Summary of Northern Regional Data for Acute Cardiac Events

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

31 October 2010

The following report was prepared by Te Rōpū Rangahau Hauora a Eru Pōmare (Eru Pōmare Māori Health Research Centre)

Acknowledgements

Funding
Health Research Council of New Zealand, within the Health Inequalities Research Programme
Data from NZHIS funded by Central TAS

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Key findings

In our Northern Region cohort study of individuals with a first hospital admission of acute coronary syndrome (ACS) between 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 Northern 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 Northern 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.

In 2008, Dr Matire Harwood presented the national results from the initial stage of this project to the Māori Health Advisory Committee of the Auckland District Health Board based on the years 2000-2004. The MHAC then requested information on the receipt of cardiac procedures for Māori in the Auckland District.

The second stage of the project involved updating the analysis to the period 2000-2008 and conducting a regional analysis. Te Rōpū Rangahau Hauora a Eru Pōmare was therefore invited by He Kamaka Oranga to analyse and present the data for the Auckland district and the Northern region served by the tertiary cardiac services at Auckland Hospital.

Preliminary findings were presented to members of the Auckland Hospital Cardiac Service and the Auckland DHB funding and planning section during October 2010, in collaboration with He Kamaka Oranga.

Aim of the research

To determine if there are ethnic disparities in receipt of cardiac procedures in a cohort of Māori and non-Māori from the Northern region[1] 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 the Northland, Waitemata, Auckland, and Counties Manukau 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.
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

[1] Northern region includes residents within the districts served by Northland, Waitemata, Auckland, and Counties Manukau District Health Boards.

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

The study was informed by a clinical reference group (see Acknowledgements).

Findings

Description of the Northern Region study participants

There were 20,522 people aged over 18 years of age first admitted to a public hospital within the Northern region district health boards (DHBs) with Acute Coronary Syndrome between the years 2000-2008, in a routine acute admission, and were therefore included in the cohort study.

Of these, 1714 (8.4%) were identified as Māori and the remaining 18,808 were classified in the study as non-Māori.

Less than half of the individuals included in the cohort study were female (39.6%).

The mean age for Māori in the cohort was 57.9 years, and for non-Māori was 68.0 years. This age difference will be largely driven by the difference in age structure of the Māori and non-Māori populations.

Māori males were on average 8 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 6,737 individuals in the study who reside in the region of Waitemata DHB, 5788 residents from Counties Manukau, 4756 from Auckland and 2912 from Northland (Table 1).

There were also large differences between the DHBs in the percentage of admissions with ACS which were for Māori patients. In Northland, 19.6% of the residents admitted with ACS were Māori, compared with only 4.4% and 4.8% respectively in Waitemata and Auckland.

For all DHBs, less than half of ACS admissions were for females. When we consider Māori ACS admissions 47.5% were for females compared to 39.8% 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.

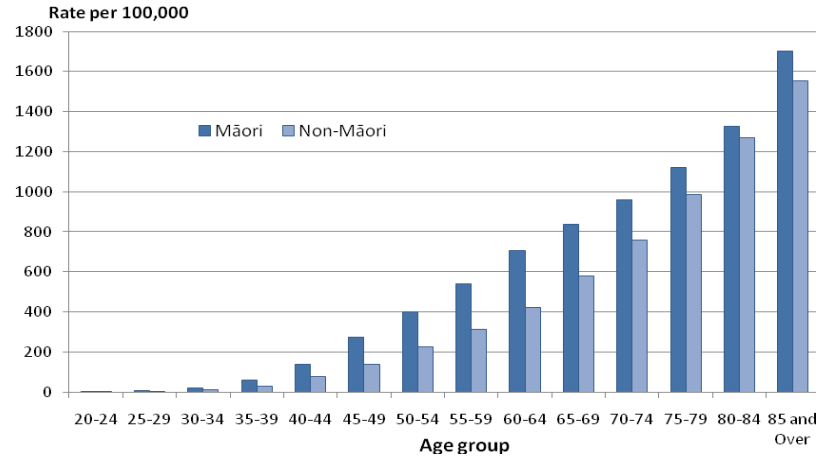
Table 1: Demographics of the Northern Region DHBs residents with Acute Coronary Syndrome admissions, 2000-2008

ACS admissions of Northern region residents		Māori admissions		Female admissions				Mean age	
				Māori		Non-Māori		Māori	Non-Māori
		N	%	N	%	N	%	Yrs	Yrs
Northland	2912	570	19.6	274	48.1	933	39.8	60.4	69.3
Waitemata	6737	295	4.4	128	43.4	2520	39.1	57.4	68.5
Auckland	4756	227	4.8	110	48.5	1803	39.8	57.1	68.8
Counties Manukau	5788	614	10.6	299	48.7	1936	37.4	55.9	66.2
All Northern Region	20193	1706	8.4	811	47.5	7192	38.9	--	--

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 group.

