ETHNIC DIFFERENCES IN SEEKING MEDICAL CARE FOR CHEST PAIN AMONG CULTURALLY AND LINGUISTICALLY DIVERSE POPULATIONS

Time, Ethnicity and Delay (TED) study

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Statement of Original Authorship

'I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.'

Kannikar Wechkunanukul Date

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5. **Wechkunanukul, K**, Grantham, H, Teubner, D, Hyun, KK & Clark, RA 2016, 'Presenting characteristics and processing times for culturally and linguistically diverse (CALD) patients with chest pain in an emergency department: Time, Ethnicity, and Delay (TED) Study II', International Journal of Cardiology, vol. 220, pp. 901-8.

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5. Hyun, KK, Redfern, J, Woodward, M, Briffa, T, Chew, DP, Ellis, C, French, J, Astley, C, Gamble, G, Nallaiah, K, Howell, T, Lintern, K, Clark, R, **Wechkunanukul, K** & Brieger, D 2016, 'Is There Inequity in Hospital Care Among Patients With Acute Coronary Syndrome Who Are Proficient and Not Proficient in English Language?: Analysis of the SNAPSHOT ACS Study', Journal of Cardiovascular Nursing, vol. Publish Ahead of Print.

Presentations

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2. **Wechkunanukul, K**, Grantham, H & Clark, R 2016, 'Presenting Characteristics and Processing Times for Culturally and Linguistically Diverse (CALD) Patients with Chest Pain in an Emergency Department: Time, Ethnicity and Delay (TED) Study II. The 64th Annual Scientific Meeting of the Cardiac Society of Australia and New Zealand in Adelaide, Australia, 4-7 August 2016, accepted for oral presentation in Allied Health Prize session.

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Awards and certificates (Appendix I)

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5. 2013 Comprehensive Systematic Review Training Programme, The Joanna Briggs Institute

Summary

Background

Delay in seeking medical care for chest pain in the general population is well documented and may adversely impact on patient outcomes. To date there has been limited knowledge of differences in seeking medical care for chest pain among culturally and linguistically diverse (CALD) populations.

Methodology

The Time, Ethnicity, and Delay (TED) study was a triangulation of three distinct research approaches aimed to investigate differences in seeking medical care for chest pain among CALD populations. The process of triangulation in the TED study involved:

TED I: a systematic review to determine the association between ethnicity and delay time in seeking medical care for chest pain globally

TED II: a cross-sectional analysis of an Emergency Department Information System (EDIS) dataset which focused on the differences in the characteristics and processing times between CALD and Australian-born patients with chest pain

TED III: a retrospective medical record review which aimed to determine the differences in care-seeking behaviours during the suspected ACS events among all ethnic groups living in Australia.

Results

The systematic review (TED I) found global reports of an association between ethnicity and a delay time n seeking medical care for chest pain, with patients from some ethnic groups (e.g. Black, Asian, Hispanic and South Asian) took a longer time than those of the majority population.

TED II study revealed that CALD patients were older than the Australian patients (mean ± SD; 62 ± 18.4 years vs 56 ± 19.6 years, $p < 0.001$). There was no difference in ambulance utilisation (41.7% vs 41.1%, $p = 0.679$). There was no significant difference in times taken to receive treatment in ED, but CALD patients spent a longer time in ED compare to the Australian-born population (median 5.4 (2.9, 7.7) vs 4.3 (0.5, 7.0) hours, $p < 0.001$). There was a low rate of concordance with three chest

pain related standards (ambulance use, Triage priority 1 or 2 and time to treatment ≤10 minutes) from the guidelines (the Guidelines for the management of acute coronary syndromes 2006 and the Guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments) in both groups, but it did not differ significantly (12.5% vs 13.1%, p = 0.556). CALD status was a significant predictor of the guideline concordance. CALD patients were 22% (95% CI, 0.65, 0.95, p=0.015) less likely to receive the guideline management for chest pain.

The ethnic differences in care-seeking behaviour during suspected ACS events were found in TED III. The median decision time (hours) ranged from 1.5 (Australian) to 4.5 (Sub-Saharan African). Five ethnic groups had significantly longer decision times compared to Australian, including Sub-Saharan African (4.5 (1.8, 14.3) vs 1.5 (0.6, 4.5), p=0.001); North African and Middle Eastern (4.1 vs 1.5 (0.6, 4.5), p <0.013); South-East Asian (3.9 vs 1.5 (0.6, 4.5), p =0.001); North-East Asian (3.0 vs 1.5, (0.6, 4.5), p <0.006); and Oceanian (2.4 (1.0, 7.0) vs 1.5 (0.6, 4.5), p = 0.035). The median prehospital delay time (hours) ranged between 2.5 (1.0, 10.7) (Southern and Eastern European) and 6.0 (2.3, 20.6) (Sub-Saharan African). Only two ethnic groups had their delay time differ significantly from Australian; the Sub-Saharan African (6.0 (2.3, 20.6) vs 3.2 (1.4, 8.8) hours, p=0.025) and the South-East Asian (5.3 (3.0, 22.3) vs 3.2 (1.4, 8.8) hours, p=0.012) groups.

Decision time accounted for 58.4% of prehospital delay time. There was no difference in ambulance utilization between ethnic and Australian groups. CALD patients were 60% less likely to seek medical care within one hour when experiencing chest pain (95% CI, 0.23, 0.68, p=0.001). CALD patients had a higher readmission rate than Australians at 30 days and 6 months.

Conclusions

The outcomes of TED study have demonstrated an association between ethnicity and delay in seeking medical care for chest pain globally and in the area studies in Australia. The ethnic differences in responding to chest pain, particularly decision time were found, and ethnicity had a significant impact on patients' delay. The initial treatment in ED was equally provided to all patients, but CALD patients spent a longer time in ED and had a higher readmission rate than Australian patients reviewed in this study.

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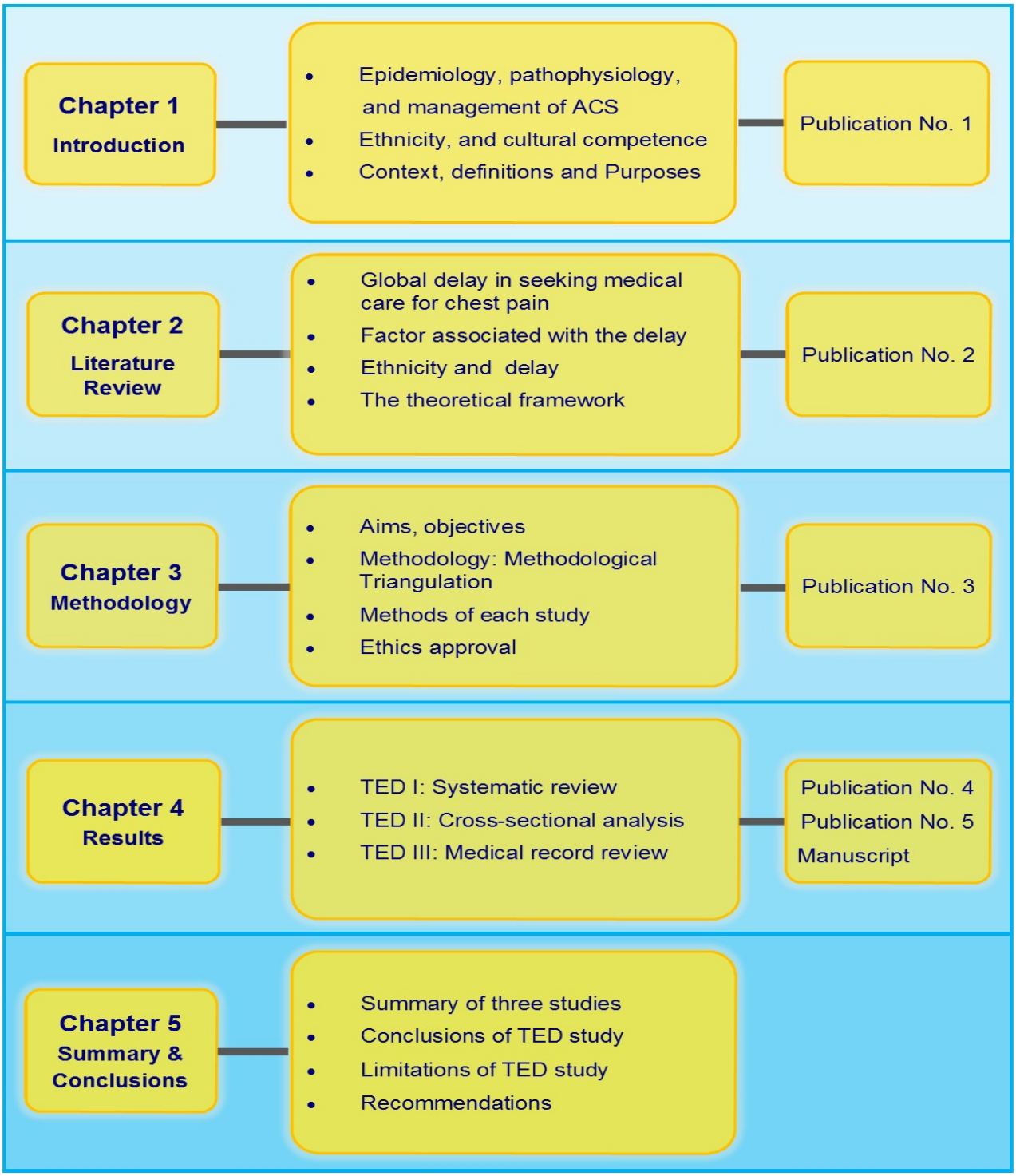
Abbreviations

ABS	Australian Bureau of Statistics
ACS	Acute coronary syndromes
AHA	The American Heart Association
AIHW	Australian Institute of Health and Welfare
AMI	Acute myocardial infarction
CALD	Culturally and Linguistically Diverse
CHD	Coronary heart disease
CSANZ	The cardiac Society of Australia and New Zealand
CVD	Cardiovascular disease
GRACE	Global Registry of Acute Coronary Events
MI	Myocardial infarction
NHF	National Heart Foundation
NHMRC	National Medical and Health Research Council
UA	Unstable angina
WHF	World Heart Federation
WHO	World Health Organisation

Overview of the thesis



CHAPTER 1
INTRODUCTION

CHAPTER 1 INTRODUCTION

This chapter provides overview of Cardiovascular Disease (CVD), and Coronary Heart Disease (CHD) and current situation of CVD globally in the first section. The next two sections describe risk factors of heart disease and atherosclerosis, the common cause of Acute Coronary Syndromes (ACS). The definitions, epidemiology and managements of ACS are included in the following sections. The next section provides the definitions and timeframe of time taken to seeking medical care for chest pain. Multiculturalism in Australia and cultural competence are detailed in the next three sections. The publication entitled 'Cultural competence in emergency department' has been presented in this part. The next section provides definitions of the important terms used in this study, followed by the last section which provides the aims, research questions, objectives, context, scope and expected outcomes of TED study.

