

# Management of suspected acute coronary syndrome patients admitted to cardiology or non-cardiology services at Auckland City Hospital: implications for future national data collection

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## ABSTRACT

**AIMS:** To review the number, characteristics and clinical management of suspected ACS patients admitted to cardiology and non-cardiology services at Auckland City Hospital, to assess differences between these services and to assess the number who would potentially be enrolled in the All New Zealand Acute Coronary Syndrome (ACS) Quality Improvement Programme (ANZACS-QI) database.

**METHODS:** Auckland City Hospital patient data was extracted from the Australia and New Zealand ACS 'SNAPSHOT' audit, performed over 14 days in May 2012.

**RESULTS:** There were 121 suspected ACS admissions to Auckland City hospital during the audit period, with 45 (37%) patients directly managed by the cardiology service, and 76 (63%) patients cared for by non-cardiology services. Based on the subsequent discharge diagnosis, the cardiology service had more patients with definite ACS than the non-cardiology services; 27/45 (60%) compared to 16/76 (21%), difference (95%CI) 39% (22–56),  $P < 0.0001$ . Cardiology ACS patients were more likely to undergo echocardiography; 15/27 (56%) compared to 2/16 (13%), difference 42% (18–68),  $P = 0.0089$ , coronary angiography; 21/27 (78%) compared to 3/16 (19%), difference (95%CI) 59% (34–84),  $P = 0.0003$ , coronary revascularisation; 18/27 (67%) compared to 3/16 (19%), difference (95%CI) 48% (22–74),  $P = 0.004$ , and be discharged on two antiplatelet agents; 18/26 (69%) compared to 3/15 (20%), difference (95%CI) 49% (22–76),  $P = 0.0036$ , or an ACEI/ARB; 20/26 (77%) compared to 5/15 (33%), difference (95%CI) 44% (15–72),  $P = 0.0088$ .

**CONCLUSIONS:** In patients with a discharge diagnosis of definite ACS, those managed by non-cardiology services were less likely to receive guideline-recommended investigations, and management, in this relatively small cohort study. About one-third of all ACS patients are managed by non-cardiology services and would not be recorded by the ANZACS-QI database.

Cardiovascular disease causes 33% of mortality in New Zealand and is the most common cause of death.<sup>1</sup> Audits of the care of patients with acute coronary syndrome (ACS) are very important to evaluate whether patient diagnosis and management adhere to guidelines.<sup>2–5</sup> The Regional Cardiac Society of New Zealand

ACS audit group undertook three comprehensive audits of clinical practice in 2002, 2007 and 2012<sup>6–8</sup> and contributed to the “momentum for change” for the improved management of ACS patients. Significant improvements in service provision have been recorded.<sup>9,10</sup> The All New Zealand ACS Quality Improvement Programme (AN-

ZACS-QI) funded by the Ministry of Health of New Zealand was then implemented in 2013 to prospectively record characteristics of all ACS admissions and is an important step forward in achieving this goal.<sup>11</sup> However, a limitation is that this database does not capture ACS patients who are under the care of non-cardiology services during the admission, which means the data may not be fully representative of all ACS patients admitted to a New Zealand hospital.

We reviewed the Auckland City Hospital subgroup of patients admitted with a suspected ACS during a two-week period as part of the third New Zealand 'SNAPSHOT' ACS audit in 2012, to assess how clinical service admission influenced the management of these patients, and to record the number potentially not enrolled in the ANZACS-QI programme.

## Methods

### Study population

This study focused on the ACS cohort from Auckland City Hospital that contributed to the New Zealand ACS 2012 audit, which prospectively enrolled all patients admitted with a suspected ACS to a New Zealand Hospital over 14 days in May 2012, with methods previously described in detail.<sup>6-8</sup> This third National New Zealand audit was also the first bi-national 'SNAPSHOT' ACS study, which also included ACS admissions to Australian hospitals over the same period.<sup>12</sup> The two-week audit period was chosen as a compromise between the need to collect sufficient patient numbers for a representative cohort and the ability of unfunded clinicians and nurses to collect patient data, and was undertaken from 00.00 hours on Monday 14 May to 24.00 hours on Sunday 27 May 2012. The study was designed and run by clinicians with support from the Cardiac Society of Australia and New Zealand. Ethics approval was obtained from the National Multicentre Ethics Committee, with a consent waiver being given, as the study was an audit of clinical management.

