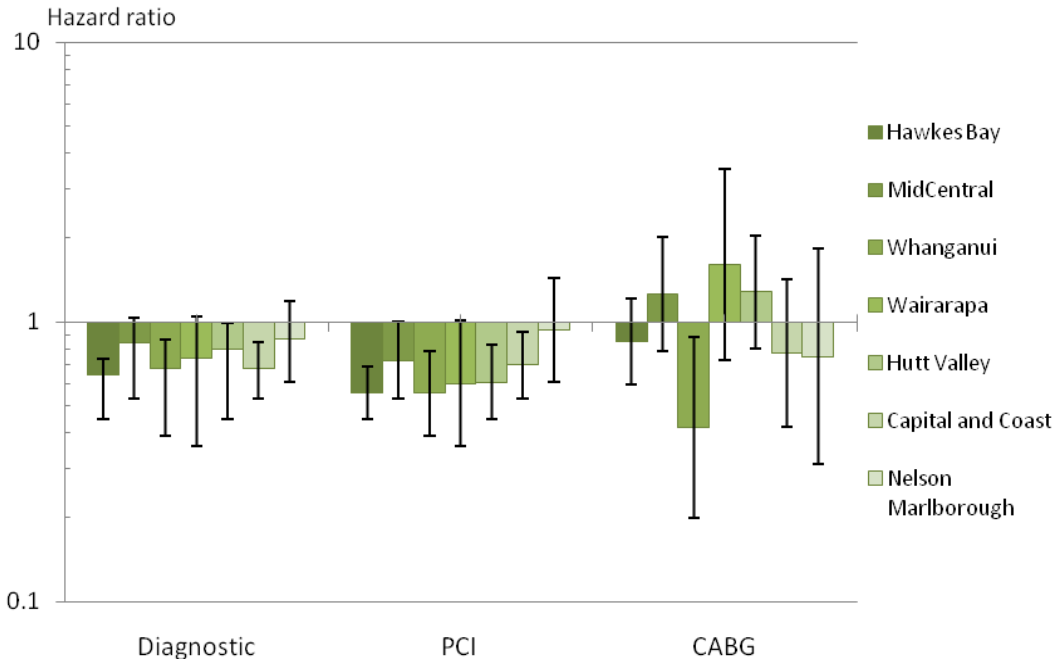


Table 4 shows the number and proportions of people receiving procedures in each DHB, unadjusted for age or sex.

Table 4: Procedure receipt after initial admission, 2000-2008, by Central DHB.

Procedure	DHB of residence	Māori		Non-Māori	
		N	%	N	%
Diagnostic	Hawkes Bay	243	53.6	1464	49.6
	MidCentral	101	42.8	1032	31.9
	Whanganui	87	42.4	582	39.8
	Wairarapa	36	40.0	285	35.2
	Hutt Valley	103	59.9	1026	48.4
	Capital and Coast	93	56.0	1581	51.2
	Nelson Marlborough	43	64.2	1058	46.1
PCI	Hawkes Bay	98	21.6	763	25.8
	MidCentral	44	18.6	519	16.1
	Whanganui	36	17.6	315	21.5
	Wairarapa	16	17.8	167	20.6
	Hutt Valley	43	25.0	580	27.4
	Capital and Coast	53	31.9	988	32.0
	Nelson Marlborough	23	34.3	515	22.4
CABG	Hawkes Bay	38	8.4	220	7.5
	MidCentral	20	8.5	189	5.8
	Whanganui	8	3.9	98	6.7
	Wairarapa	8	8.9	37	4.6
	Hutt Valley	21	12.2	154	7.3
	Capital and Coast	11	6.6	198	6.4
	Nelson Marlborough	5	7.5	203	8.8

Procedure receipt over time after first admission

There were differences in the proportion of Māori admitted with ACS receiving procedures, as well as differences in how quickly these procedures take place. The following graphs demonstrate the chances of receiving each of the three procedures over time for Māori and non-Māori aged 50-70 years, after their first routine acute admission to hospital with acute coronary syndrome. This age group was selected as it contains a majority of the Māori patients in the study. The x- axis (horizontal) shows the time since the first admission and the y-axis the rate of procedure receipt. The black line (the lower line) shows the chance of receiving the procedure over time for Māori and the grey line shows the chance for non-Māori patients, aged 50-70 years.

Diagnostic procedure (Figures 9-10)

The gap between the two lines demonstrates that Māori and non-Māori had different chances of receiving diagnostic procedures (Figure 9). One year after first admission, just fewer than 50% of Māori patients had received a diagnostic procedure, rising to around 55% by 5 years. For non-Māori, just under 50% in this age group had received a diagnostic procedure within 2 weeks, rising to over 60% by 1 year and up to ~68% by 5 years.

The gap between Māori and non-Māori in diagnostic procedure receipt was established within the first two weeks of admission (Figure 10), and remained constant over time (Māori patients did not 'catch up' to non-Māori patients).

PCI (Figures 11-12)

There is a similar pattern for PCI receipt over time, where Māori have lower receipt of PCI, which is established within the first week after admission and remains constant over time.