Background

Cardiovascular Diseases

Cardiovascular diseases (CVD) include all diseases and conditions of the heart and blood vessels which can be classified into six types (World Health Organisation 2013; World Heart Federation 2013a)

1. Coronary heart disease (CHD) or Ischaemic Heart disease
2. Cerebrovascular disease
3. Hypertensive heart disease
4. Rheumatic heart disease
5. Inflammatory heart disease
6. Other CVDs: Congenital heart disease and Heart failure

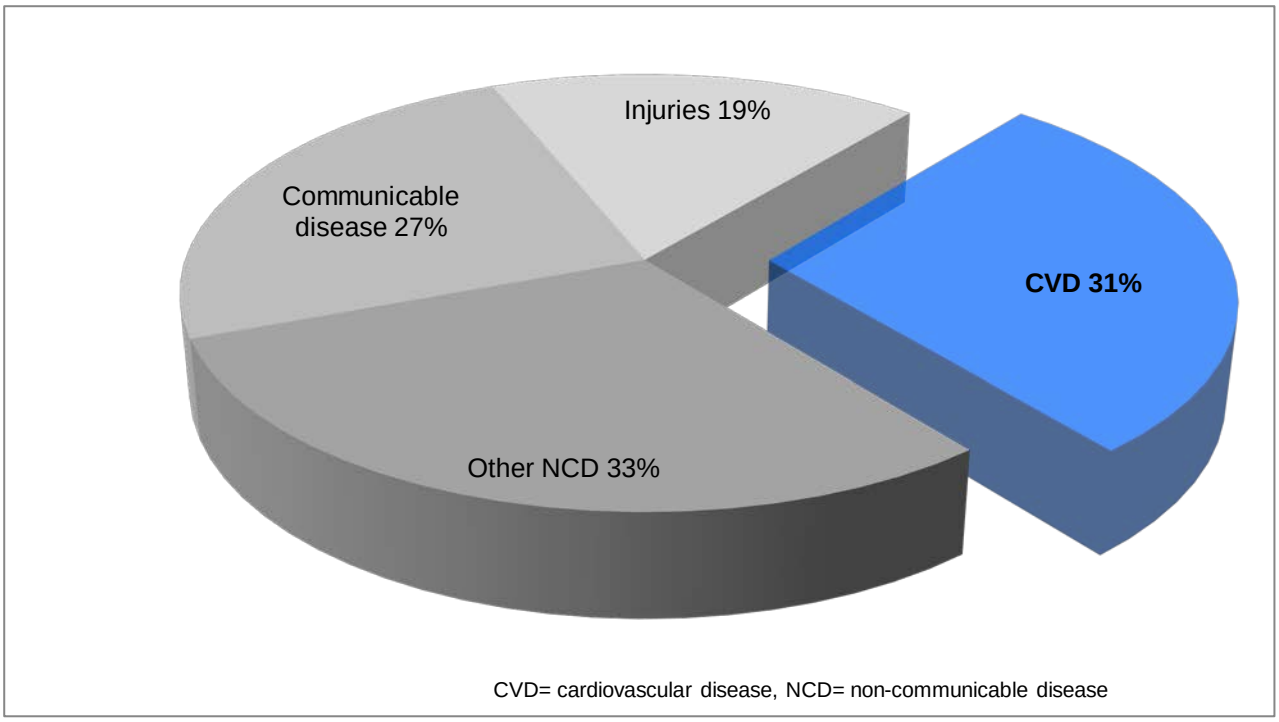
In 2008, approximately 57 million people died worldwide, of which noncommunicable diseases (NCD) accounted for two-third of all deaths, 36 million (63%), up from 60% in the last decade (Alwan 2011). The principle cause of NCD death in 2008 was CVD, estimated at 17.3 million deaths, representing 48% of NCD death and 31% of all global deaths (Mendis, Puska & Norrving 2011)

(Figure 1.1). This statistical data shows the global impact from CVD which is expected to reach 23.3 million deaths and is projected as being a leading cause of death in 2030 (Mathers & Loncar 2006; Mendis, Puska & Norrving 2011). Over 80% of cardiovascular deaths occurred in the low-middle income countries (LMIC) such as Southeast Asian countries, also the CVD was the highest proportions of deaths among the high-income and upper-middle income countries such as the USA, the UK and Australia (Mendis, Puska & Norrving 2011; World Health Organisation 2013).

Cardiovascular disease contributes to premature mortality and is also a leading contributor to Years Living with Disability (YLD). According to the Disability Adjusted Life Years (DALYs), CVD is responsible for 151,377 million DALYs, including 62,587 million due to CHD and 46,591 million to cerebrovascular disease (Mathers, Fat & Boerma 2008; World Health Organisation 2009). Furthermore, it is a leading cause of premature deaths. One third of all deaths occurring before 60 years of age are due to CVD, and 39% of deaths before 70 years of age are due to CDV (Mathers, Fat & Boerma 2008; Mendis, Puska & Norrving 2011).

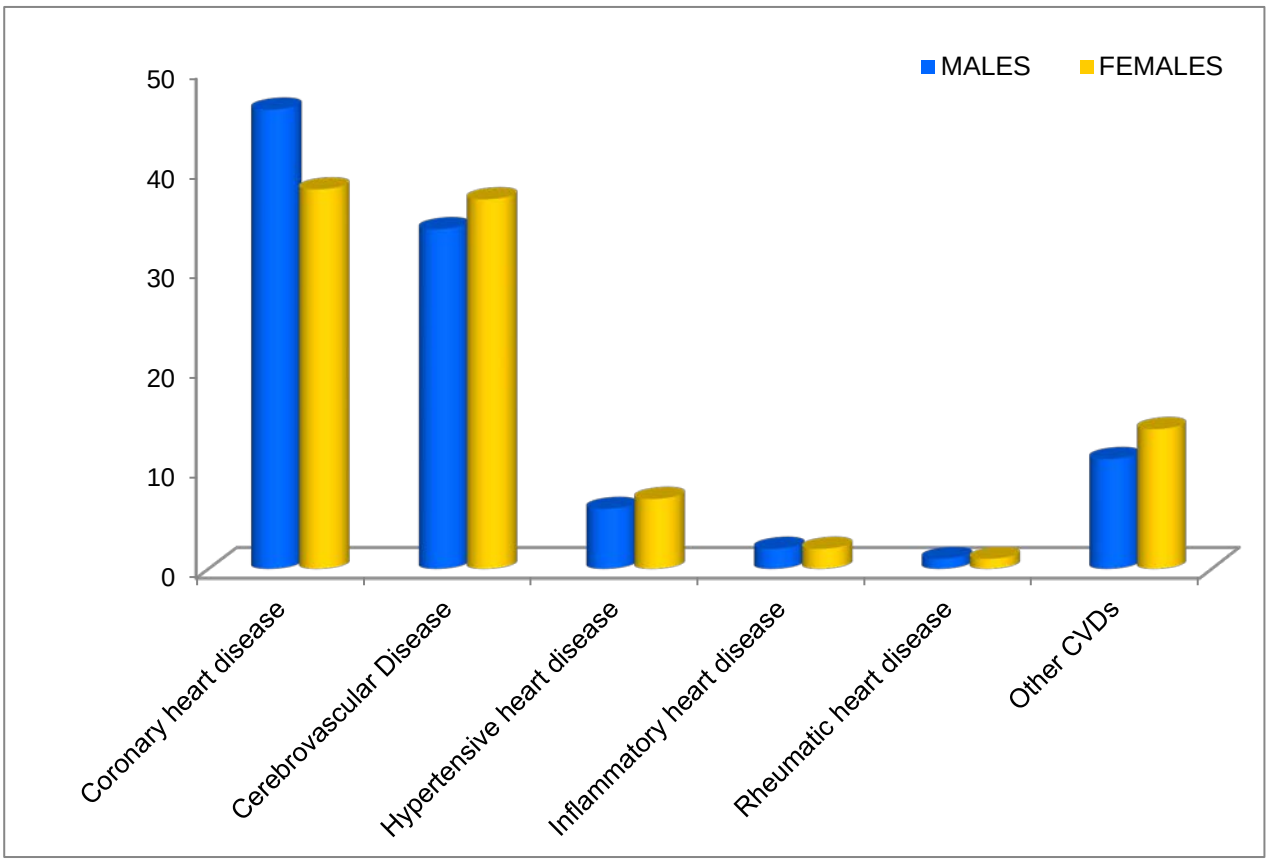
By gender, the upward trend of CVD incidences with age is similar in both sexes. Men have a higher rate of CVD morbidity and mortality than women at all ages, particularly for CHD (Mathers, Fat & Boerma 2008; Mendis, Puska & Norrving 2011). Coronary heart disease mortality rate at standardised age in men is higher than those of women and have a similar difference in many countries such as the USA, Canada, Russian, China (urban) and Australia (Manuel, Leung & Nguyen 2003; Thom et al. 2006; WHO2006). However, women at a younger age have a higher Acute Myocardial Infarction (AMI) mortality rate than men (Vaccarino et al. 2001).

Epidemiological evidence demonstrates differences in low and middle income countries. For instance, women have a higher proportion of CVD deaths than men; women with high risk of CVD have a higher mortality rate. In addition, women who have high risk of CVD are more likely to become disabled than men (Pilote et al. 2007; World Health Organisation 2004).