### Data definitions and collection

All sites, including Auckland City Hospital were supplied with written study protocols

and definitions for all characteristics, which were prospectively collected; these included patient demographics, comorbidities, investigations, treatment, discharge diagnosis and outcomes. For this current study, patient hospital records were reviewed and patients were categorised into two groups: those admitted for all or some of their hospitalisation under the cardiology service, and those who were managed by non-cardiology services.

A 'discharge diagnosis' was determined by the local clinical team and coded based on the following categories: a) ST-segment elevation myocardial infarction (STEMI) or new left bundle branch block (LBBB), b) non-STEMI (NSTEMI), c) unstable angina pectoris (UAP), d) chest pain, 'unlikely ischaemic' and e) other cause: for those patients who had a clear alternative diagnosis.<sup>6-8,12</sup> Outcomes included in-hospital death and major adverse cardiovascular events (MACE), a composite of death, myocardial infarction, stroke, cardiac arrest or worsening heart failure. Morbid obesity was defined as body mass index >35kg/m<sup>2</sup> or if 'obesity' was recorded in the medical record.

### Statistical analysis

Data are presented as mean (standard deviation), median (interquartile range) or frequency (percentage) as indicated. Comparisons between groups for categorical variables were made using Fisher's exact test/Monte Carlo estimation of exact P values where the Cochrane requirements for a chi-square test were not met and between non-normally distributed continuous variables using the Wilcoxon/Kruskall Wallis test. Confidence intervals for rates were calculated using a mid P method ([www.openepi.com](http://www.openepi.com), accessed 16/06/2017).

Asymptotic 95% confidence intervals were calculated for the pairwise differences in proportions and the Wilson method was used for calculating confidence intervals around median differences. All tests were two tailed, with p value <0.05 considered significant. No adjustment to the overall significance level was made. Unless otherwise stated, analyses were performed using SAS (v9.4, SAS Institute Inc., Cary, NC, USA).

## Results

A total of 121 patients were admitted to Auckland City Hospital with a suspected ACS over the 14-day audit period. There were 76 (63%) non-cardiology and 45 (37%) cardiology patients. Of the 45 cardiology patients, 40 were admitted and discharged solely from cardiology, two were admitted by cardiology but later discharged from another specialty, and three were admitted to a non-cardiology service but subsequently transferred

to and discharged from cardiology. Of the 76 non-cardiology patients, three underwent a coronary angiogram, but were not directly managed by the cardiology service.

Patients admitted to the cardiology service were of similar mean age (years), 66 (SD16) compared to 67 (SD13), difference (95% CI) 1.1 (-4.3–6.5), but were more likely to have a history of stroke or transient ischaemic attack (20% vs 5.3%),  $P=0.016$ , have elevated serum troponins (66% vs 25%,  $P<0.0001$ ), and be of Māori ethnicity (8.9% vs 0%) (Table 1).

**Table 1:** Baseline demographic data of all patients with suspected or confirmed ACS admitted to Auckland City Hospital (n=121).

	Non-cardiology	Cardiology	Difference cardiology-Non-cardiology (95% CI)	P
	N/76 (%)	N/45 (%)		
Sex (female)	38 (50)	14 (31)	-19 (-36– -1.3)	0.057
Family history of CVD	14 (18)	4 (8.9)	-9.5 (-22–2.5)	0.19
<b>Ethnicity</b>				
Caucasian	50 (66)	33 (73)	7.5 (-9.2–24)	0.038
Māori	0	4 (8.9)	8.9 (0.6–17)	
Pacific Island	7 (9.2)	4 (8.9)	-0.3 (-11–10)	
Asian	9 (12)	1 (2.2)	-9.6 (-18– -1.2)	
Indian	7 (9.2)	3 (6.7)	-2.7 (-12–7.2)	
<b>Tobacco smoking</b>				
Current	9 (12)	11 (24)	13 (-1.9–27)	0.19
Past	26 (34)	14 (31)	-3.1 (-20–14)	
Never	41 (54)	20 (44)	-9.5 (-28–8.8)	
<b>Clinical factors</b>				
Hypertension	49 (65)	29 (64)	-0.03 (-18–18)	0.99
Diabetes mellitus	11 (15)	7 (16)	1.1 (-12–14)	0.99
Dyslipidaemia	40 (53)	29 (64)	12 (-6.1–30)	0.26
Atrial fibrillation	11 (15)	4 (8.9)	-5.6 (-17–5.9)	0.41
Renal impairment	8 (11)	6 (13)	2.8 (-9.3–15)	0.77
Morbid obesity	7 (9.2)	7 (16)	6.4 (-6.1–19)	0.38
Chronic lung disease	2 (2.6)	2 (4.4)	-1.8 (-5.2–8.8)	0.63
Active cancer limiting life	1 (1.3)	1 (2.2)	0.9 (-4.1–5.9)	0.99
Major cognitive impairment	2 (2.6)	1 (2.2)	-0.4 (-6.0–5.2)	0.99
Significant frailty	2 (2.6)	1 (2.2)	-0.4 (-6.0–5.2)	0.99
<b>Prior vascular disease</b>				
Prior myocardial infarction	11 (15)	10 (22)	7.8 (-6.8–22)	0.32
Prior CABG	9 (12)	2 (4.4)	-7.4 (-17–2.0)	0.21
Prior TIA/stroke	4 (5.3)	9 (20)	15 (2.0–27)	0.016
Prior PAD	5 (6.6)	3 (6.7)	0.1 (-9.1–9.3)	0.99
<b>Troponin</b>				
Troponin elevation	19 (25)	30 (66)	42 (25–59)	<0.0001