For PCI, within the first 3 weeks after admission 30% of non-Māori had received PCI, rising steadily over to reach around 37% by 3 years. By 3 weeks less than 20% of Māori patients had received PCI rising to just over 20% in the first few months, and not even reaching 25% by 5 years after admission.

CABG (Figures 13-14)

The gap between Māori and non-Māori chances of receiving a CABG was smaller than for diagnostic procedures and PCI. It took longer for Māori patients to receive a CABG than non-Māori patients, with the proportion of Māori having received CABG at 4 weeks after admission the same as the proportion of non-Māori at just over 2 weeks after admission. By 5 years after admission around 15% of Māori patients had received CABG and around 17% of non-Māori patients.

Figure 9: Receipt of diagnostic procedures (first of angiogram or PCI), for those aged 50-70 years, up to five years following admission, Central region, 2000-2008

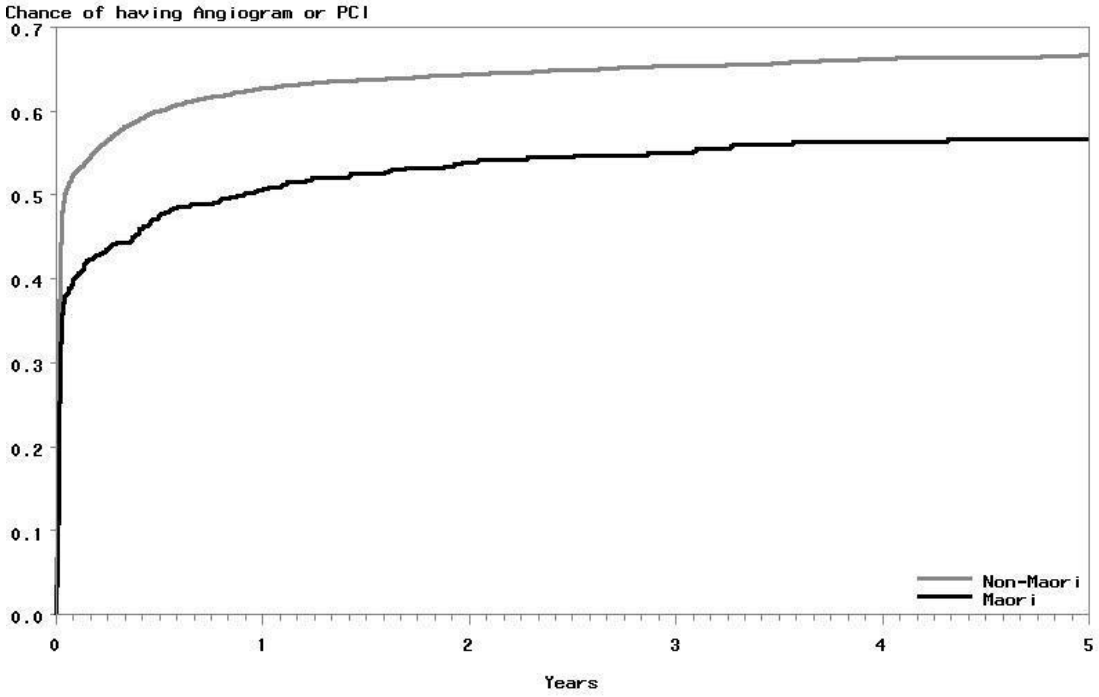


Figure 10: Receipt of diagnostic procedures (first of angiogram or PCI), for those aged 50-70 years within the <u>first three weeks</u> following admission, Central region, 2000-2008