Mendis, Puska and Norrving (2011)

Figure 1.1 Principal causes of death worldwide in 2008



Mendis, Puska and Norrving (2011)

Figure 1.2: Distribution of death in different cardiovascular disease by gender

Epidemiological evidence demonstrates differences in low and middle income countries. For instance, women have a higher proportion of CVD deaths than men; women with high risk of CVD have a higher mortality rate. In addition, women who have high risk of CVD are more likely to become disabled than men (Pilote et al. 2007; World Health Organisation 2004).

Cardiovascular Disease in Australia

Cardiovascular disease is the major cause of death, disability and medical expense in Australia (Australian Bureau of Statistics 2011a; Australian Institute of Health and Welfare 2000; Taylor et al. 1999), of which almost 50% were due to CHD (Australian Institute of Health and Welfare 2011a). Despite an integrated policy, program, and action plan, plus substantial progress in improving mortality rate, Australia is still facing a heavy burden of CVD. It was recorded at 18% in 2003 before reaching 25.8% in 2010 of all burdens of disease based on years of life lost (YLL) or premature death (Australian Institute of Health and Welfare 2011a; Begg et al. 2007; Waters et al. 2013).

Cardiovascular disease was considered the most expensive disease, costing nearly six billion in 2004-05 (Australian institute of Health and Welfare 2008) and just under eight billion in 2008-09 (Australian Institute of Health and Welfare 2011a, 2012a). The expenditure included costs from hospitalisations; 475,000 hospitalisations were recorded in 2007-2008 were due to CVD, with an increase of 12% in the decade (1999-2009) (Australian Institute of Health and Welfare 2011c). As the proportion of the elderly in Australia continues to rise, there is no doubt that the prevalence of CVD and CVD deaths will continue to soar and shift to a more elderly group (Australian Bureau of Statistics 2012; Australian Institute of Health and Welfare 2011a; Waters et al. 2013).

According to the National Aboriginal and Torres Strait Islander Health Survey (NATSIHS), there are higher rates and upward trends of illness, hospitalisation and death from CVD among Aboriginal and Torres Strait Islanders (Australian Bureau of Statistics 2006; Australian institute of Health and Welfare 2008, 2011c). Additionally, socioeconomic and remoteness status contribute to a pattern of inequity in CVD health that lead to a higher hospitalization and mortality rate in the lower socioeconomic groups, and people in remote areas than those in the higher status and non-remote groups (Australian Institute of Health and Welfare 2011a; Page et al. 2012; Waters et al. 2013).

These findings reflect the fact about inequalities among disadvantaged groups, who are more likely to have a poor health status which has both direct and indirect effects on CVD health including prevalence, morbidity and mortality (Mendis, Puska & Norrving 2011).

Coronary Heart Disease

Cardiovascular disease accounted for 18% of burden of disease with an over 80% contribution due to coronary heart disease and stroke. Coronary Heart disease is a single biggest cause of mortality and morbidity worldwide responsible for 7.4 million deaths in 2012, 42.6% of cardiovascular disease deaths and 13% of global mortality across income groups (Alwan 2011; Mendis, Puska & Norrving 2011; World Health Organisation 2015). Although global mortality rates attributed to CHD have declined, the burden of disease is still high, particularly in developed countries and LMIC countries (Australian Institute of Health and Welfare 2011a; Go et al. 2013; Mendis, Puska & Norrving 2011). Coronary heart disease is the most common form of CVD and covers a spectrum of clinical presentations including acute coronary syndromes (unstable angina, myocardial infarction, silent ischemia and sudden death), stable angina and cardiac failure (Australian Institute of Health and Welfare 2011a; Walker & Lorimer 2004, p. 1). The primary feature of CHD is insufficient blood supply to the heart itself due to narrowing of the coronary arteries causing myocardial ischemia (Davis 2005; Ross 1999). The first type of conditions is angina, of which a restricted blood flow and a temporary imbalance in the oxygen supply/demand occur. The second condition is myocardial infarction, a sudden onset of obstructed blood flow resulting in heart muscle ischemia and therefore death if not treated (Australian Institute of Health and Welfare 2011a; Walker & Lorimer 2004). The most important underlying pathologic process affecting coronary arteries and leading to CHD is atherosclerosis (Hanson et al. 2013; Mendis, Puska & Norrving 2011; Walker & Lorimer 2004)

Atherosclerosis

The artery consists of three main layers including the intima,-the inner layer, the media, the layer between internal and external elastic laminae, and the adventitia, the outer layer (Evans 2012, p. 20). Atherosclerosis commences as a protective process as a result of an inflammatory fibroproliferative response to endothelial injury which involves lipid deposition, cellular infiltration and

degenerative plus inflammatory changes (Kritharides & Lowe 2011, p.55; Ross 1999; Walker & Lorimer 2004, p. 5).

It has been considered a chronic inflammatory, degenerative and proliferative process affecting medium and large sized arteries throughout the cardiovascular system (Davis 2005; Kritharides & Lowe 2011, p. 60; Ross 1999). The common consequences of this progressive inflammatory process are thickened and less elastic vessels, leading to compromised blood flow, obstruction of arteries and stepwise severity of disease progressing to occlusion and in larger vessels and occasionally, to vessel rupture. When damage to the vascular endothelium occurs, it activates endothelial cells to respond to inflammation by promoting monocytes, T-cell and platelets adhesiveness at the site of the lesion. Chronic injury and failed repair process causes upregulating and compensatory responses and leads to endothelial cell dysfunction (Evans 2012, p. 86; Mckeever & Enger 2001, pp. 3-5; Mittal 2005,pp. 113-114; Ross 1999). This is the initial step of the pathophysiology of atherosclerosis (Mckeever & Enger 2001, p. 3; Mittal 2005, p. 113; Ross 1999). At this stage the endothelium becomes permeable allowing monocytes, T-cell and low-density lipoprotein (LDL) particles to migrate into and accumulate in the intima where the serial inflammation occurs. Monocytes transform to macrophages and engulf LDL particles and finally become foam cells (Davis 2005; Evans 2012, p. 86; Lauer 2006, p. 30). The injury induces endothelial cells to promote coagulant properties; activated platelets adhere to the denuded area and then begin platelet aggregation.

Subsequent reactions include activating endothelial cells, and microphages release cytokines and growth factors which stimulate migration of smooth muscle from the media into the intima (Evans 2012, p. 86; Lauer 2006, p. 30; Ross 1999). This is the first stage of plaque formation called “fatty streak”, the accumulation of foam cells (lipid-laden macrophage), macrophages, smooth muscle cells and T cells under an intact endothelium (Mittal 2005, pp. 109-111; Walker & Lorimer 2004, pp. 5-6). The fatty streak formation is a pure inflammatory lesion which may be present in infants and throughout an individuals’ life time without any clinical manifestation and might be a reversible phenomenon (Davis 2005; Ross 1999; Walker & Lorimer 2004, pp. 5-6). If the inflammatory response

cannot reverse the lesion back to normal, the endothelium then continues the protective process indefinitely, by which the inflammation area forms an intermediate lesion of atherosclerosis where the atheroma development is present (Lauer 2006, p. 30; Ross 1999; Walker & Lorimer 2004, p. 6). Foam cells begin to die and release free lipid into the extracellular space which then coalesces to form the lipid-rich necrotic core of the plaque.

The continuing inflammatory responses stimulate migration and proliferation of smooth muscle cells in to the lesion involved in intermediate plaque formation (Davis 2005; Ross 1999). Then smooth muscle cells intermix with collagen forming a fibrous cap which lies over the necrotic core underneath the endothelium that is the key stage of plaque evolution (Davis 2005; Mckeever & Enger 2001, pp. 5-6). The next stage is known as coronary artery remodelling, where the atheromatous plaque increases in size and the external vessel artery wall dilates gradually without impinging the lumen (positive remodelling); thus the atheroma is not identified by angiography until it occupies at least 45% of total cross-sectional area (Berglund et al. 1997; Davis 2005; Foody & Nissen 2006,p. 6). This remodelling process will continue until the arterial wall can no longer compensate by increasing its diameter and then the plaque may intrude into the vessel lumen, leading to narrowed arteries and blood flow alteration (Foody & Nissen 2006, p. 6; Ross 1999). When the plaque is larger in size, its stability relies on the strength and thickness of fibrous cap, which is dependent on the balance between repair and inflammation (Evans 2012, pp. 86-87; Frobert, hansen & Falk 2005, pp. 64-67).

If inflammation becomes a dominant process, the fibrous cap will become thinner and plaque rupture may happen. The fissuring of the endothelium and the thinner fibrous cap contributes to plaque rupture, particularly at the shoulder of the lesion, the thinnest point of plaque where lipid fragments and cellular debris are released into artery lumen and exposed to thrombogenic agents (Davis 2005). Superimposed platelet adhesion, activation and aggregation occur due to plaque rupture which leads to thrombus formation and thrombus occlusion (Bhatt & Topol 2005, p. 77; Davis 2005) If the occlusive thrombus evolves into complete occlusion of the coronary artery, myocardial infraction (MI) occurs, while partially occlusive thrombus cause unstable angina (UA) (Evans 2012, pp. 90-91; Mckeever & Enger 2001, pp. 8-9).

Risk Factors of Atherosclerotic Coronary Heart Disease

The response-to-injury hypothesis has been used to describe the pathogenesis of atherosclerosis (Evans 2012,p. 85; Lauer 2006, p. 29; Ross 1999). Therefore, triggers and risk factors that cause endothelial cells injury are determined risk factors of atherosclerotic CHD and tend to be modifiable. According to the guidelines for the management of absolute cardiovascular disease risk, modifiable risk factors which can be controlled or avoided, including smoking status, blood pressure, serum lipids, body mass index (BMI), nutrition, physical activity level and alcohol intake diabetes mellitus, free radicles, genetic alteration, elevated plasma homocysteine and infectious organisms (e.g. herpes viruses, *Chlamydia pneumonia and Helicobacter pylori*) (National Vascular Disease Prevention Alliance 2012, p. 19; World Health Organisation 2013; World Heart Federation 2012).