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, Northern region cohort

Comorbidity	Māori (N= 1714)		Non-Māori (N=18808)		Relative rate
	N	%	N	%	RR (95 %CI)
Heart failure	317	18.5	3276	17.4	1.06 (0.96 - 1.18)
Peripheral vascular	56	3.3	679	3.6	0.91 (0.69 - 1.18)
Chronic pulmonary*	144	8.4	932	5.0	**1.70 (1.43 - 2.01)**
Rheumatological	6	0.4	115	0.6	0.57 (0.25 - 1.30)
Diabetes mellitus*	545	31.8	3287	17.5	**1.82 (1.69 - 1.96)**
Renal failure*	209	12.2	1764	9.4	**1.30 (1.14 - 1.49)**
Any Cancer	38	2.2	453	2.4	0.92 (0.66 - 1.28)
Obesity*	242	14.1	874	4.6	**3.04 (2.66 - 3.47)**
Dementia^	15	0.9	357	1.9	**0.46 (0.28 - 0.77)**
Other mental health*	74	4.3	637	3.4	**1.27 (1.01 - 1.61)**
Smoking history^	422	24.6	5222	27.8	**0.89 (0.81 - 0.97)**
Smoking*	741	43.2	3849	20.5	**2.11 (1.99 - 2.25)**
Number of comorbid conditions (excluding smoking and smoking history)					
No comorbidities^	757	44.2	10681	56.8	**0.78 (0.74 - 0.82)**
1 comorbidity*	500	29.2	5027	26.7	**1.09 (1.01 - 1.18)**
2 comorbidities*	284	16.6	2176	11.6	**1.43 (1.28 - 1.60)**
3+ comorbidities*	173	10.1	924	4.9	**2.05 (1.76 - 2.40)**

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

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

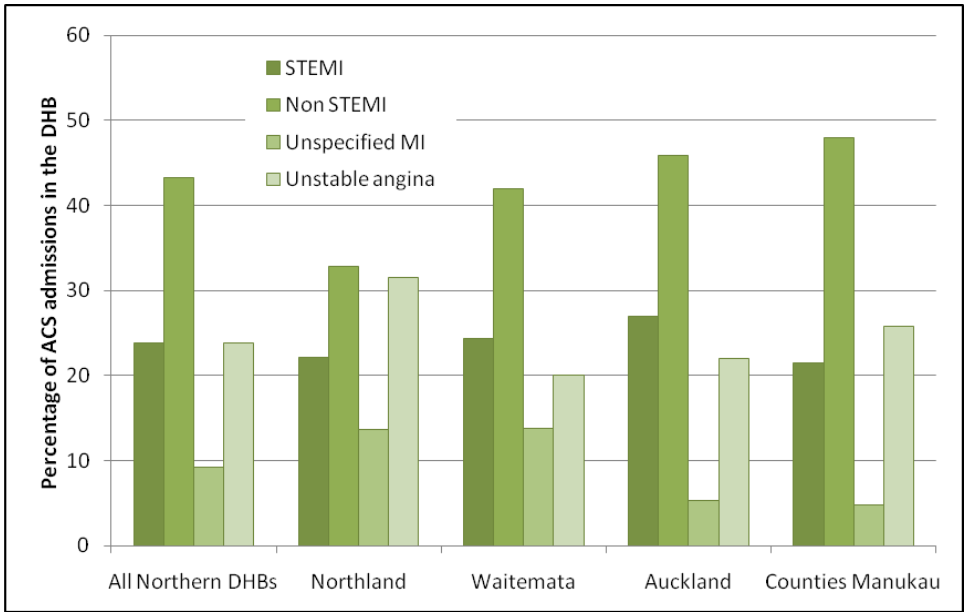
Māori in the Northern cohort were less likely to be recorded as having no comorbid conditions, and more likely to have multiple (2 or 3+) comorbidities recorded compared to non-Māori in the cohort.

Primary ACS diagnoses

Figure 2 demonstrates the distribution of ACS diagnoses within the Northern region cohort by DHB. The pattern is largely consistent between individual DHBs, and that of the total Northern cohort (all Northern region DHBs combined). The largest group of diagnoses is non-ST elevated myocardial infarction (non-STEMI) contributing 38-50%. The smallest contributor is myocardial infarction (MI) with the type unspecified, contributing between 7-11%. 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.

Comment [br1]: Check percents

Figure 2: Distribution of primary diagnoses for people first admitted with ACS, by Northern 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 have a diagnosis of MI unspecified. There was no significant difference between Māori and non-Māori for the diagnosis of unstable angina or non-STEMI.[2]

[2] 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 Northern Region, adjusted for age and sex, 2000-2008

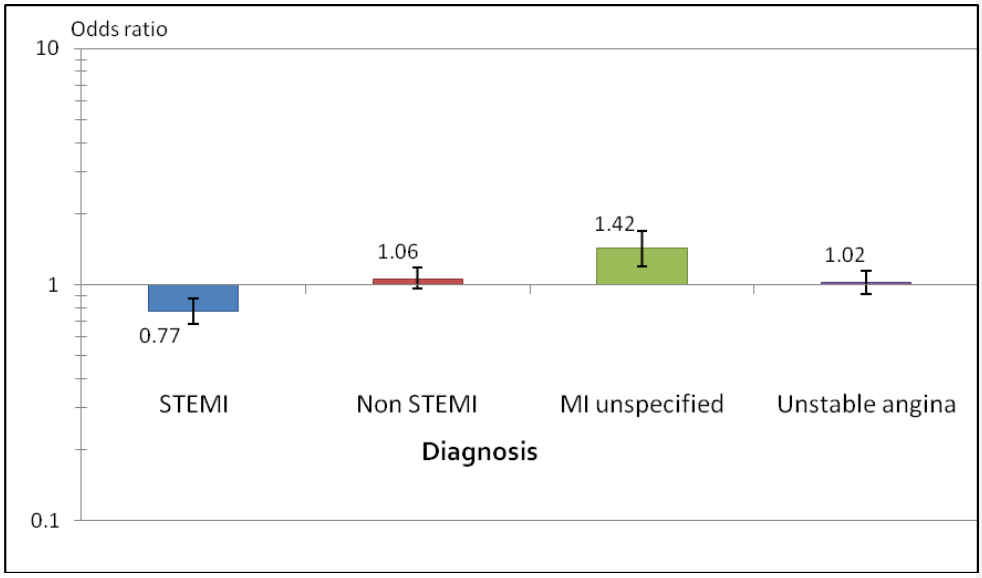


Table 3 shows the number of people with each diagnosis in the Maori and non-Maori cohorts, and by sex, and the crude distribution (unadjusted for age). STEMI was a more common diagnosis for males than females and unstable angina less common.