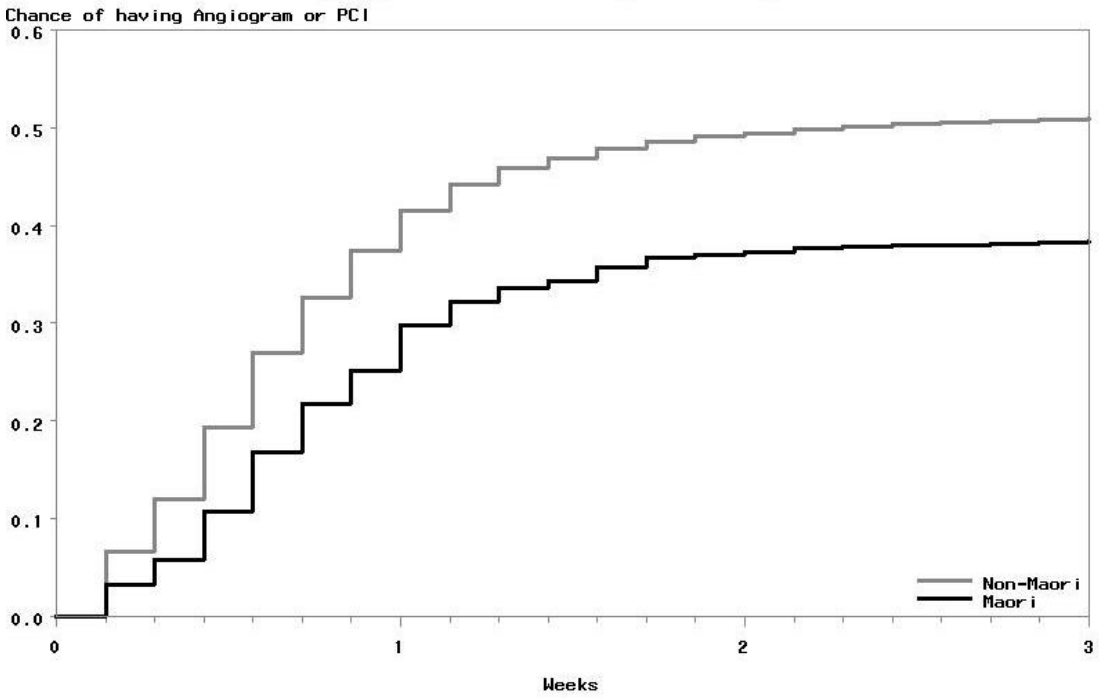


Figure 11: Receipt of PCI for those aged 50-70 years, up to five years following admission, Central region, 2000-2008

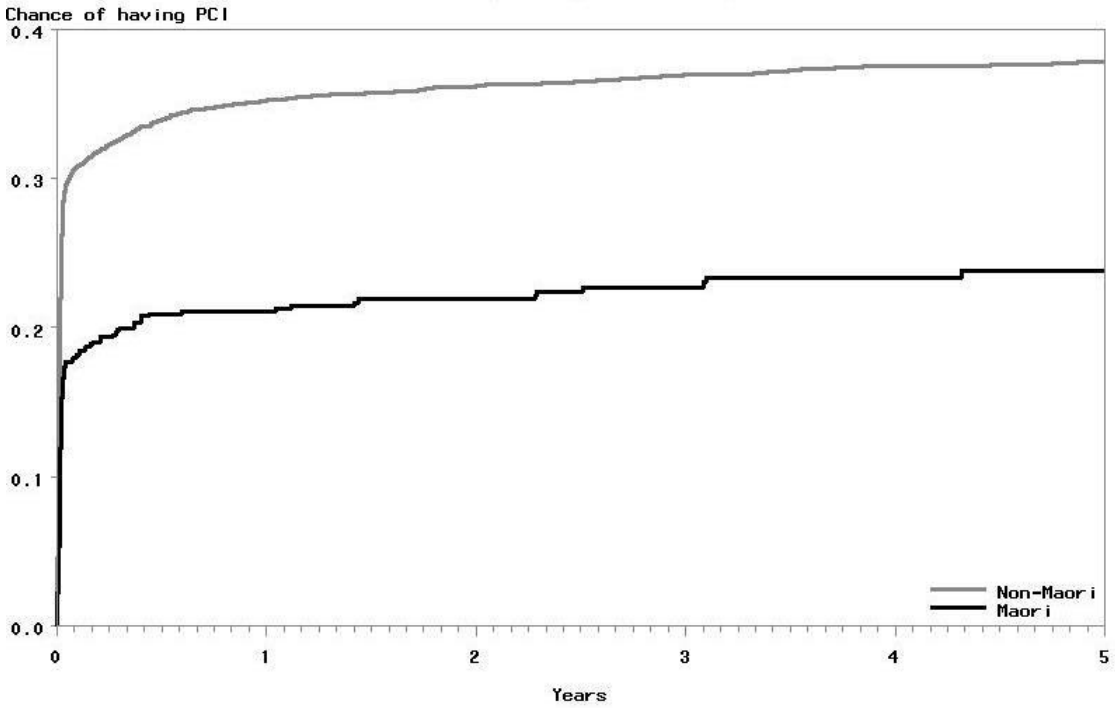


Figure 12: Receipt of PCI for those aged 50-70 years, within the <u>first three weeks</u> following admission, Central region