There are also non-modifiable risk factors such as age, gender, ethnicity and family history which have significant associations with the development of atherosclerosis (National Vascular Disease Prevention Alliance 2012, p. 19; World Health Organisation 2013; World Heart Federation 2012). For example, with advancing age, the heart has age related physiologic degeneration and will work less efficiently, which contributes to increasing the CVD risk and may complicate the existing condition (Alwan 2011; Mendis, Puska & Norrving 2011; World Heart Federation 2012). Another important risk factor is ethnic origin, as mortality and morbidity rates vary between ethnicities (Australian Institute of Health and Welfare 2011a; Khattar et al. 2000; World Heart Federation 2012). Interestingly, people of Asian or African ancestry have higher risks of developing CVD than other racial groups (Dassanayake et al. 2009; World Heart Federation 2012; Young & Coles 1992).

On the other hand, protective factors contribute to individual's positive health and wellbeing by decreasing the likelihood of developing CVD and enhance their capacity to respond to the disease. The potential protective factors of CVD are high high-density lipoprotein (HDL) cholesterol, ratio of HDL to total cholesterol, sufficient physical activity and a healthy diet. The role of HDL cholesterol as a protective factor is acknowledged, suggesting that HDL cholesterol, good cholesterol, works against atherosclerosis by removing plaques and transporting cholesterol back to the liver (Australian Institute of Health and Welfare 2011a).

Table 1.1: Common risk factors and protective factors of atherosclerosis

Non-Modified Factors	Risk	Modified Factors	Risk	Protective Factors
Age		Raised blood pressure		High HDL cholesterol
Ethnicity		Smoking/Tobacco		Sufficient physical activity
Gender		High Blood glucose		Healthy diet
Family history		Physical inactivity		Social network Support
		Overweight/Obesity		Sufficient income
		Elevated/modified LDL		
		Unhealthy diet		
		Unsafe sex		
		Alcohol consumption		
		Childhood underweight		
		Indoor smoke		

Mendis, Puska and Norrving (2011); National Vascular Disease Prevention Alliance (2012); World Heart Federation (2012)

Socioeconomic factors such as social network support and sufficient income are thought to contribute to direct or indirect effects on health including effects on CVD morbidity and mortality (Australian Institute of Health and Welfare 2011a; Mendis, Puska & Norrving 2011). Atherosclerosis is a common autopsy found in people from their first year of age throughout their lives with or without cardiovascular disease, and the progression rate of atherosclerosis is variable and related to risk factors (Ross 1999). Mendis et al. (2005) stated that even though the clinical disease may not develop in early stage of life, the early formation of atherosclerosis has a significant association with adult coronary risk factors. Coronary heart disease is the leading cause of death globally, yet more people live with coronary atherosclerosis than die of it (Frobert, hansen & Falk 2005, p. 59; Mckeever & Enger 2001, p. 1). This leads to the question of why a previous stable plaque of atherosclerosis becomes more vulnerable and suddenly ruptures and turns to a life threatening event, acute coronary syndromes.

Acute Coronary Syndromes

Acute coronary syndromes (ACS) is a leading cause of mortality and morbidity worldwide, particularly among industrialized countries (The GRACE Investigators 2001). In the United States, 1,141,000 inpatients were discharged from hospitals with ACS, and every 44 seconds, one American will have a MI (Go et al. 2013). The incidence of hospitalisation of AMI in Europe is between 90-312 per 100,000 inhabitants/year (Widimsky et al. 2010). In Australia, 11,341 deaths are attributed to acute myocardial infarction (Australian Institute of Health and Welfare 2011a; Brieger, David et al. 2009) and of 161,417 CHD hospitalisations, 34.7% of these hospitalisations were acute myocardial infarction (AMI) and 24% were for unstable angina (UA) (Australian Institute of Health and Welfare 2011c). In the overview picture of ACS trends, the European Network of Acute Coronary Treatment (ENACT) study and the Global Registry of Acute Cardiac Events (GRACE) study found that UA was the most frequent cause of ACS hospitalisations, and also the average length of hospital stay among patients with UA was close to those of MI patients (Fox et al. 2000; The GRACE Investigators 2001). Additionally, the observational study in USA reported that the prevalence of non-ST-segment elevation myocardial infarction (NSTEMI) is increasing while the proportion of ST-segment elevation myocardial infarction (STEMI) is declining (Roger et al. 2008).

ACS is a spectrum of clinical manifestations of CHD ranging from unstable angina, NSTEMI, STEMI and sudden death (Acute Coronary Syndrome Guidelines Working Group 2006; Australian Institute of Health and Welfare 2011b). The majority of ACS cases involve plaque rupture or erosion leading to thrombus formation (Bansilal & Fuster 2011, pp. 62-64; Farb et al. 1996) with subsequent thrombus in situe and eventually leads to myocardial necrosis (Bhatt & Topol 2005, p. 77; Ettekhari et al. 2008, p. 25). The pathophysiology of ACS is a consequent process of plaque rupture. Superimposed platelet adhesion, activation and aggregation occurs due to plaque rupture which leads to thrombus formation (blood clot) and thrombus occlusion (coronary blockage) (Bhatt & Topol 2005, p. 77; Davis 2005). The occlusive thrombus may evolve into complete occlusion of the coronary artery (complete coronary block) and cause an AMI. However, it may partially block the coronary artery and causes UA or MI if the restriction is severe enough (Evans 2012, pp. 90-91; Mckeever & Enger 2001, pp. 8-9).

Other forms of supply-demand mismatch can be causes of ACS, particularly UA rather than MI (Saw & Moliterno 2005, p. 132; Wilson 2012, p. 309). These secondary disorders include increased myocardial oxygen demand conditions such as fever, hyperthyroidism, infection, sudden beta-blocker withdrawal, and decreased oxygen supply conditions such as anaemia, hypoxemia and sudden emotional or physical stress (Saw & Moliterno 2005, p. 132; Wilson 2012, p. 309).

Symptoms and Chest Pain in ACS

Chest pain is the most common clinical manifestation of ACS (Acute Coronary Syndrome Guidelines Working Group 2006; Australian Institute of Health and Welfare 2011b; Younker 2007, p. 33). ACS chest pain has been described as heaviness, pressure, aching, crushing, burning or squeezing (DeVon & Ryan 2005; Hanson et al. 2013). It is characterised as pain at rest and is unaffected by activity, position or respiration (Chin & Connolly 2008; Kumar & Cannon 2009). Non-traumatic chest pain should be excluded from the major life-threatening conditions, and ACS is the most common one (Parsonage, Cullen & Younger 2013).

Table 1.2: Common symptoms of acute coronary syndromes

Symptom
Chest Pain/discomfort
Neck Pain/pressure
Back Pain
Shoulder Pain/pressure
Jaw Pain/pressure
Arm Pain/pressure
Stomach Pain/pressure
Discomfort/tightness in upper body
Short of Breath
Diaphoresis
Nausea/vomiting
Dizzy

Chew et al. (2016); World Heart Federation (2013b)

Typically, the centre of pain is often located in the substernal area and frequently radiates to left arm, abdomen, jaw, back and shoulder; as a result, some patients are unable to locate the pain in one spot (DeVon & Ryan 2005; Kumar & Cannon 2009; McLean & Moran 2001). Only two-third of patients admitted in hospital for AMI presented with chest pain, the other one-third did not have chest pain but complained with atypical presentations of ACS (Canto et al. 2000; Chin & Connolly 2008; Then et al. 2001). Dyspnoea is the most significant atypical presentation in approximately one-third of hospitalised MI patients, followed by diaphoresis, which occurred for approximately 20-50% of MI patients (Chin & Connolly 2008; Kumar & Cannon 2009; Then et al. 2001). Other atypical presentations of ACS include fainting, nausea, vomiting, cold sweating, becoming pale, fatigue and headaches (Table 1.2).

Table 1.3: Differential diagnosis of chest pain

Life-threatening Conditions	Non-Life-threatening Conditions
Aortic dissection	Pericarditis
Pulmonary embolus	Brugada syndrome
Perforating peptic ulcer	Myocarditis
Tension pneumothorax	Vasospasdic angina
Boerhaave Syndrome	Gastroesophageal reflux
Pericardial tamponade	Plurisy
	Peptic ulcer
	Pancreatitis
	Costochonditis
	Cervical disk disease
	Herpes Zoster
	Neuropathic pain
	Depression
	Panic attack/Anxiety disorder
	Psychogenic

Hollander and Chase (2013); Jaffery and Grant (2010); (Kumar & Cannon); McLean and Moran (2001); Panjrath, Josephson and Herzog (2008)

Recent studies show that women, the elderly and diabetes patients are more likely to present to ED with these atypical symptoms (Canto et al. 2000; Culic et al. 2002; Gupta, Tabas & Kohn 2002). Culic et al. (2002) stated that presentations of atypical symptoms may cause delays in seeking medical care and receive less aggressive treatment which possibly leads to negative outcomes. Consequently, it is important for health professionals to assess atypical symptoms thoroughly in order to avoid missing ACS, particularly in high risk groups such as women, the elderly and diabetics (Gupta, Tabas & Kohn 2002; Then et al. 2001). In addition to assessment in healthcare services setting, health education about typical and atypical symptoms of ACS should be provided to the public in order to raise awareness of ACS (Culic et al. 2002; Then et al. 2001).

The early arrival to emergency department after the onset symptoms and an optimum course of treatment is essential for patients' survival. As a result, a patient's delay in seeking medical care for chest pain is a potential life-threatening issue that needs serious action and an implementable policy (Acute Coronary Syndrome Guidelines Working Group 2006; National Clinical Guideline Center 2013; O'Gara et al. 2013b; Parsonage, Cullen & Younger 2013). Although the presentation of chest pain is the central hallmark of ACS, it does not always reflect the cardiac conditions (Chin & Connolly 2008; Jaffery & Grant 2010) . Therefore, differential diagnosis remains a vital process for patient outcomes because it may indicate other serious or life threatening conditions which need specific treatment (Jaffery & Grant 2010; Kumar & Cannon 2009; McLean & Moran 2001; Panjrath, Josephson & Herzog 2008) (Table 1.3).