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

	Māori N= 1714		Non-Māori N=18808	
Principal diagnosis	n	%	n	**%**
Total				
STEMI	366	21.5	4487	23.9
Non-STEMI	721	42.1	8175	43.5
Unspecified MI	167	9.7	1714	9.1
Unstable angina	460	26.8	4432	26.8
Females	***N=812***		***N=7315***	
STEMI	118	14.5	1409	19.3
Non-STEMI	342	42.1	3157	43.2
Unspecified MI	74	9.1	735	10.1
Unstable angina	278	34.2	2014	27.5
Males	***N=902***		***N=11493***	
STEMI	248	27.5	3078	26.8
Non-STEMI	379	42.0	5018	43.7
Unspecified MI	93	10.3	979	8.5
Unstable angina	182	20.2	2418	21.0

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)

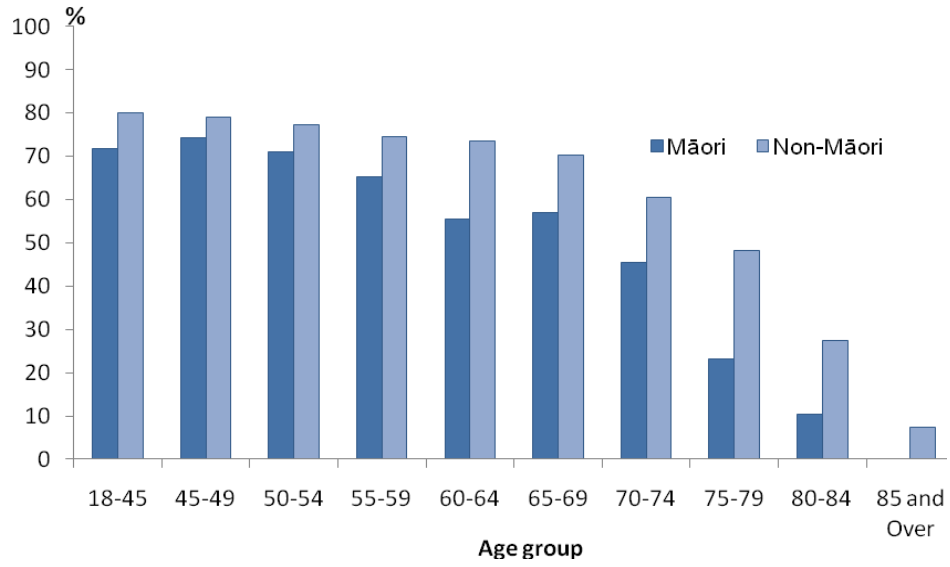
Therapeutic procedures
1. time from admission to angioplasty censoring after receipt of CABG
2. time from admission to CABG censoring after receipt of angioplasty.

Rates of procedures

Figure 4 shows the proportion of Māori and non-Māori in the 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.

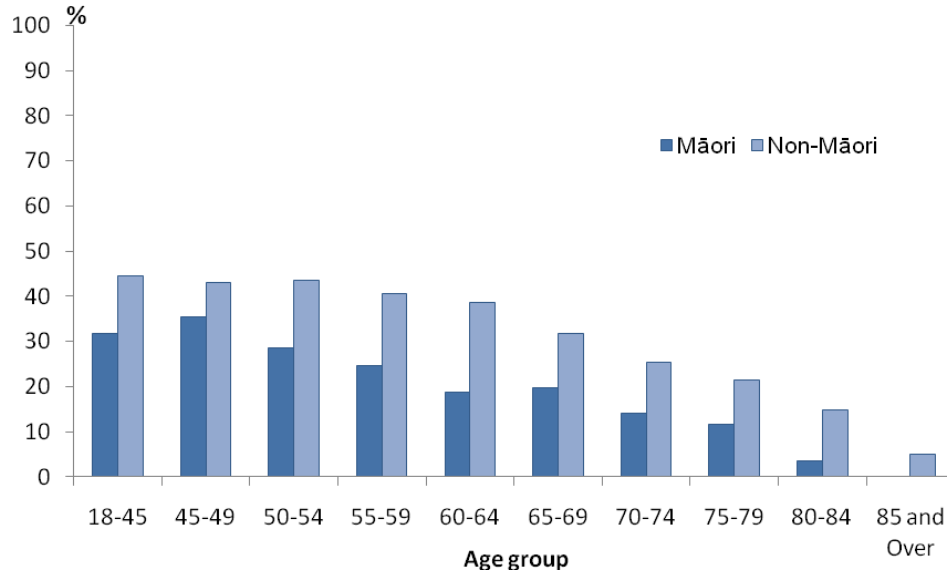
Because there is a relationship between age and procedure receipt we will later adjust for age in the hazard ratios in order to compare the chances of procedure receipt for Māori patients compared to non-Māori patients of the same age and sex.