ACS: Acute coronary syndrome, SD: Standard deviation CVD: Cardiovascular disease, CABG: Coronary artery bypass graft, TIA: Transient ischaemic attack, PAD: Peripheral artery disease.

**Table 2:** Investigations and outcomes. All patients (n=121).

Procedure	Non-cardiology	Cardiology	Difference cardiology-Non-cardiology (95% CI)	P
	N/76 (%)	N/45 (%)		
Chest x-ray	68 (90)	44 (98)	8.3 (0.2–16)	0.15
Echocardiogram	8 (11)	23 (51)	41 (24–57)	<0.0001
Stress echocardiogram	2 (2.6)	1 (2.2)	-0.4 (-6.0–5.2)	0.99
Exercise test	12 (16)	5 (11)	-4.7 (-17–7.6)	0.59
Coronary angiogram	3 (3.9)	25 (56)	52 (36–67)	<0.0001
Length of stay, days mean (SD)	2.1 (3.9)	5.2 (5.4)	3.0 (1.3–4.8)	0.0008
In-hospital death	2 (2.6)	2 (4.4)	1.8 (-5.2–8.8)	0.63

SD: Standard deviation, q1, q3: first quartile, third quartile.

Patients admitted to the cardiology service were more likely to receive an echocardiogram (51% v 11%,  $P<0.0001$ ), or an invasive coronary angiogram (56% v 3.9%,  $P<0.0001$ ) as part of inpatient investigations (Table 2).

A definite ACS was diagnosed in 60% of patients under the cardiology service and 21% of patients under non-cardiology services (Table 3). Among those without the diagnosis of ACS at discharge, non-cardiology service patients were more likely to have a diagnosis of ‘chest pain, unlikely ischaemic’ (64% vs 16%).

The baseline characteristics of the patients with definite ACS were similar between cardiology and non-cardiology services, except that cardiology patients were more

likely to be female (81% v 37%,  $P=0.007$ ) and were more likely to have an elevated troponin (93% v 31%,  $P<0.0001$ ) (Table 4). The mean age (years) of patients with definite ACS was 69 (SD 13) and 71 (SD 15) ( $P=0.69$ ), for those admitted to cardiology or non-cardiology services respectively. For patients with a definite ACS, revascularisation procedures by either percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG) surgery was more common in the cardiology service group (67% v 19%,  $P=0.004$ ) (Table 5). The hospital stay was longer for the definite ACS patients in the cardiology group compared to the non-cardiology service group (5.1 vs 2.4 days,  $P=0.04$ ). In-hospital death was not significantly different (3.7% vs 6.3%,  $P=0.99$ ).

**Table 3:** Discharge diagnoses for all suspected ACS patients (n=121) following suspected or confirmed ACS admission.

Service	Non-cardiology	Cardiology	Difference cardiology-Non-cardiology (95% CI)	P
	N/76 (%)	N/45 (%)		
<b>Discharge diagnosis</b>				
• STEMI/LBBB	1 (1.3)	10 (22)	21 (8.5–33)	<0.0001
• NSTEMI	4 (5.3)	12 (27)	21 (7.5–35)	
• Unstable angina	11 (15)	5 (11)	-3.4 (-15–8.8)	
• Chest pain, unlikely ischaemic	49 (64)	7 (16)	-49 (-64– -34)	
• Other diagnosis	11 (15)	11 (24)	10 (-4.9–25)	
<b>ACS discharge diagnosis</b>	16 (21)	27 (60)	39 (22 to 56)	<0.0001

STEMI/LBBB: ST segment elevation myocardial infarction/left bundle branch block ACS: Acute coronary syndrome, NSTEMI: Non-ST segment elevation myocardial infarction CI: Confidence interval.