Acute Coronary Syndromes Management

The timely arrival of patients with chest pain to emergency department (ED) after the onset of symptoms, and a rapid evidence-based treatment is important for patients' survival (Chew et al. 2016; National Clinical Guideline Center 2013; Parsonage, Cullen & Younger 2013). The National Heart Foundation of Australia has promoted the 'Heart Attack Action Plan' (National Heart Foundation of Australia 2009a) to help reduce the delay time when patient experience chest pain or heart attack symptoms.

ACS management include the process from the initiation of symptom onset to in-hospital care which may consists of presentation of patient with chest pain, working diagnosis, electrocardiogram (ECG), cardiac biomarker tests, final diagnosis and therapies (Acute Coronary Syndrome Guidelines Working Group 2006). Working diagnosis is a process started at the first medical contact that may be made by a call taker, paramedic, physician or other medical personnel (Acute Coronary Syndrome Guidelines Working Group 2006; National Clinical Guideline Center 2010a; Steg et al. 2012). It is based on clinical presentation and initial ECG. The working diagnosis plays a vital key in clinical decision making whether a patient will be defined as ST- segment elevation acute coronary syndromes (STEACS) or non-ST- segment elevation acute coronary syndrome (NSTEACS) (Acute Coronary Syndrome Guidelines Working Group 2006) (Figure 1.3). New terminology, STEACS and NSTEACS, has been used to describe ACS at the initial working diagnosis stag in order to guide clinical decision making, but they do not impact on ongoing prevention therapies (Acute Coronary Syndrome Guidelines Working Group 2006; Steg et al. 2012). History and physical examination is the next step of diagnosis, which plays a key role in assessing the likelihood of ACS and may help investigate any pertinent clues or contraindications for certain therapies (Kumar & Cannon 2009). The physical findings in ACS are often unremarkable but may include pallor, tachycardia, a high respiratory rate, a high systolic blood pressure, cardiogenic shock, S3 gallops, and crepitation (Chin & Connolly 2008; Pryor et al. 1993).Additionally, history related to risk factors such as diabetes, hyperlipidaemia, history of MI, smoking, age and gender should be recorded for the ACS risk stratification along with the result from ECG and cardiac biomarker measurements (Kumar & Cannon 2009; Panjrath, Josephson & Herzog 2008; Wilson 2012).

Electrocardiogram

According to the guidelines for the management of acute coronary syndromes, patients that present to ED with chest pain or suggestive symptoms of ACS should be considered high–priority triage cases (Acute Coronary Syndrome Guidelines Working Group 2006; National Clinical Guideline Center 2013; O'Gara et al. 2013a). These patients should be assessed rapidly and accurately by multiple evaluations to identify the condition and then have a definitive therapy (Parsonage, Cullen & Younger 2013).

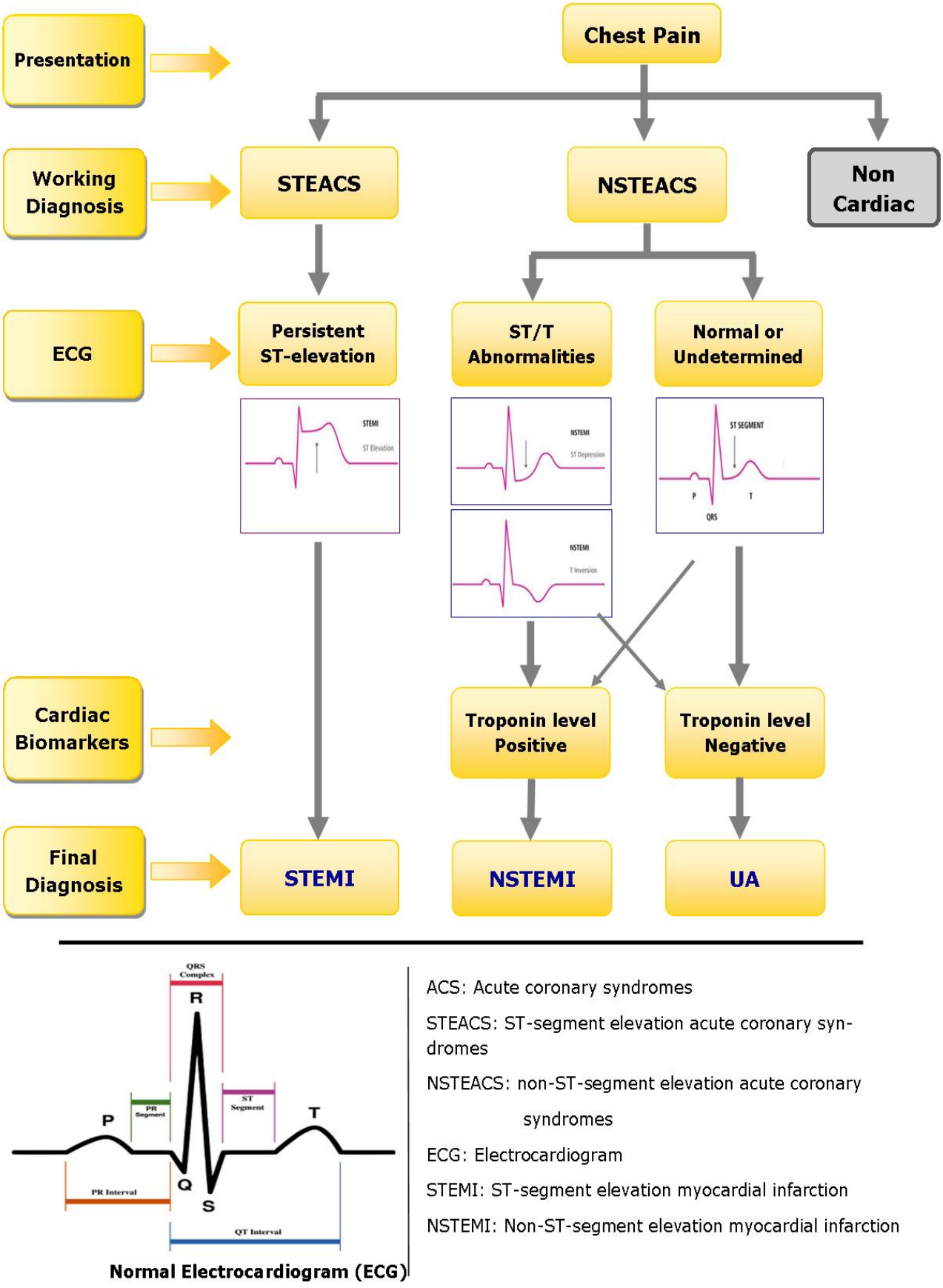


Figure 1.3 Clinical pathways for identification of acute coronary syndromes

The initial 12-lead ECG should be obtained within 10 minutes of arrival (O'Gara et al. 2013a). However, NICE guidelines recommend it within 5 minute on arrival and as soon as possible respectively (Cooper et al. 2010). Pryor et al. (1993) stated that the initial assessment by history, physical examination, ECG and chest radiograph for suspected ischaemic heart disease can be used to identify high and low risk patients; this is also considered a cost efficient strategy to reduce unnecessary testing. The term 'NSTEACS' is used for patients without the ST- segment elevation, and these patients should undergo serial ECG tracing or ST- segment monitoring and serial troponin blood test (Braunwald et al. 1994; Tamis-Holland et al. 2008). Even though ECG is important for ST suggestion, it is a low-specificity diagnosis tool. Therefore laboratory tests for cardiac biomarker have been used in ACS diagnosis, particularly in NSTEACS group (Hanson et al. 2013; Kumar & Cannon 2009).

Cardiac Biomarkers

Creatine kinase-MB (CK-MB) is a biomarker released into the serum after myonecrosis. Therefore, it was set as a standard biomarker for MI diagnosis until 2000 when troponin T and I were recommended as a new standard cardiac biomarker (Antman et al. 2000; Apple 2009; Cooper et al. 2010). This is due to a superior cardiac specificity and sensitivity to myocardial injury of troponin (DeVon & Ryan 2005; Kumar & Cannon 2009; Tamis-Holland et al. 2008). Despite extreme sensitivity, troponin level would be increased for at least 6 hours after the onset of symptoms(Chew et al. 2011); the repeat assay should be done at 8 to 12 hours after the onset of symptoms to avoid negative results in the early period (Kumar & Cannon 2009). However, if the high sensitivity troponin assays are using, patients with negative result should have a repeat test done in 3-4 hours later (Chew et al. 2011). On the other hand, troponin may be elevated for 5-14 days after myocardial necrosis. That prolonged rise might mask reinjury, this is, however, helpful for detecting myonecrosis in patient who present to ED several day after the onset of symptoms (Kumar & Cannon 2009; Panjrath, Josephson & Herzog 2008; Tamis-Holland et al. 2008). The recommendations of The NHF/CSANZ 2006 Guidelines advise using high sensitivity troponin assays (where available) because of its high sensitivity for the myonecrosis detection even though a reduction of specificity for the MI diagnosis may occur (Chew et al. 2011).