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

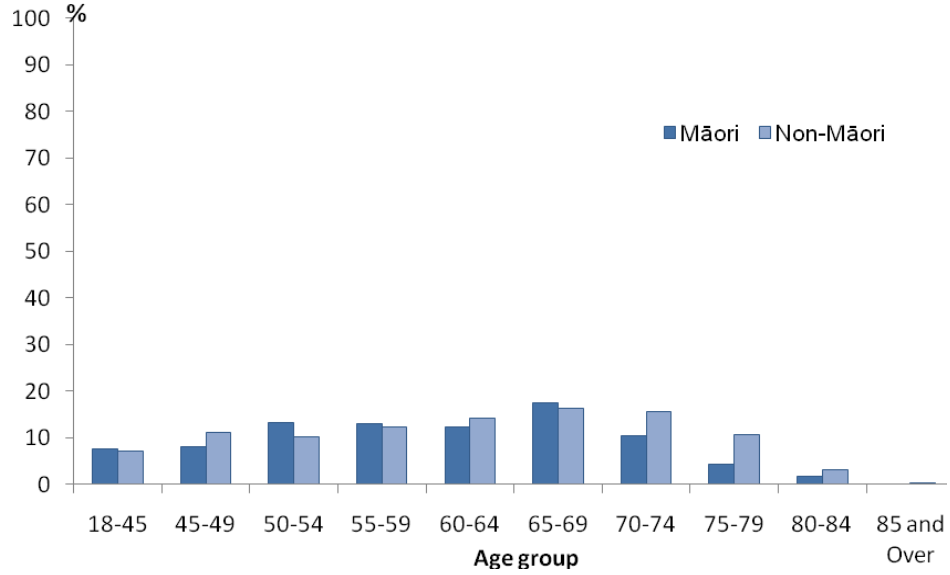


The proportion of Māori and non-Māori patients in the Northern region cohort who received CABG any time after admission is lower than the proportion who received diagnostic procedures or PCI. The pattern by age is also different from the patterns for diagnostic procedures or PCI, with less of a clear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

Among Māori the chance of receiving CABG was fairly constant between the ages 50 -74 years, apart from a higher rate in the 65-69 age group, and dropped off steeply from age 70 years. Among non-Māori the chances of receiving CABG were highest at ages 65-74 years, and dropped off steeply from 75 years.

There was no consistent pattern of lower or higher receipt of CABG by Māori or non-Māori across the age groups (except from age 70 and over).

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



There are 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 co morbid 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 (77% as likely as non-Māori) or PCI (65% 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.

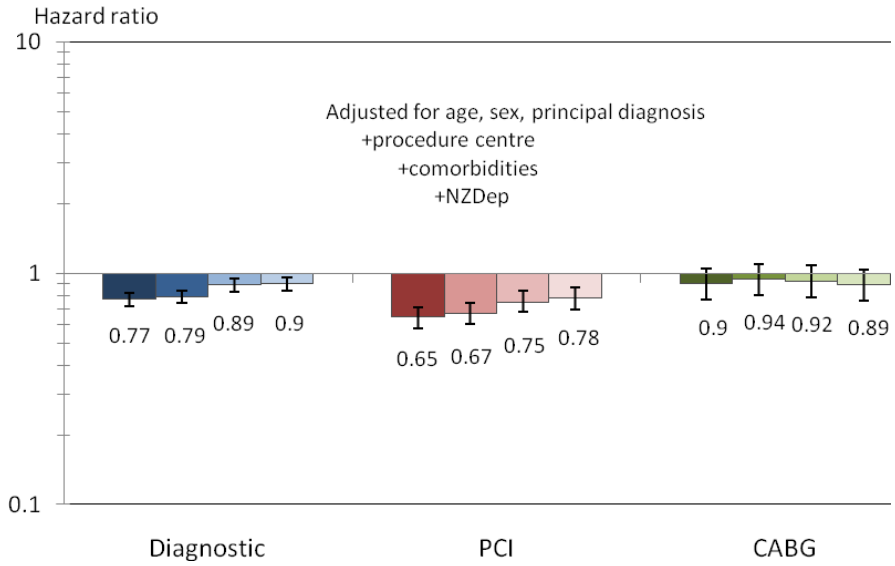
In addition to adjusting for age, sex and diagnosis, the second bar for each procedure also adjusts for procedure centre, which is whether the hospital of initial admission provided the procedure in consideration (diagnostic, PCI or CABG). For both diagnostic procedure and PCI, the second bar is slightly 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 (79% as likely as non-Māori) and PCI (67% 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 additionally 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 11% lower and PCI 25% 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 10% 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, Northern 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 Northern 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 Northern 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, there were differences by DHB. The greatest disparity occurred in Northland DHB where Māori had only 50% the chance of non-Māori in the DHB to receive PCI. The smallest disparity occurred for Counties Manukau however, Māori in the DHB still had lower chances of receipt of PCI than non-Māori (78%).

There was no consistent pattern of differential receipt of CABG between Māori and non-Māori, and no significant differences between the Northern DHBs.