**Table 4:** Baseline demographic data of patients discharged with a definite diagnosis of ACS to Auckland City Hospital (n=43).

	<b>Non-cardiology</b>	<b>Cardiology</b>	<b>Difference cardiology-Non-cardiology (95% CI)</b>	<b>P</b>
	<b>N/16 (%)</b>	<b>N/27 (%)</b>		
Sex (female)	6 (38)	22 (81)	44 (76–72)	0.007
Family history of CVD	1 (6.3)	3 (11)	4.9 (-12–22)	0.08
<b>Ethnicity</b>				
• Caucasian	11 (69)	20 (74)	5.3 (-23–33)	0.13
• Māori	0	3 (11)	11 (-0.7–23)	
• Pacific Island	3 (19)	2 (7.4)	-11 (-33–10)	
• Asian	2 (13)	0	-13 (-29–3.7)	
• Indian	0	2 (7.4)	7.4 (-2.5–17)	
<b>Tobacco smoking</b>				
• Current	4 (25)	8 (30)	4.6 (-23–32)	0.85
• Past	4 (25)	8 (30)	4.6 (-23–32)	
• Never	8 (50)	11 (41)	-9.3 (-40–21)	
<b>Clinical factors</b>				
Hypertension	12 (75)	16 (59)	-16 (-44–12)	0.34
Diabetes mellitus	3 (19)	4 (15)	-3.9 (-27–19)	0.99
Dyslipidaemia	10 (63)	20 (74)	12 (-17–40)	0.19
Atrial fibrillation	4 (25)	1 (3.7)	-21 (-44–1.1)	0.056
Renal impairment	1 (6)	5 (19)	12 (-6.5–31)	0.39
Morbid obesity	1 (6.3)	0	-6.3 (-18–5.6)	0.37
Chronic lung disease	0	2 (7.4)	7.4 (-2.5–17)	0.52
Active cancer limiting life	1 (6.3)	1 (3.7)	-2.6 (-16–11)	0.99
Major cognitive impairment	1 (6.3)	1 (3.7)	-2.6 (-16–11)	0.99
Significant frailty	0	1 (3.7)	3.7 (-3.4–11)	0.99
<b>Prior vascular disease</b>				
Prior myocardial infarction	6 (38)	6 (22)	-15 (-44–13)	0.31
Prior CABG	4 (25)	1 (3.7)	-21 (-43–1.1)	0.056
Prior TIA/Stroke	2 (13)	6 (22)	9.7 (-13–32)	0.69
Prior PAD	1 (6.3)	3 (11)	4.9 (-12–22)	0.99
<b>Troponin</b>				
Troponin elevation	5 (31)	25 (93)	61 (37–86)	<0.0001
<b>GRACE risk score</b>				
GRACE risk score mean (SD)	146 (45)	164 (32)	17 (-7.4–41)	0.17
GRACE Score $\geq$ 140	4 (25)	5 (19)	-6.5 (-32–19)	0.71

ACS: Acute coronary syndrome, SD: Standard deviation, CVD: Cardiovascular disease, TIA: Transient ischaemic attack, CABG: Coronary artery bypass grafts, PAD: Peripheral artery disease.

**Table 5:** Investigations, revascularisations and outcomes. ACS Patients (n=43).

Procedure	Non-cardiology	Cardiology	Difference cardiology-Non-cardiology (95% CI)	P
	N/16 (%)	N/27 (%)		
Chest x-ray	16 (100)	26 (96)	-3.7 (-11–3.4)	0.99
Echocardiogram	2 (13)	15 (56)	43 (18–68)	0.0089
Stress echocardiogram	0	0	-	-
Exercise test	4 (25)	5 (19)	-6.5 (-32, 19)	0.71
Coronary angiogram	3 (19)	21(78)	59 (34–84)	0.0003
PCI	3 (19)	16 (59)	41 (14–67)	0.01
CABG	0	2 (7.4)	7.4 (-2.5–17)	0.52
PCI or CABG	3 (19)	18 (67)	48 (22–74)	0.004
In hospital death	1 (6.3)	1 (3.7)	-2.6 (-16–11)	0.99
Length of stay, days mean (SD)	2.4 (2.8)	5.1 (5.2)	2.7 (0.1–5.3)	0.04

ACS: Acute coronary syndrome, PCI: percutaneous coronary intervention, CABG: Coronary artery bypass graft, SD: Standard deviation, q1, q3: first quartile third quartile.