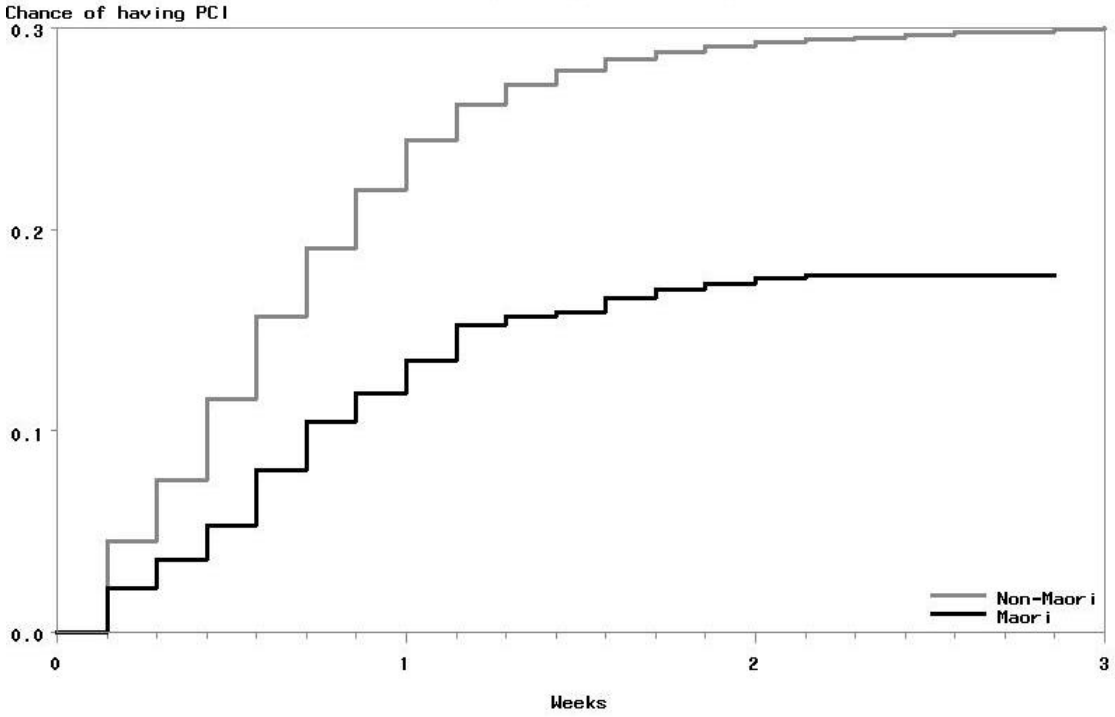


Figure 13: Receipt of CABG for those aged 50-70 years, up to five years following admission, Central region, 2000-2008

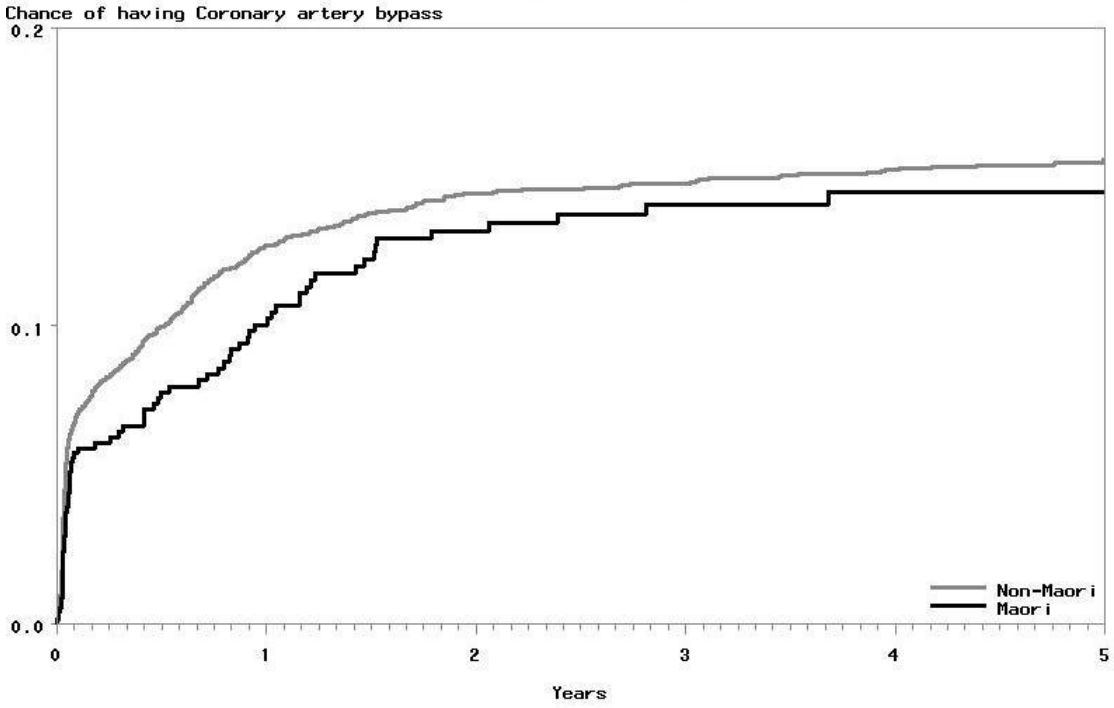
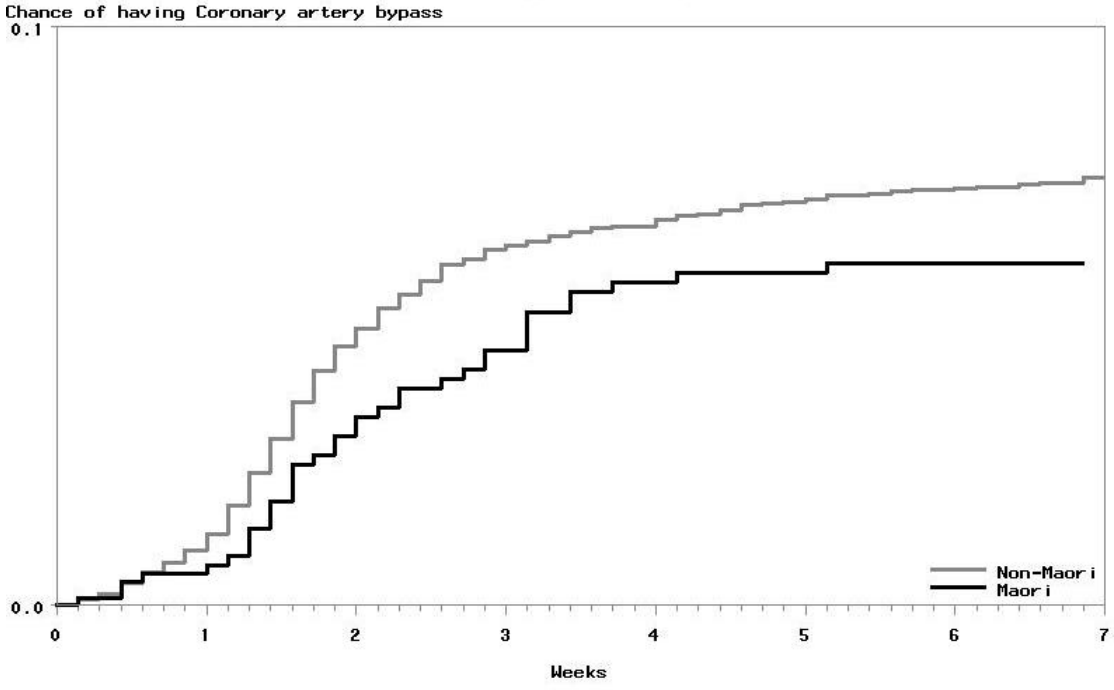