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

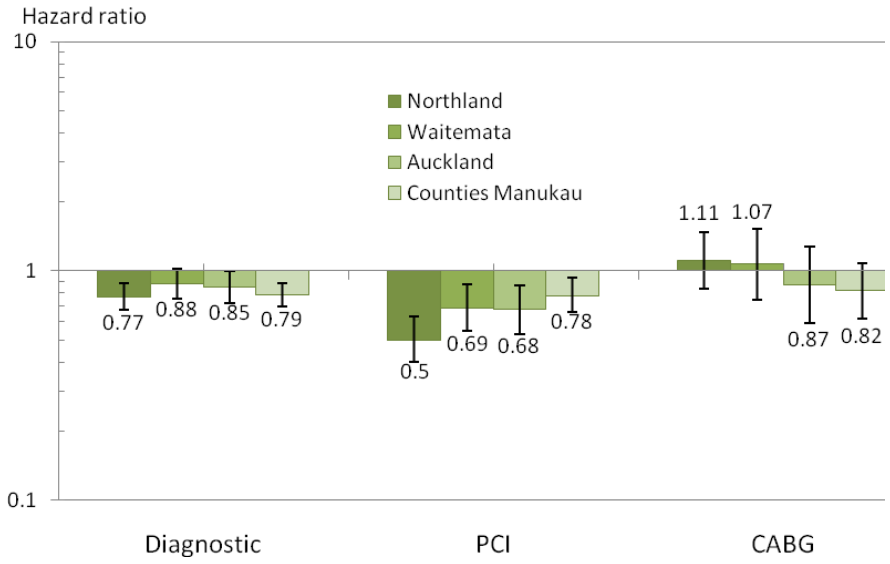


Table 4 shows the number and proportions of people receiving procedures in each DHB, unadjusted for age or sex.

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

Procedure	DHB of residence	Māori		Non-Māori	
		n	%	n	%
Diagnostic	Northland	292	51.2	1125	48.0
	Waitemata	196	66.4	3718	57.7
	Auckland	160	70.5	2732	60.3
	Counties Manukau	374	60.9	2906	56.2
PCI	Northland	95	16.7	566	24.2
	Waitemata	79	26.8	1909	29.6
	Auckland	70	30.8	1455	32.1
	Counties Manukau	160	26.1	1384	26.7

CABG	Northland	67	11.8	216	9.2
	Waitemata	33	11.2	624	9.7
	Auckland	28	12.3	519	11.5
	Counties Manukau	58	9.4	535	10.3

Procedure receipt over time after first admission

There are 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 receipt 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, 60% of Māori patients had received a diagnostic procedure, rising to around 65% by 5 years. For non-Māori, 60% in this age group had received a diagnostic procedure within 2 weeks, rising to over 70% by 1 year and up to ~75% 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 2 weeks after admission 30% of non-Māori had received PCI, rising steadily over the next several years to reach 40% 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 only reaching less than 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 around 2 weeks after admission.

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

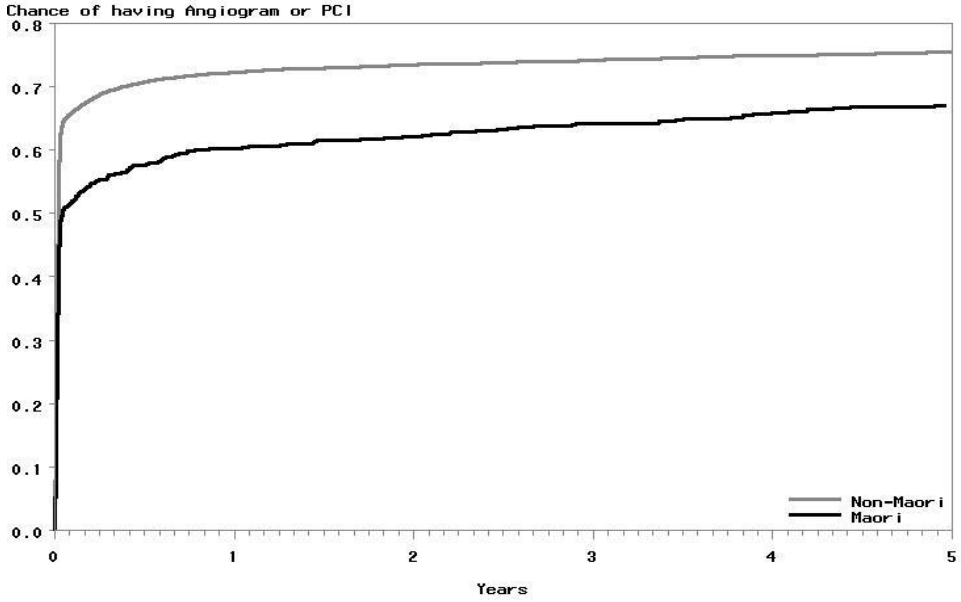


Figure 10: Receipt of diagnostic procedures (first of angiogram or PCI), for those aged 50-70 years within the <u>first three weeks</u> following admission, Northern region