Among patients who had a definite ACS and survived to discharge, patients under the cardiology service were more likely to be prescribed a second antiplatelet agent (73% vs 27%,  $P=0.008$ ) and an angiotensin converting enzyme (ACE) inhibitor or angiotensin receptor blocking (ARB) agent (77% vs 33%,  $P=0.0088$ ) while prescription of other medications was similar (Table 6).

## Discussion

This study has several important findings. The majority of patients, 63%, admitted to a large New Zealand hospital with a diagnosis of *suspected* ACS were not primarily managed by the cardiology service, and these patients were less likely to undergo cardiac investigations to determine the diagnosis. Further, about one-third of patients,

37% of the *confirmed* ACS cases were treated by a non-cardiology service, and potentially would not have been captured by the ANZACS-QI database. These observations have important implications for the overall management, data collection and auditing methods for ACS in New Zealand.

Perhaps not surprisingly, patients under the care of the cardiology service had received more cardiac investigations, as these patients would have a greater overall pre-test probability of an ACS and be more likely to have an elevated troponin level. Hence, a higher proportion of patients under the care of the cardiology service with a *suspected* ACS had a final diagnosis of ACS. In addition, it might be speculated that patients in the cardiology department might have an easier access to cardiology investigations.

**Table 6:** Discharge medications in ACS patients discharged alive (n=41).

Procedure	Non-cardiology	Cardiology	Difference cardiology-Non-cardiology (95% CI)	P
Number (%)	N/15 (%)	N/26 (%)		
Aspirin (1)	12 (80)	22 (85)	4.6 (-20–29)	0.69
Other anti-platelet (2)	4 (27)	19 (73)	46 (18–75)	0.0080
Dual antiplatelet (1 & 2)	3 (20)	18 (69)	49 (22–76)	0.0036
Beta blocker	13 (87)	21 (81)	-5.9 (-29–17)	0.99
ACE-I/ARB	5 (33)	20 (77)	44 (15–72)	0.0088
Statin	11 (73)	23 (89)	15 (-10–41)	0.39

ACE-I: Angiotensin converting enzyme inhibitor, ARB: Angiotensin receptor blocker.

Hospital services are working with significant pressure to discharge patients, and optimal assessment, while an inpatient, is not always possible. Patients under the care of non-cardiology services were more likely to be discharged without further investigations, and were more often given the less satisfactory diagnosis of 'unlikely ischaemia'. It is notable that the majority (64%) of *suspected* ACS patients in the non-cardiology service were discharged without a definite diagnosis. Limited access to important cardiac investigations such as echocardiography, computed tomographic (CT) coronary angiography and invasive coronary angiography is a significant barrier to making a definite diagnosis.

It is also notable that *suspected* ACS patients had a significantly shorter length of stay when managed by non-cardiology services (two days) compared to those managed by the cardiology service (five days); the reasons for the shorter stay are not known. It might be speculated that access to investigations requires an in-hospital wait, and if the pressure to discharge patients becomes overwhelming, then the test may not be undertaken or even requested. Unfortunately, we were not able to examine these aspects of management with these observational data. However, whatever the reason, the 'unlikely ischaemia' cohort is an important patient group as they have an increased risk of cardiovascular events for at least five years after discharge,<sup>13</sup> and the suspicion remains that some may actually have been ACS patients.

There were few statistically significant differences between the clinical characteristics of the two groups. In addition, there were relatively few differences between groups that might be clinically or scientifically important but missed because of lack of precision (eg, non-statistically significant differences of about 7% in prior myocardial infarction/CABG). Nevertheless it is possible that unknown factors will have influenced the clinical decision to admit a patient under a cardiology or a non-cardiology service. For example, some patients may have been frailer and it was felt more appropriate for conservative management in the first instance, and hence they were not admitted to the cardiology service. However, it is also possible that a relative lack of cardiology or

coronary care unit (CCU) beds has resulted in non-cardiology management. Unfortunately, we were not able to examine these aspects of management with these observational data. Patients presenting with a 'low risk' NSTEMI should be monitored for up to 24 hours, or until revascularisation occurs, or, if at 'high risk', should be monitored for more than 24 hours.<sup>5</sup> However, cardiac monitoring cannot be given to most patients outside of the cardiology service.