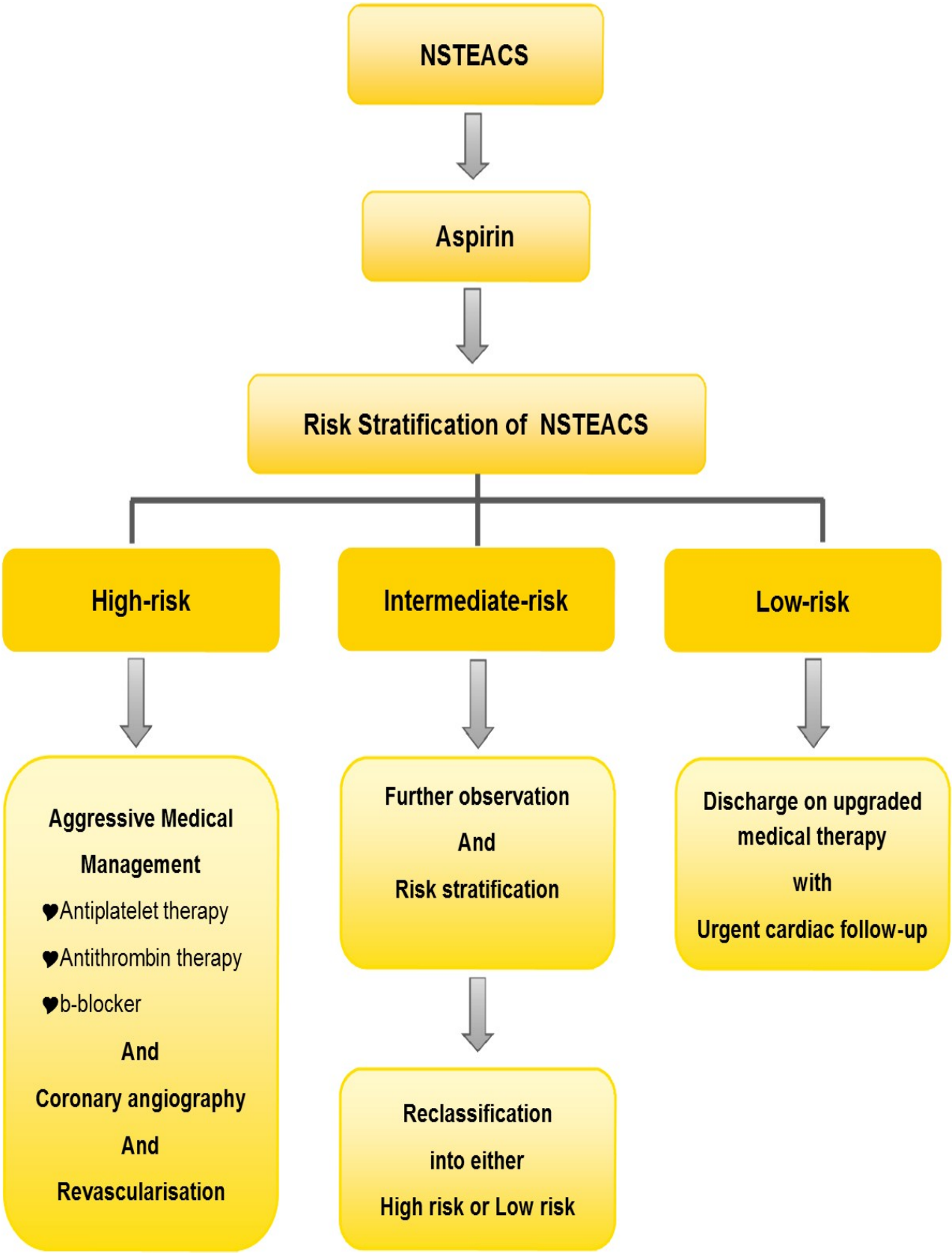
Ideally, biomarkers for assessing ACS should be highly specific to cardiac tissue, undetectable in the serum of a healthy person, be released rapidly after myocardial necrosis and remain in serum long enough to be detected but be eliminated rapidly enough to not mask reinjury (Panjrath, Josephson & Herzog 2008). Unfortunately, there is no perfect biomarker, and multiple biomarkers have been used in assessment of ACS such as troponin, CK-MB, myoglobin, brain natriuretic peptide and high-sensitivity C-reactive protein (DeVon & Ryan 2005; Tamis-Holland et al. 2008).

Management of Non ST-Elevation Acute Coronary Syndromes

NSTEACS patients will be differentiated as NSTEMI or UA as a final diagnosis and be offered a specific treatment (Acute Coronary Syndrome Guidelines Working Group 2006; Hamm et al. 2011). Risk stratification along with physical examination, ECG and blood tests are recommended for the NSTEACS group in order to identify the risk of adverse cardiac outcomes (Brieger, David et al. 2009; Keller et al. 2009; Khan, Kornberg & Coven 2008). The National Heart foundation and Cardiac Society of Australia and New Zealand (NHF/CSANZ) stratify patients with ACS into three groups, high-risk, intermediate-risk and low-risk (Acute Coronary Syndrome Guidelines Working Group 2006). The common approaches utilised for risk stratification are the Thrombolysis in Myocardial Infarction (TIMI) score and the Global Registry of Acute Coronary Events (GRACE) score (Brieger, D et al. 2009; Morrow et al. 2000) (Appendix A II). NHF/CSANZ recommends aspirin for all patients with NSTEACS prior to specific treatment in high-risk, intermediate-risk and low-risk classes (Figure 1.4). This recommendation is similar to other guidelines in the USA, the UK and Europe (Hamm et al. 2011; Jneid et al. 2012; National Clinical Guideline Center 2010). Cannon et al. (2001) have argued that the combination use of early invasive strategies with glycoprotein IIb/IIIa inhibitors significantly reduce the cardiac events in NSTEMI/UA.

Management of ST-Elevation Myocardial Infraction

Patients with ST –segment elevation evident in the initial ECG are diagnosed as STEMI and will be offered reperfusion therapy within 12 hours (Acute Coronary Syndrome Guidelines Working Group 2006; National Clinical Guideline Center 2013; Steg et al. 2012; Talwar et al. 2009). Reperfusion refers to the restoration of blood flow to an area of heart muscle that has been deprived of circulation for a period of time (e.g. as a result of a heart attack) (National Heart Foundation of Australia 2012).



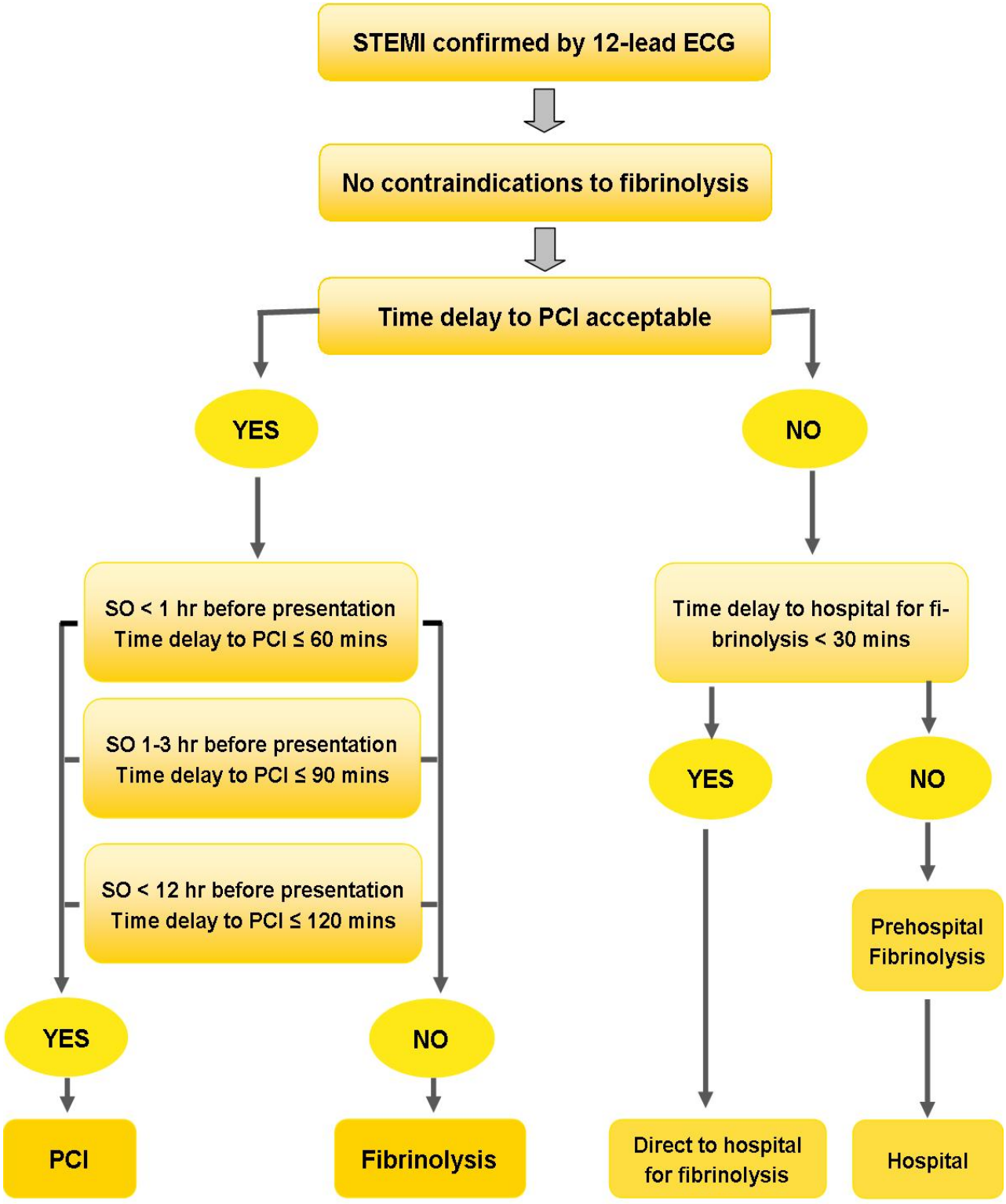
Non-ST- segment elevation acute coronary syndrome = NSTEACS

Figure 1.4 Risk stratification of non-ST elevation acute coronary syndromes

Reperfusion therapy includes percutaneous coronary intervention (PCI), fibrinolysis, and coronary artery bypass (CABG) (Acute Coronary Syndrome Guidelines Working Group 2006). Reperfusion is the most important therapy for STEMI as it has an enormous impact on short-term and long-term patient outcomes (Bassand et al. 2005). Percutaneous Coronary Intervention (PCI) and fibrinolytic therapy are the two commonly recommended reperfusion therapies; however, the former is the preferred therapy recommended for all eligible STEMI patients at a PCI-capable hospital (Acute Coronary Syndrome Guidelines Working Group 2006; National Clinical Guideline Center 2013; Steg et al. 2012).