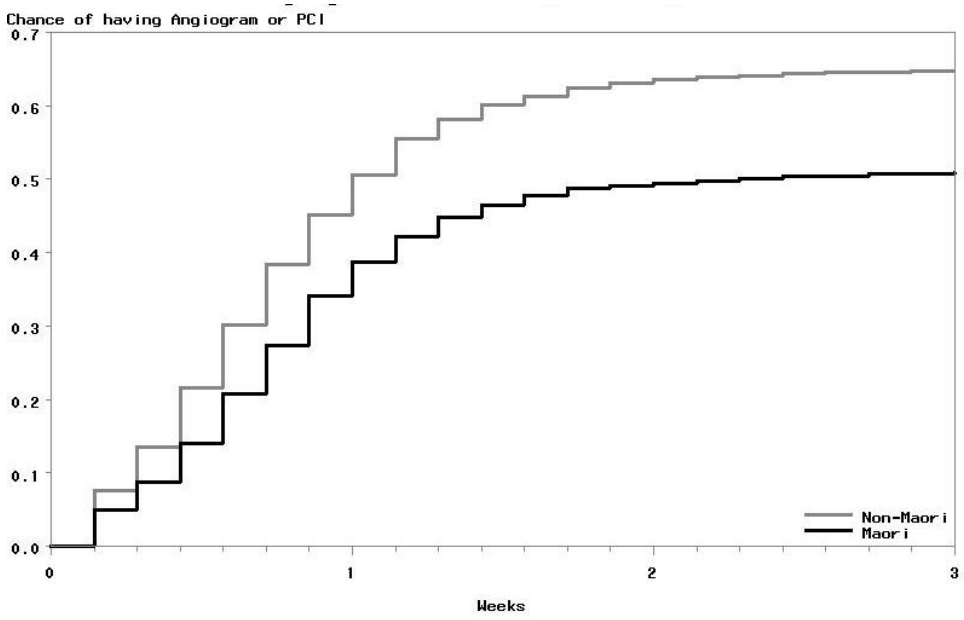


Figure 11: Receipt of PCI for those aged 50-70 years, up to five years following admission, Northern region

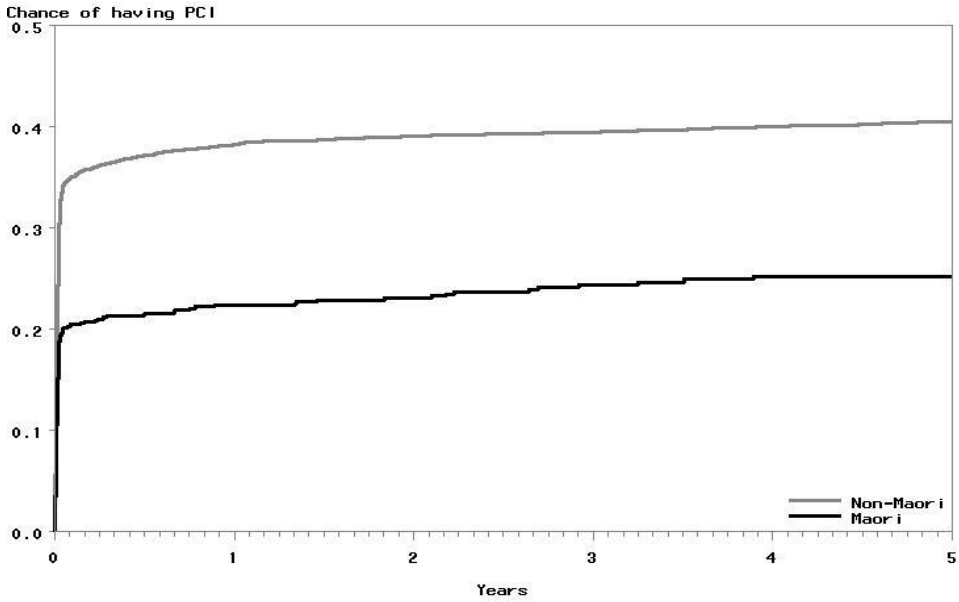


Figure 12: Receipt of PCI for those aged 50-70 years, within the <u>first three weeks</u> following admission, Northern region

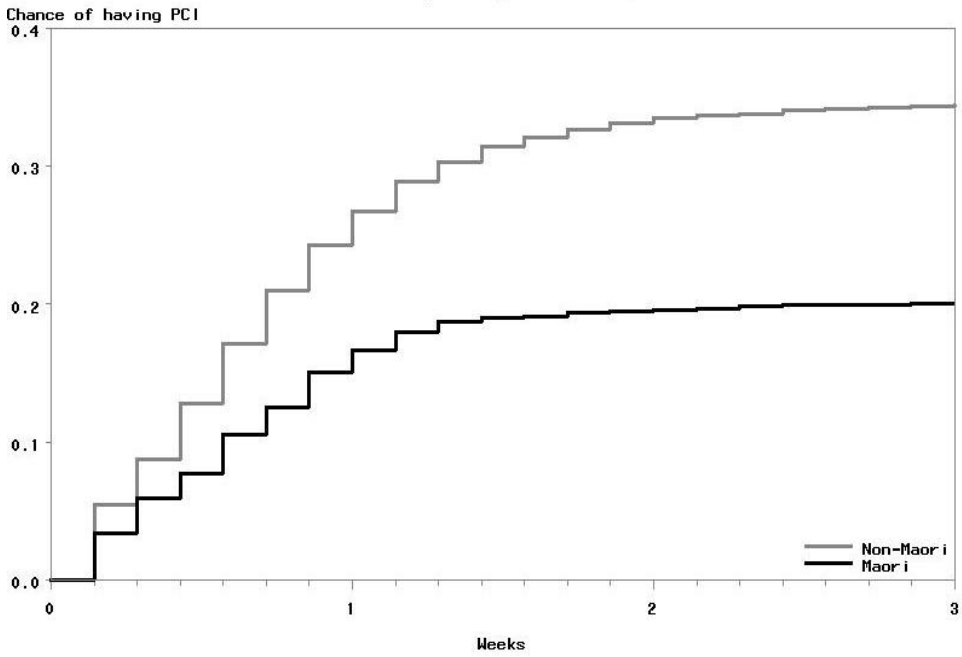


Figure 13: Receipt of CABG for those aged 50-70 years, up to five years following admission, Northern region