In a busy, large hospital, there are no clearly defined criteria to guide the decision to admit a patient with a suspected ACS to a cardiology or non-cardiology service. We might speculate that the pivotal factor is the number of beds available in the cardiology department or CCU. If these beds are already full, the admitting clinical team needs to access a non-cardiology bed. Other influences to this decision may be subtle variations in practice of many junior and senior medical staff, as well as additional influences from the patients and their relatives. Although not "arbitrary", there is no consistent approach, and with the complexities of medical presentation and hospital patient loads, where a patient is actually admitted may never be a decision which is able to be strictly 'guideline managed'. Nonetheless, the suspicion remains that limited funding of the more expensive CCU beds leads to some of the patients not being able to access this facility. Patients with a diagnosis of a *definite* ACS were more likely to receive coronary revascularisation if they were under the care of the cardiology service than under the care of a non-cardiology service. Revascularisation of ACS patients has significantly changed the prognosis of ACS patients.<sup>5</sup> It would be of concern if appropriate ACS patients admitted to a non-cardiology service were not managed with this revascularisation strategy.

Another important finding is the discrepancy in the discharge medications prescribed between cardiology and non-cardiology ACS patients. Guidelines recommend one year of dual antiplatelet therapy in all patients with ACS, whether UAP, NSTEMI or STEMI, and regardless of treatment strategy: with or without revascularisation.<sup>2-5,14,15</sup> Despite this, only 69% of cardiology patients and 20% of non-cardiology patients received dual anti-platelet therapy on discharge.

Although a small number of ACS patients would have an elevated bleeding risk or adverse effects to these medications, or were planned for palliative management, these reasons are unlikely to account for all of the patients not receiving dual anti-platelet therapy on discharge. Similarly, ACE inhibitors and ARBs play an important role in ACS patient management, particularly in those with hypertension and an impaired left ventricular function, but were prescribed in only 33% of non-cardiology service ACS patients compared to 77% of cardiology service ACS patients in this audit.

These findings have important implications for the management of ACS patients in New Zealand. Significant differences may exist between the investigations and interventions offered to ACS patients presenting to large metropolitan hospitals depending on their admission to a cardiology or a non-cardiology service. It is certainly possible that these issues are less (or more) prominent in smaller New Zealand centres, but data are not available. Hence our study may not translate to all hospitals across New Zealand.

We have highlighted the potential benefits for a patient receiving cardiology service care. The potential benefits of a patient receiving non-cardiology care may include more attention to non-cardiology pathologies when in hospital, and a shorter hospital stay. Unfortunately we were not able to examine these aspects of management with these observational data.

The ANZACS-QI programme is funded by the New Zealand Ministry of Health and has made significant advances in prospective recording of data on ACS patients under inpatient cardiology services. However, if a significant number of ACS patients managed by non-cardiology services are not included in the ANZACS-QI audit, their omission could potentially bias both the performance indicators of management (non-invasive and invasive) and the reported outcomes of ACS patients in New Zealand. To address this issue, patients with an ACS diagnosis under non-cardiology services would also need to

be enrolled to the ANZACS-QI database to increase the robustness of the programme.

### Study limitations

A significant limitation of this study is that these are observational data (albeit prospectively collected) from a single-centre, with a small sample size and therefore potentially low statistical power, originally from a two-week bi-national audit. Multiple statistical comparisons between the groups have the potential for the introduction of type 1 errors (findings from chance alone), and a relatively small sample size can mean that small, but potentially clinically important differences could be missed (type 2 error). Nonetheless, the patients admitted to the non-cardiology services did have some clinical differences to those admitted to the cardiology service, and observed rates of investigation and management may result from this. These findings may not be generalisable to smaller and/or rural hospitals, and those without a 24 hour cardiac catheterisation laboratory service. Follow-up data after hospital discharge for patients was also limited.

## Conclusions

Our study found that two-thirds of *suspected* ACS patients admitted to Auckland City Hospital were not directly managed by the cardiology service. These patients were found to be less likely to undergo both non-invasive and invasive cardiac imaging. In addition, for those patients admitted to a non-cardiology service with a *confirmed* ACS, they were less likely to receive guideline-directed ACS medical therapy and revascularisation. Furthermore, approximately one-third of all patients with a *confirmed* ACS as their discharge diagnosis who were admitted to a non-cardiology service would potentially not be enrolled in the ANZACS-QI database. ACS audit is an appropriate tool for improving service delivery through identifying deviations from best practice, but it should be applied equally across all ACS patients and so should also include those who are admitted to non-cardiology services.

**Competing interests:**

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