To maximize the benefit from reperfusion, patients should obtain therapy within the first hour (Acute Coronary Syndrome Guidelines Working Group 2006; Rawles 1992). Nonetheless, practically the ideal time for emergency medical services to transport to a PCI capable hospital is 90 minutes or less and 120 minutes or less for transfer to a PCI capable hospital (Acute Coronary Syndrome Guidelines Working Group 2006) (Figure 1.5). Fibrinolysis has been recommended for patients at non-PCI capable settings in the absence of contraindications, and should be administered to patients within 30 minutes of hospital arrival (Acute Coronary Syndrome Guidelines Working Group 2006; National Clinical Guideline Center 2013; Srimahachota et al. 2012; Steg et al. 2012; Talwar et al. 2009). Current studies have compared the outcome between PCI and thrombolytic therapy, and the evidence indicates that PCI within the time window is superior to fibrinolysis for STEMI treatment (Keeley, Boura & Grines 2003). Although PCI is highly recommended for STEMI management, some implementation barriers may occur in particular health care settings.

The studies in 30 countries in Europe revealed barriers to PCI implementation including unavailable inter-hospital transport (reimbursement policy), insufficient ambulances, low staffing level and conservative attitude of medical staff (Widimsky et al. 2010). Furthermore, the SNAPSHOT, a large scale multicentre study in Australian and New Zealand concluded that cultural factors are one of potential barriers to the implementation of recommended management for ACS (Chew et al. 2013).



STEACS = ST-segment elevation acute coronary syndromes, STEMI= ST-segment elevation myocardial infarction, ECG = electrocardiogram, PCI = percutaneous coronary intervention, SO = symptom onset, mins = minutes, hr = hours

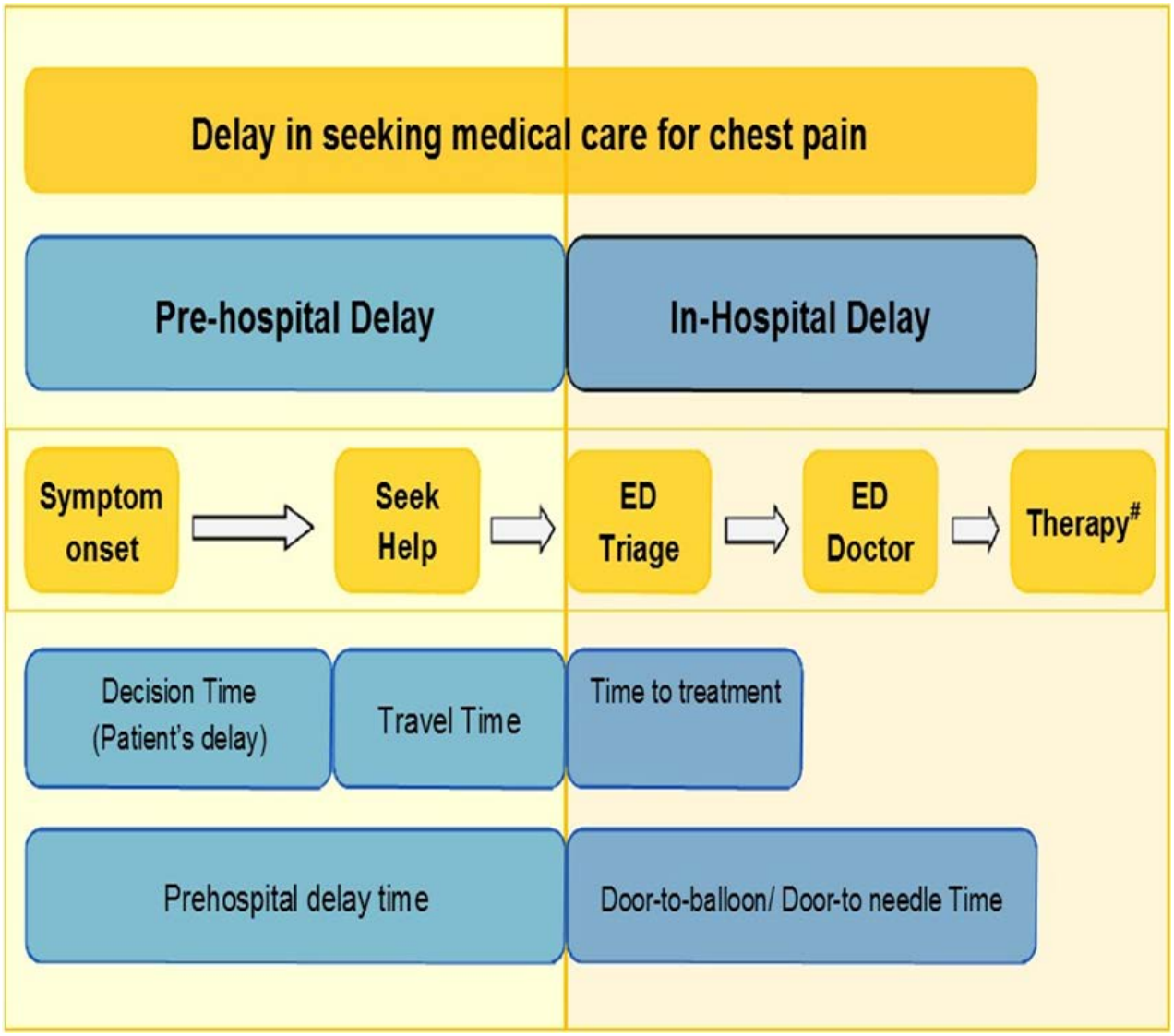
Figure 1.5 Prehospital through hospital STEACS management

Adjective therapies

In addition to reperfusion therapy, antiplatelet therapy (e.g. aspirin, clopidogrel) ant thrombin (e.g. heparin), glycoprotein IIa/IIIa inhibitors and medication (e.g. nitrates, calcium antagonists) are recommended as adjective therapies for STEMI management (Brener 2005, pp. 253-257; Mountain & Thompson 2011, pp. 462-463). In cases where the coronary anatomy is suitable for surgery, coronary artery bypass graft surgery (CABG) may be indicated for patients in certain situations: when they are unsuitable for PCI and fibrinolysis, they have failed reperfusion, they are in cardiogenic shock, and/or they have haemodynamic instability (Acute Coronary Syndrome Guidelines Working Group 2006; Newman & Taggart 2011). Post-hospitalisation care plans or secondary prevention for patients with ACS are recommended as a long-term management in order to prevent a second cardiac event (Chew et al. 2016). These recommendations include pharmacotherapy, lifestyle modification, cardiac rehabilitation, and psychological advice.

Time Taken in Delay

The framework of the delay in seeking medical care for chest pain begins with the initiation of symptom onset through the therapy (Figure 1.6). When patients suffer from chest pain, the most important further step is making a decision whether they should go to hospital, call ambulance or stay and wait for a while. This is the first part of the process involving patients and bystanders and the time between symptom onset to seek help which is defined as ‘decision time (Dracup et al. 1995). The second part of the delay is called travel time where the most of time is spent on transportation from the event to emergency department between location of cardiac episode and emergency department (Dracup et al. 1995). The first two parts of the framework defined as ‘prehospital delay’ and the amount of time during this delay defined as time to seek care or prehospital delay time (Alonzo 1984; Dracup et al. 1995). The following sections after patients’ arrival at triage at the emergency department until receipt of definitive therapy called in-hospital delay where health professional and clinical governance play a vital role in the process (Alonzo 1984; Dracup et al. 1995).



ED: emergency department, # definitive therapy

Figure 1.6 Timeframe of delay in seeking medical care for chest pain

The Interval between arriving at triage and have seen by ED doctor is defined as 'time to treatment', and the amount of time patients been waiting for the definitive therapy (i.e. percutaneous coronary intervention (PCI) and fibrinolysis) is defined as' door-to-balloon time' or 'door-to-needle time' respectively. In some cases, coronary artery bypass gift (CABG) may be the appropriated therapy. The entire process is defined as 'delay in seeking medical care for chest pain', and the total amount of time patients spend from symptom onset to initiation of definitive therapy is defined as 'delay time' (table 1.4). The entire framework involves patients, bystanders, paramedics, clinical staff and healthcare system.

Table 1.4: Definitions of times and expected time frame

Term	**Definition**	**Reference**	**Expected timeframe**
Time of symptom onset	the time during which the patient reported becoming acutely or severely ill, prompting the patient to seek medical care	Goldberg et al. (2002)	
Triage time	the time at which a patient is assessed to determine the urgency of their problem, and their priority of care	Australian Institute of Health and Welfare (2012b)	
Time of medical treatment initiation in ED	the time of first contact between the patient and the ED doctor who is initially responsible for their care	Australasian college for Emergency Medicine (2013)	
First medical contact	the point at which the patient is either initially assessed by a paramedic, physician, or other medical personnel in the pre-hospital setting, or when the patient arrives at the hospital emergency department	Steg et al. (2012)	
Decision time	the interval from symptom onset to the time of first medical contact	Dracup et al. (1995)	within1 hour
Time to treatment	the interval between triage time and the time of medical treatment/assessment initiation in ED (time seen by doctor in ED)	Australasian college for Emergency Medicine (2013)	10 minutes
Prehospital delay time	the interval between the time of symptom onset and the triage time	(Acute Coronary Syndrome Guidelines Working Group 2006); Goldberg et al. (2009)	within 1 hour
Door-to-balloon time	the duration of time from the point of arrival at a PCI facility (triage) to the first inflation of a balloon inside the blocked coronary artery during a PCI procedure	National Heart Foundation of Australia (2012)	90 minutes
Door-to-Needle time	The interval between triage time and time of initiation of fibrinolytic therapy	O'Gara et al. (2013a)	30 minutes
Delay time	the interval from the onset of the symptoms to the definitive medical care initiation	Dracup et al. (1995)	Within 2 hours