Figure 14: Receipt of CABG for those aged 50-70 years, within the <u>first seven weeks</u> following admission, Central region



Changes in the rate of procedures received over time

The number and rate of procedures offered in Central region DHBs changed over the study period. There was an increase in the rate of receipt of diagnostic procedures (first of angiogram or PCI) and PCI among both Māori and non-Māori during the period 2000 to 2008, however, for these two procedures the increase was greater for non-Māori than for Māori, which resulted in a widening of disparities over time (Table 5).

For Māori there was an 8% increase in the receipt of diagnostic procedures per year, but among non-Māori there was an 11% increase per year and so the disparity widened over the period 2000-2008 (with the Māori relative chance decreasing from 80% to 63% the non-Māori chances).

For PCI receipt, Māori rates increased by 7% increase per year while non-Māori rates increased by 9% per year, so there was a widening gap between Māori and non-Māori receipt of PCI.

For CABG, there was no change in the rate of CABG received by Māori but there was a significant increase in non-Māori of 4% per year, and a widening gap.

Table 5: Trends in procedures over time, proportional hazards modelling adjusted for age sex and diagnosis, Central region 2000-2008

Procedure	Difference in rate of change	Māori rate of change	Non-Māori rate of change	Māori:non-Māori 2000	Māori:non-Māori 2008
	P value	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)
Diagnostic*	0.057	1.08 (1.05–1.11)	1.11 (1.10–1.12)	0.80 (0.68–0.93)	0.63 (0.55–0.72)
PCI	0.43	1.07 (1.03–1.12)	1.09 (1.08–1.11)	0.66 (0.53–0.83)	0.57 (0.47–0.70)
CABG	0.38	1.00 (0.93–1.08)	1.04 (1.01–1.06)	1.04 (0.73–1.48)	0.79 (0.55–1.15)

* First of Angiogram or PCI

Discussion

The whole continuum of care for ischaemic heart disease is important – from prevention through to rehabilitation – and there is a need to focus on equity at each level. This study, however, looks in detail at one part of the continuum - the receipt of revascularisation procedures (angiography, PCI, and CABG). It also restricts its examination to a specific group of people - those first admitted to hospital with acute coronary syndrome (MI or unstable angina) during the period 2000-2008. It is important to note that this study included only patients presenting acutely to hospital for the first time with ACS, and not those on waiting lists or admitted for elective surgery.

This report compares the chances of receiving revascularisation procedures among Māori and non-Māori patients resident in the seven Central region DHBs served by the tertiary cardiac service at Wellington Hospital – Hawkes Bay, MidCentral, Whanganui, Wairarapa, Hutt Valley, Capital and Coast, Nelson-Marlborough.

The study found that Māori were less likely than non-Māori to receive diagnostic procedures (angiography) or PCI than non-Māori patients. The difference was significant even after adjusting for age, sex, principal diagnosis, comorbid conditions recorded on the index admission, neighbourhood deprivation, and initially being admitted to a centre where the procedure was offered (although these all accounted for a small part of the disparity).

The disparities were driven by what was happening within the first days following the initial admission.

There was no significant difference in the receipt of CABG between Māori and non-Māori patients, although the chances were around 8% lower for Māori.

Access to diagnostic and PCI procedures increased significantly during the study period for residents of the Central region. However, the increase was greater for non-Māori than for Māori, which led to an increase in inequalities in procedure receipt.

Study Limitations

In this study we were unable to examine whether patients underwent stress testing, the percentage of eligible patients given thrombolysis, what discharge medications were prescribed or smoking cessation aids, nor whether people were referred to cardiac rehabilitation – each of which are quality improvement indicators in the Ministry of Health's Quality Improvement Plan.

We have also not examined other outcomes such as readmissions with ACS, 5-year mortality rates from ischaemic heart disease, or all-cause mortality. Preliminary survival analysis however, found a higher risk of death from ischaemic heart disease among Māori patients in the cohort (see Appendix One) but further work is required to complete this analysis.

Further useful analyses could also investigate whether Māori patients initially admitted to non-procedure hospitals were less likely than non-Māori patients to be transferred or were taken longer to get transferred to tertiary services.