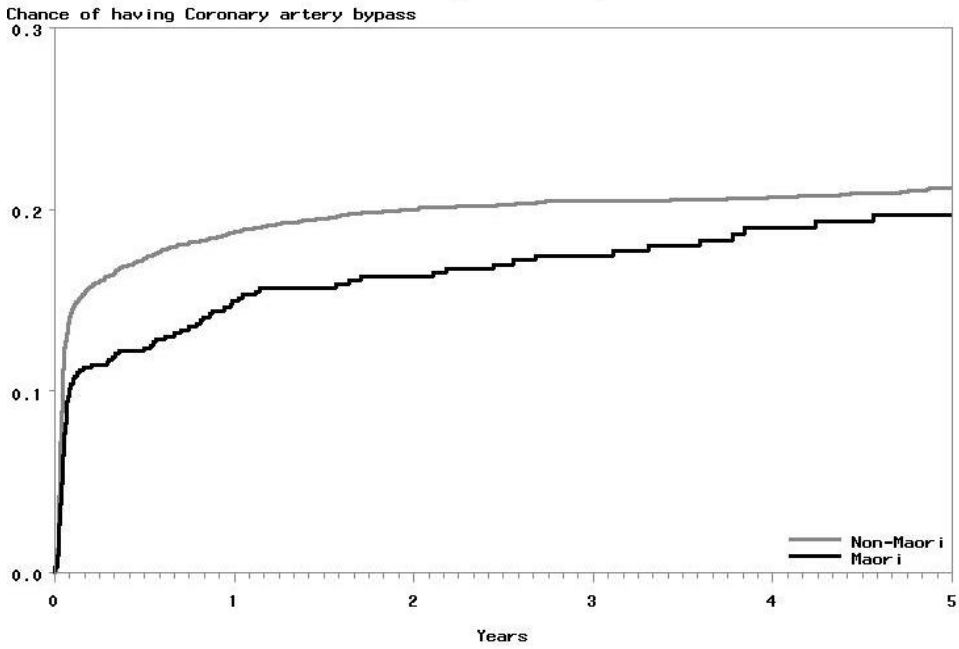
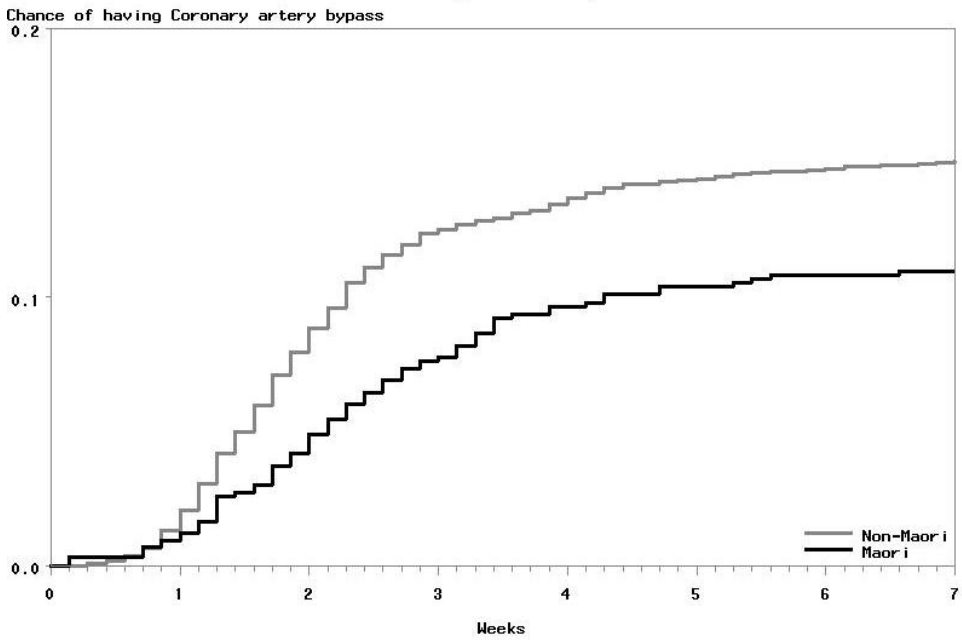


Figure 14: Receipt of CABG for those aged 50-70 years, within the <u>first seven weeks</u> following admission, Northern region



Changes in the rate of procedures received over time

The number and rate of procedures offered in Northern region DHBs changed over the study period. There was an increase in the rate of receipt of angiography 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 a 16% increase in the receipt of diagnostic procedures per year, but among non-Māori there was an 18% increase per year and so the disparity widened over the period 2000-2008 (with the Māori relative chance decreasing from 80% to 69% the non-Māori chances).

For PCI, Māori had a 17% increase per year while non-Māori rates increased by 19% per year, so there was a widening gap between Māori and non-Māori receipt of PCI.

For CABG, there was a decrease in the rate of CABG received by Māori by 2% per year but there was an increase in non-Māori of 2% per year, and a widening gap (although not statistically significant).

Table 5: Trends in procedures over time, proportional hazards modelling adjusted for age sex and diagnosis, Northern region

Procedure	Difference in rate of change	Māori rate of change	Non-Māori rate of change	Māori:non-Māori 2000	Māori:non-Māori 2008
	P	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)
Diagnostic*	0.15	1.16 (1.13–1.19)	1.18 (1.17–1.19)	0.80 (0.70–0.91)	0.69 (0.62–0.77)
PCI	0.48	1.17 (1.12–1.21)	1.19 (1.17–1.20)	0.67 (0.54–0.83)	0.60 (0.50–0.70)
CABG	0.15	0.98 (0.93–1.04)	1.02 (1.00–1.04)	1.05 (0.81–1.36)	0.74 (0.55–1.01)

* 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 four Northern region DHBs served by the tertiary cardiac service at Auckland Hospital– Northland, Waitemata, Auckland, and Counties Manukau.

