The influence of travelling to hospital by ambulance on reperfusion time and outcomes for patients with STEMI

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In Australia, an estimated 12.7% of patients with ST-elevation myocardial infarction (STEMI) die or have recurrent myocardial infarctions within 30 days of diagnosis.[1] Prompt reperfusion reduces morbidity and mortality, and guidelines consequently aim to minimise the time between symptom onset and reperfusion.[1-3] Patients with chest pain may arrange their own transport to an emergency department or travel by ambulance. The risk period is shorter for patients without access to a defibrillator when they travel by ambulance, and they receive initial management more promptly. In Australia, only one in two patients with STEMI calls an ambulance.[4] Characterising patients less likely to call an ambulance would inform targeted public health efforts to improve this situation.

We analysed data contributed by 43 hospitals across Australia to the Cooperative National Registry of Acute Coronary Care, Guideline Adherence and Clinical Events (CONCORDANCE)[5] for patients with confirmed STEMI who presented to these hospitals during 23 February 2009 – 31 December 2017. We excluded patients who experienced out-of-hospital cardiac

Baseline characteristics and times to reperfusion of 2765 patients who presented with STEMI to CONCORDANCE hospitals, 2009–2017

Characteristic	Transport to hospital		P
	Ambulance	Other means	
Number of patients	1616 (58.4%)	1149 (41.6%)	
Age (years), median (IQR)	64 (54–74)	59 (51–67)	< 0.001
Sex (men)	1140 (71%)	933 (81%)	< 0.001
English as first language	1383 (86%)	959 (83%)	0.44
Prior myocardial infarction	252 (16%)	151 (13%)	0.046
Prior heart failure	49 (3%)	27 (2%)	0.27
Prior percutaneous coronary intervention	177 (11%)	116 (10%)	0.46
Prior coronary artery bypass graft	52 (3%)	26 (2%)	0.10
Prior atrial fibrillation	96 (6%)	30 (3%)	< 0.001
Prior bleeding	17 (1%)	14 (1%)	0.63
Chronic renal failure	73 (5%)	42 (4%)	0.17
Prior stroke/transient ischaemic attack	94 (6%)	32 (3%)	< 0.001
Diabetes	321 (20%)	232 (20%)	0.80
Hypertension	853 (53%)	534 (47%)	< 0.001
Dyslipidaemia	696 (43%)	473 (41%)	0.21
Family history of coronary heart disease	514 (32%)	477 (42%)	< 0.001
Grace risk score (Fox), median (IQR)	114 (95–135)	102 (85–119)	< 0.001
Reperfusion modality			
Primary percutaneous coronary intervention	919 (57%)	486 (42%)	< 0.001
Fibrinolysis	434 (27%)	442 (38%)	< 0.001
None	320 (20%)	273 (24%)	0.010
Hospital arrival to reperfusion (h), median (IQR)			
Primary percutaneous coronary intervention	1.2 (0.7–2.1)	2.1 (1.4–6.1)	< 0.001
Fibrinolysis	0.6 (0.3–1.3)	0.8 (0.5–1.3)	0.002

IQR = interquartile range; STEMI = ST-elevation myocardial infarction. ◆

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arrest or cardiogenic shock. We compared the clinical characteristics, time to reperfusion, and hospital outcomes, including death and major adverse cardiovascular events (MACE) — cardiac death, myocardial infarction, heart failure, or shock — for patients who arrived by ambulance or otherwise, after adjusting for Global Registry of Acute Coronary Events (GRACE) risk score[6] at baseline. The statistical significance of differences in categorical variables was assessed in Rao–Scott χ^2 tests and that of continuous variables in Wilcoxon rank-sum tests. For adjusted analyses, we used multivariable logistic regression models in a generalised estimating equation (GEE) framework, adjusted for clustering by hospital. Analyses were conducted in SAS 9.4. Ethics approval for the study was granted by the Concord Repatriation General Hospital Human Research Ethics Committee (reference, HREC/08/CRGH/180).

Of 2765 patients who presented with STEMI to CONCORDANCE hospitals during 2009–2017, 1616 (58.4%) arrived by ambulance and 1149 (41.6%) by other means. The median age of patients arriving by ambulance (64 years; interquartile range [IQR], 54–74 years) was higher than for the other patients (59 years; IQR, 51–67 years), and the proportions with hypertension, a family history of coronary heart disease, or prior myocardial infarction, atrial fibrillation, or stroke/transient ischaemic attack were larger (Box).

Time between arrival at hospital and reperfusion (primary percutaneous intervention or fibrinolysis) was significantly shorter for patients who arrived by ambulance than for other patients (Box). After adjusting for GRACE risk score, the odds of death (adjusted odds ratio [aOR], 1.16; 95% confidence interval [CI], 0.65–2.08) and MACE (aOR, 0.89; 95% CI, 0.72–1.10) were similar for the two patient groups (Supporting Information).

Our analysis of data from a large Australian registry indicates that fewer than 60% of patients with STEMI arrive at hospital by ambulance; those who do have a higher median age and larger proportions have histories of cardiovascular disease. Importantly, their median time to reperfusion is shorter than for those not arriving by ambulance, probably because STEMI is diagnosed by electrocardiography during their journey to the hospital, which facilitates priming of emergency departments (for fibrinolysis) and catheterisation laboratories (for percutaneous coronary intervention).

Despite the less favourable risk profiles of patients who arrive by ambulance, their hospital outcomes are comparable with those of patients who present directly to hospital, presumably because of their more rapid access to reperfusion.

Our finding that patients with STEMI who are older and have more comorbid conditions are more likely to call an ambulance is not novel,[7] but does indicate that this has not changed in recent years. This underscores the value of calling an ambulance when chest pain develops, and suggest that this public health message should be more actively promoted.

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5 Aliprandi-Costa B, Ranasinghe I, Turnbull F, et al. The design and rationale of the Australian Cooperative National Registry of Acute Coronary care, Guideline Adherence and Clinical Events (CONCORDANCE). *Heart Lung Circ* 2013; 22: 533–541.

6 Fox KAA, Dabbous OH, Goldberg RJ, et al. Prediction of risk of death and myocardial infarction in the six months after presentation with acute coronary syndrome: prospective multinational observational study (GRACE). *BMJ* 2006; 333: 1091.

7 Kerr D, Holden D, Smith J, et al. Predictors of ambulance use in patients with acute myocardial infarction in Australia. *Emerg Med J* 2006; 23: 948–952. ∎

Supporting Information

Additional Supporting Information is included with the online version of this article.