This study was unable to examine what happened to patients admitted after the end of 2008. Any further developments within the Central region's cardiac services since the beginning of 2009 that may affect differences in procedure receipt between Māori are not reflected in these findings.

Conclusion

There are disparities in the receipt of angiography and PCI between Māori and non-Māori patients within the Central region, and these appear to develop within the first few days following admission.

While we were unable to determine the reasons for the differences in procedure receipt between Māori and non-Māori in this study, the processes by which patients are prioritised for revascularisation may play a part and should be further investigated.

Appendix One: Methods

This section provides more detail on the methods used in this study.

What was the population (cohort) that we studied?

This report focuses on Māori and non-Māori adults (over 18 years of age) with an acute first presentation of acute coronary syndrome to a hospital within the Central Region, for the years 2000-2008.

How did we define acute coronary syndrome?

The following tables list the ICD codes used for defining acute coronary syndrome

Table 6.1: ICD codes used for Acute Coronary Syndrome

Description	ICD-9-CM codes	ICD-10-AM codes
Total IHD	410-414	I20-I25
Acute Coronary Syndrome		
• STEMI		
▪ Anterior wall	410.0, 410.1	I21.0, I22.0
▪ Other sites	410.2-410.6, 410.8	I21.1, I21.2, I22.1, I22.8
• Non-STEMI	410.7	I21.4
• MI unspecified	410.9	I21.3, I21.9, I22.9
• Unstable angina	I411.1	I20.0
• Other acute	411.0, 411.81, 411.89, 412	I23, I23.0, I23.2, I23.5, I23.8, I24, I24.0, I24.1, I24.8, I24.9
Non-acute IHD		
▪ Other angina	413, 413.0, 413.1, 413.9	I20.1, I20.8, I20.9
▪ Chronic IHD	414.0, 414.10, 414.11, 414.19, 414.8, 414.9	I25.0, I25.1-I25.6, I25.8, I25.9

IHD = ischaemic heart disease
MI = myocardial infarction (or heart attack)
STEMI = ST-segment elevation myocardial infarction
Non-STEMI = non-ST-segment elevation myocardial infarction

What were our sources of data?

Admissions

Data on publicly funded hospital admissions for IHD in New Zealand between 1 January 2000 and 31 December 2008 was obtained from the New Zealand Health Information Service. To limit our analyses to acute coronary syndrome, we included patients with a primary discharge diagnosis of unstable angina or MI (as listed above). We also limited our dataset to each individual's first hospital admission recorded for acute coronary syndrome, and therefore excluded admissions with previous public (from 1988) or private (1994-1995, 2000-2001) hospital discharges in New Zealand with a primary diagnosis of IHD (ICD-9 code 410–414 or ICD-10 code I20–I25 from July 1999.

In the initial selection of our cohort we included individuals over the age of 18 years with acute routine admissions (Admission type code AC or ZC, admission source code R) thereby excluding those whose first admission was an arranged admission, or elective admission, those on waiting lists, and transfers from other hospitals (AA, AP, WN ,T).

In addition to data on the principal diagnosis (ICD codes listed above) we also obtained data from NZHIS on secondary diagnoses, age, sex, ethnicity, domicile of residence, hospital, type of admission, type of discharge, type of service, date of admission and discharge, and procedures received.

Mortality
Deaths due to IHD were taken from the death register, up until 31 December 2007 with censoring at the first of 31/12/07 or death.

How did we measure ethnicity?
For all of the analyses included in this report, patients were classified as Māori if they were coded as Māori on any of the three ethnicity fields on the hospital admission record, otherwise they were classified as non-Māori. For patients who were transferred to another hospital following their initial presentation, we took their ethnicity as it was recorded in the initial hospital presentation, prior to transfer.

Which procedures were included?
The following tables list the ICD codes used for defining acute coronary syndrome

Table 6.2: ICD codes used for IHD procedures

Description	ICD-9-CM codes	ICD-10-AM codes	
		Block	Codes
Angiography	88.5, 37.21, 37.22, 37.23	668	38215-00, 38218-00, 38218-01, 38218-02
		607	59900-00, 59900-01, 59900-02
		667	38200-00, 38203-00, 38206-00
Angioplasty	36.06, 36.0736.01, 36.02, 36.05	671	35310-00, 35310-01, 35310-02, 35310-03, 35310-04, 35310-05
		670	35304-00, 35305-00, 35304-01, 35305-01
Coronary artery bypass	36.1	672	38497-00 – 38497-03
		673	38497-04-38497-07
		674	38500-00, 38503-00
		675	38500-01, 38503-01
		676	38500-02, 38503-02
		677	38500-03, 38503-03
		678	38500-04, 38503-04, 90201-00, 90201-01

Which comorbid conditions were included?
Co-morbid conditions were selected in consultation with the clinical reference group (Table 8).

Table 6.3: ICD Codes used for analysis of co-morbidities (secondary diagnosis on index admission)

Description	ICD-9-CM codes	ICD-10-AM codes
Heart failure	428	I50
Peripheral vascular disease	440-444	I70-I74, I79.2
Chronic pulmonary disease	491.2, 492, 493.2, 496	J43-J44
Rheumatoid and other inflammatory arthritis	714 (excluding 714.3), 716.5, 716.6	M05-M07, M13
Diabetes mellitus	250	E10-E14
Renal failure	584-586	N17-N19

Cancer		
Obesity	278.0	E66
Dementia	290, 294.1	F00-F03
Other mental health	291-319, excluding 294.1	F04-F99
Smoking history	V15.82	F17.3, F17.4, Z86.43
Smoking	305.1, V15.83	F17 excluding F17.3 and F17.4, Z72

How did we analyse the data?
Included in this report is a very brief description of the methods used to analyse the data.