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 10% lower for Māori.

Access to revascularisation procedures increased significantly during the study period for residents of the northern 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 required to complete this analysis.

Further useful analyses could also investigate whether Maori patients initially admitted to non-procedure hospitals were less likely than non-Maori 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 Northern region's cardiac services since the beginning of 2009 that may affect differences in procedure receipt between Maori are not reflected in these findings.

Conclusion

There are disparities in the receipt of angiography and PCI between Maori and non-Maori patients within the Northern region, including Auckland DHB, and 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 are likely to 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 Northern 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 1.1: 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

We obtained data on publicly funded hospital admissions for IHD in New Zealand between 1 January 2000 and 31 December 2008 from NZHIS. 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 with arranged admissions, elective admissions, 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 1.2: 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 1.3: ICD Codes used for analysis of co-morbidities [secondary diagnosis on index admission; primary diagnosis on previous admission; secondary diagnosis on previous 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.

Table 1.4: Northern region hospitals that had acute admissions for acute IHD during 2000-2008, with no previous IHD admissions.

Facility	Name	Address
3211	Auckland Hospital	Park Road Grafton Auckland
3212	Greenlane Clinical Centre	Greenlane West Road Greenlane
3214	Middlemore	Hospital Road Otahuhu Auckland
3215	North Shore Hospital	Shakespeare Road Takapuna Auckland
3216	Waitakere Hospital	55 Lincoln Road Henderson Auckland
3220	Pukekohe Maternity Unit	Tuakau Road Pukekohe Auckland
3232	Franklin Memorial	Kitchener Road Waiuku Pukekohe
3260	Auckland City Hospital	Park Road Grafton Auckland
4111	Whangarei Hospital	Maunu Road Whangarei
4112	Kaitaia Hospital	29 Redan Road Kaitaia
4113	Dargaville Hospital	Awakino Road Dargaville
4114	Bay of Islands Hospital	Hospital Road Kawakawa
4115	Hokianga Health Enterprise Trust	163 Parnell Street Rawene

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

Table1. 5: Angiocardiography procedure centres

Hospital	Code	Time

Auckland Hospital	3211	Ended 6/03
Greenlane Clinical Centre	3212	Ended 6/03
Middlemore *	3214	From 10/05
North Shore Hospital	3215	From 11/07
Waitakere Hospital	3216	From 11/07
Auckland City Hospital	3260	Started 6/03
Mercy Hospital Auckland ‡	8233	
Ascot Hospital ‡	8595	

* 300-400 2000-2004 then more 860, 1200, 1200 to 1400 in 2008
‡ no first admissions to these hospitals for cohort

Table 1.6: Angioplasty procedure centres

Hospital	Code	Note
Greenlane Clinical Centre	3212	Ended 6/03
Middlemore *	3214	From 12/05
North Shore Hospital	3215	From 11/07
Waitakere Hospital	3216	From 11/07
Auckland City Hospital	3260	Started 6/03
Mercy Hospital Auckland ‡	8233	

* 1/month 2000-mid2004, to Nov05 12/month, then 30/month
‡ no first admissions to these hospitals for cohort

Table 1.7: Coronary artery bypass procedure centres

Hospital	Code	Note
Greenlane Clinical Centre	3212	Ended 6/03
Auckland City Hospital	3260	Started 6/03
Mercy Hospital Auckland ‡	8233	
Ascot Hospital ‡	8595	

‡ 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 91 of the Māori participants (6.0% of the Māori cohort) and 1,260 of the non-Māori participants (7.5 % 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 103% 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 81% 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 quarter 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 2.1: Proportional hazards modelling of Māori versus non-Māori IHD specific mortality following the primary admission for acute coronary syndrome, until December 2007, Northern region.

	Hazard ratio	95% CI	P value
Adjusted for age and sex	2.01	(1.61–2.50)	<0.0001
Adjusted for age, sex and diagnosis	2.03	(1.63–2.53)	<0.0001
Adjusted for age, sex, diagnosis and comorbidity	1.81	(1.45–2.27)	<0.0001
Adjusted for age, sex, diagnosis, comorbidity and NZDep	1.62	(1.29–2.04)	<0.0001

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

Table 3.1: Māori/Non-Māori hazard ratios for procedure receipt among patients with diabetes, 2000-2008, Northern 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	0.72	(0.64–0.82)	<0.0001	0.77	(0.68–0.87)	<0.0001
PCI	0.65	(0.53–0.80)	<0.0001	0.69	(0.56–0.86)	0.0008
CABG	0.70	(0.55–0.91)	0.006	0.77	(0.60–0.99)	0.043

Table 3.2: Māori/Non-Māori hazard ratios for procedure receipt among patients with renal failure, 2000-2008, Northern 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	0.63(0.49–0.81)	0.0003	0.65(0.50–0.84)	0.001
PCI	0.52(0.33–0.84)	0.008	0.55(0.34–0.90)	0.016
CABG	0.79 (0.49–1.26)	0.31	0.79 (0.49–1.27)	0.33

Table 3.3: Māori/Non-Māori hazard ratios for procedure receipt among patients with heart failure, 2000-2008, Northern 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	0.67(0.56–0.81)	<0.0001	0.72(0.60–0.88)	0.001
PCI	0.41(0.27–0.62)	<0.0001	0.43(0.29–0.66)	<0.0001
CABG	0.79 (0.56–1.11)	0.17	0.85 (0.60–1.20)	0.35

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