P values <0.05 were deemed statistically significant. All analyses were undertaken in SAS (version 9.1, SAS Institute Inc., Cary, NC).

Proportional hazards modelling was used to estimate the Māori: non-Māori hazard ratio for procedure receipt (angioplasty, angiography and CABG) adjusted for age, sex, principal diagnosis, co morbidity, and for the procedures available at the hospital they were first admitted to. They were censored (no longer followed up) at death, 31 December 2008, or on receipt of the relevant alternative procedure (i.e no longer followed up for angiogram if received PCI or CABG, no longer followed for PCI if receive CABG and vice versa.

Table 6.4: Central region hospitals that had acute admissions for acute IHD during 2000-2008, with no previous IHD admissions.

Facility	Name	Address
3612	Hawkes Bay Regional Hospital	Omahu Road (aka Hastings Hospital) Hastings
3613	Wairoa Hospital & Health Centre	Kitchener Street Wairoa
3811	Wairau Hospital	Hospital Road Blenheim
3911	Nelson hospital	Tipahi Street Nelson
3917	Motueka Community Hospital	Courtney Street Motueka
3918	Golden Bay Community Hospital	Crn State Highway 60 & Central Takaka Road R D 1 Takaka Golden Bay
3920	Phyllis Moffatt	High Street Motueka
4030	Chatham Islands Community Hospital	Waitangi
4311	Palmerston North Hospital	50 Ruahine Street Palmerston North
4313	Horowhenua Hospital	62 Liverpool Street Levin
5411	Waipukurau Hospital	Porongahau Road Waipukurau
5511	Masterton Hospital	Te Ore Ore Road Masterton
5711	Whanganui Hospital	Heads Road Wanganui
5714	Taihape Rural Health Centre	3 Hospital Road Taihape
5811	Wellington Hospital	Riddiford Street Newtown Wellington
5812	Hutt Hospital	High Street Lower Hutt
5816	Kenepuru Community Hospital	Raiha Street Porirua

Facility	Name	Address
8319	Aroha Care Centre for the Elderly	6 Cooper Street Taita Lower Hutt
8561	Dannevirke Community Hospital	Barraud Street Dannevirke

Procedure centres

Hospitals where study people (acute and other) have received publicly funded procedures are listed in Table 6.5. A few other hospitals have had a few procedures coded. These are assumed to be coding errors.

Table 6. 5: Angiocardiography procedure centres

Hospital	Code	Time
Hawkes Bay Regional Hospital	3612	
Nelson Hospital	3911	
Palmerston North Hospital †	4311	From 6/01 excluding 04 & 05
Wellington Hospital	5811	
Wakefield Hospital ‡	8432	

† few months with none or few in period. 3 months with some in excluded time period

‡ no first admissions to these hospitals for cohort

Table 6.6: Angioplasty procedure centres

Hospital	Code	Note
Nelson Hospital	3911	From 10/07
Wellington Hospital	5811	
Wakefield Hospital ‡	8432	

‡ no first admissions to these hospitals for cohort

Table 6.7: Coronary artery bypass procedure centres

Hospital	Code	Note
Wellington Hospital	5811	
Wakefield Hospital ‡	8432	
Southern Cross Wellington ‡	8471	

‡ no first admissions to these hospitals for cohort

Appendix Two: Survival/Mortality – preliminary results only

For the analysis of survival after admission we followed the individuals in the cohort study until the end of 2007, and found that 78 of the Māori participants (6.3% of the Māori cohort) and 1,320 of the non-Māori participants (9.2 % of the non-Māori cohort population), died from ischaemic heart disease (IHD) (with a primary death diagnosis of either acute or chronic IHD).

Māori patients in the cohort had a 66% higher risk of dying from ischaemic heart disease after their first hospital admission for ACS than non-Māori patients of the same age, sex, and ACS diagnosis. Comorbidities accounted for a quarter of the survival disparity between Māori and non-Māori, with a 48% higher risk of death after taking comorbidities into account (adjusted for comorbid conditions associated with procedure receipt only – further analysis including other comorbidities is required). Deprivation also accounted for a small amount of the survival disparity. However the survival disparity remained significant after adjusting for age, sex, diagnosis, comorbidities and deprivation.

Note: We have not adjusted for procedure receipt in these analyses.

Table 7: Māori/non-Māori hazard ratios for IHD specific mortality following the primary admission for acute coronary syndrome, until December 2007, Central region

	Hazard ratio (95% CI)	P value
Adjusted for age and sex	1.66 (1.31-2.10)	0.0001
Adjusted for age, sex and diagnosis	1.66 (1.31-2.10)	0.0001
Adjusted for age, sex, diagnosis and comorbidity	1.48 (1.17-1.88)	0.001
Adjusted for age, sex, diagnosis, comorbidity and NZDep	1.45 (1.14-1.85)	0.002

Appendix Three: Procedure receipt among patients with diabetes, renal failure, heart failure

When we look at the procedures received by patients in the study that had diabetes, Māori with diabetes have significantly lower receipt of all three procedures categories compared to non-Māori with diabetes (adjusted for age and diagnosis) (Table 8.1). Similar results are found when we consider only patients in the cohort with renal failure (Table 8.2), and heart failure (Table 8.3).

Given that Māori in the cohort have a higher chance of having multiple co-morbid conditions, for each of these analyses we adjust for the other comorbidities that the patients have (Table 2). This has a varying effect on the difference between Māori and non-Māori procedure receipt.

Table 8.1: Māori/Non-Māori hazard ratios for procedure receipt among patients with diabetes, 2000-2008, Central region.

Procedure	Adjusted for age, sex and diagnosis			Adjusted for age, sex and diagnosis and comorbidities		
	HR	(95% CI)	p value	HR	(95% CI)	p value
Diagnostic	0.61	(0.52–0.72)	<0.0001	0.65	(0.55–0.76)	<0.0001
PCI	0.63	(0.49–0.80)	0.0001	0.70	(0.55–0.89)	0.004
CABG	0.56	(0.38–0.82)	0.003	0.56	(0.38–0.83)	0.004

Table 8.2: Māori/Non-Māori hazard ratios for procedure receipt among patients with renal failure, 2000-2008, Central region.

Procedure	Adjusted for age, sex and diagnosis			Adjusted for age, sex and diagnosis and comorbidities		
	HR	(95% CI)	p value	HR	(95% CI)	p value
Diagnostic	0.80	(0.57–1.11)	0.19	0.75	(0.53–1.05)	0.093
PCI	0.87	(0.50–1.52)	0.63	0.84	(0.48–1.50)	0.56
CABG	0.63	(0.29–1.35)	0.24	0.46	(0.21–1.02)	0.056

Table 8.3: Māori/Non-Māori hazard ratios for procedure receipt among patients with heart failure, 2000-2008, Central region.

Procedure	Adjusted for age, sex and diagnosis			Adjusted for age, sex and diagnosis and comorbidities		
	HR	(95% CI)	p value	HR	(95% CI)	p value
Diagnostic	0.76	(0.59–0.97)	0.026	0.79	(0.62–1.01)	0.062
PCI	0.71	(0.47–1.07)	0.10	0.72	(0.48–1.09)	0.12
CABG	0.73	(0.44–1.22)	0.23	0.72	(0.43–1.20)	0.21

Appendix Four: Diabetes and Cardiovascular Disease Quality Improvement Plan Indicators

Table 1: Indicators of quality improvement for proposed priority areas

Setting	Priority area	Measure	
Primary prevention	Risk assessment	Percentage of people who have had five-year CVD risk assessment (any person who has had any previous CVD event is at high risk and requires intensive management)	
	Risk management	Percentage of people identified at risk receiving appropriate management according to established guidelines (effective management requires resources for practice management systems, staff training, and access to counselling and support services)	
		Management measures: • smoking cessation • Green Prescription • dietary advice • statin uptake for patients with CVD risk >15% • aspirin uptake for patients with CVD • warfarin use in high stroke-risk AF	
Treatment of CV events		*Acute coronary syndromes*	*Stroke and TIA*
	Patient delay	Time (hrs) from symptom onset to first medical consult	Time (hrs) from symptom onset to first medical consult
	Treatment delay	Time (hrs) from arrival at hospital until start of thrombolysis or PCI	Time (hrs) from admission until imaging CT/MRI ± US
		Percentage of eligible patients given thrombolysis or direct PCI	Percentage of eligible stroke patients given thrombolysis in experienced centres
			Percentage of people assessed by an organised stroke service
	Clinical assessment and risk stratification	Classification of MI (ST or non-ST), UA For all MI patients, assessment before discharge of: • left ventricular function • stress testing • coronary angiography	Classification of stroke and prioritisation of TIA For all stroke patients: specialist neuro-functional assessment (related to needs and personal environment)
	Revascularisation	Percentage of patients receiving PCI before discharge from admitting or receiving hospital	Consideration of need for carotid, cardiac, other vascular, haematological intervention
		Percentage of patients receiving coronary bypass surgery before discharge from admitting or receiving hospital	
	Discharge medications	• aspirin • statin • beta blocker • aCE inhibitor • clopidogrel • NRT or other smoking cessation aid	• Anti-platelet agent(s), eg, aspirin • blood pressure lowering therapy • statin • warfarin in AF or cardioembolic stroke from valvular disease or recent MI • NRT or other smoking cessation aid
	Rehabilitation (cardiac or stroke)	• referral • attendance • completion	• referral • attendance • completion • environmental rehabilitation/ support (therapeutic and prosthetic intervention, stroke Foundation services)

Note: Bold text indicates priority areas for initial attention.

AF – atrial fibrillation; CT/MRI ± US – computed tomography/magnetic resonance imaging, ultrasound; MI – myocardial infarction; NRT – nicotine replacement therapy; PCI – percutaneous coronary intervention; TIA – Transient ischaemic attack; UA – unstable angina