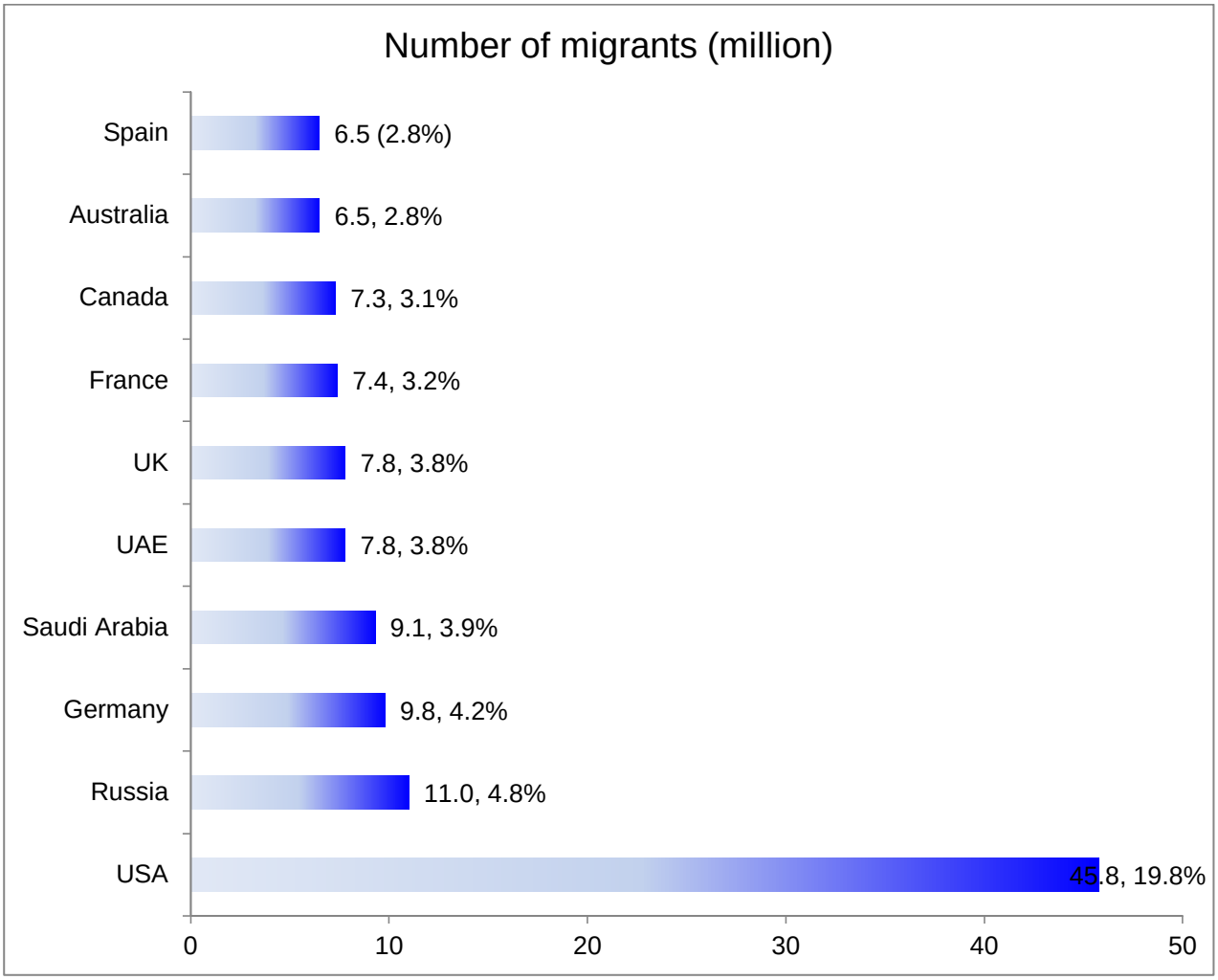
ED= emergency department, PCI= percutaneous coronary intervention

Multinational Collaboration

For decades, the partnership of health professionals, researchers and policy makers have dedicated their effort to establish and improve guidelines for management of ACS in various areas around the world. Current studies have demonstrated that the reduction in incidence, mortality rate and heart failure in ACS have been associated with improvement of treatment and prevention management (Fox et al. 2007; McManus et al. 2011). Despite the evidence of effectiveness of management of ACS, some studies have argued that there are substantial opportunities for improvement of both primary and secondary prevention (The GRACE Investigators 2001; Yan et al. 2004). Consequently, from time to time the recommendations and guidelines have been improved and augmented for the best outcomes of patients (Antman et al. 2000; Chew et al. 2011; Fox et al. 2002). It is important to identity the significant gaps between theory and real -world practice that would lead to optimal outcomes of patients and the best management. The multinational studies have provided a wide range of perspectives from patients to health professionals that greatly facilitate opportunities for advancements in ACS implementation (Fox et al. 2002; Goodman et al. 2009). These provide consistent evidence that the distinct variations such as hospital location, demographic characteristic, and regions may influence the management and eventually, the patients' outcomes.

Multiculturalism and Health Care

We are living in a multicultural world where the universal and divergent beliefs, cultures and attitudes mix and co-exist. Multiculturalism have been acknowledged and accepted in many countries. Recently, international migrants living abroad worldwide have reached a total of 232 million people, accounting for 3.2% of the world's population (United Nations 2013a). Just under 60% of all international migrants reside in developed countries (United Nations 2013d). Asians are the largest diaspora group living outside their major area of birth, with 19 million in Europe, 16 million in North America, and 3 million in Oceania (United Nations 2013b). The second largest group is from Latin America and the Caribbean, followed by Europeans as the third diaspora group who reside in a foreign land. Europe and Asia represent the most popular destinations for international migrants (United Nations 2013b), while the top 10 countries that gained the largest number of international migrants in 2013 are demonstrated in Figure 1.7.



United Nations (2013a, 2013c)

Figure 1.7 Top ten countries for international migrations in 2013

An international migrant is defined as any person who changes his or her country of usual residence" (United Nations 1998). The most common reason to move to another country for the majority of migrants is to improve their economic status and for better opportunities (United Nation Population Fund 2014).Their journeys inevitably end with a change of lifestyle, including food, activities, jobs, socialisation, and health care. Nevertheless, they may keep their culture, beliefs, and attitudes in many aspects of their lives, such as language, traditional foods, traditional medicine, and social activities. These phenomena may lead to acculturation where changes in the cultural patterns occur as a consequence of being a member of a plural society, and adaptation of the newcomers in the short-term and the long-term after moving to a different culture (Berry 1997; Frisbie, Cho & Hummer

2001; Gilbert & Khokhar 2008). A multicultural society may not be harmonious in all aspects, particularly regarding the balance of healthcare and need. The influence of culture and beliefs on their health behaviours especially concerning delay in seeking medical care is very interesting and somewhat ambiguous.

Cultural Competence

Inequity and accessibility in health care among culturally and linguistically diverse (CALD) migrants has been an issue for decades (National Health and Medical Research Council 2006). Although public health promotion and national plans have been implemented in multicultural communities, the disparities and unequal care have still occurred to some extent and further action and policies are needed to close the gap (Anderson, Green & Payne 2009; Gushulak & Williams 2004). For health care providers, not only does the system need to be developed and improved, but an understanding of CALD migrants from all aspects would be helpful in meeting their needs by including cultural care and cultural competence in health practice (Lancellotti 2008; Leininger 2006; McFarland & Eipperle 2008; Sobralske & Katz 2005).

Research has found different perceptions of disease among different cultures which contribute to their health behaviours, such as seeking care (Klingler et al. 2002). Some studies have stated that different beliefs and attitudes of migrants and refugees contribute to their patterns of health care access (Fung & Wong 2007; Gilman et al. 1992). In addition, Liamputtong and Naksook (2003) found that the social context of new environments, and different perceptions between partners who come from differing ethnic backgrounds, affect perceptions of both motherhood and emotions. These findings illustrate the impact of culture, beliefs, and attitudes on health behaviour among CALD populations. A number of studies on migrants have shown that the delay in seeking medical care for various diseases is associated with cultural barriers such as language, education deficits, lack of health insurance, and insufficient income (Becares, Nazroo & Stafford 2009; Beiser & Hou 2001; Sihavong et al. 2011; Tran 2009). Perceptions and emotional factors were also included as cultural barriers. They suggested that it is necessary for health professionals to learn and understand the importance of cultural values in health care delivery and in public health strategies.

This section presents the publication arising from this thesis which has been published in Australian Nursing and Midwifery Journal 2014, volume 22, issue 4, page 35.

Citation: Wechkunanukul, K, Grantham, H & Clark, RA 2014, 'Cultural competence in emergency department', *Australian Nursing and Midwifery Journal*, vol. 22, no. 4, p. 35.

http://search.informit.com.au/documentSummary;dn=612028390552703;res=IELHEA

Cultural competence in Emergency Department

Australia is one of the most multicultural societies in the world, and continues to grow in the diversity of culture, language and religion. Almost one-third of the Australian population have been born overseas (Australian Bureau of Statistics 2013a) and therefore one third of Emergency Department (ED) presentations will have been born in another country. New migrants to Australia are prone to encounter difficulties with settlement including education, employment taxation and a different health care system. There is evidence to indicate that Australian's culturally and linguistically diverse (CALD) population has different perceptions of health and illness which contribute to their health behaviours, including emergency care. CALD groups are also less likely to access primary and preventive care such as follow up visits and often experience difficulties communicating with health professionals which create issues for emergency nurses when gaining informed consent and providing education regarding medication at discharge (Kirkman-Liff & Mondragón 1991).

Over the past decade, several studies have concluded that routinely using interpreters can enhance delivery of health care, decrease ED visit time and reduce diagnosis- related costs. However, there is evidence interpreters are largely under-utilised in ED settings (Ramirez, Engel & Tang 2008). Effective communication is not only the indicator of quality of emergency care according to CALD patients but should also include empathy and interpersonal interaction with family (Beattie et al. 2012). There are standards of practice and competencies for nurses and clinical nurse specialists in emergency care. Nonetheless, these documents are focused on providing timely care in an appropriate manner to a general population who are English-speaking. How well these standards apply to culturally and linguistically diverse population, working in a different language and culture is unknown. How emergency department staff including nurses meet these standards when faced with challenges in culture and communication with patients is the subject of a research project we currently have in progress.

Cultural competence is a set of congruent behaviours, attitudes and policies that come together in a system, agency or among professionals and enable that system, agency or those professions to work effectively in cross-cultural situations. It is more than awareness of culture difference but

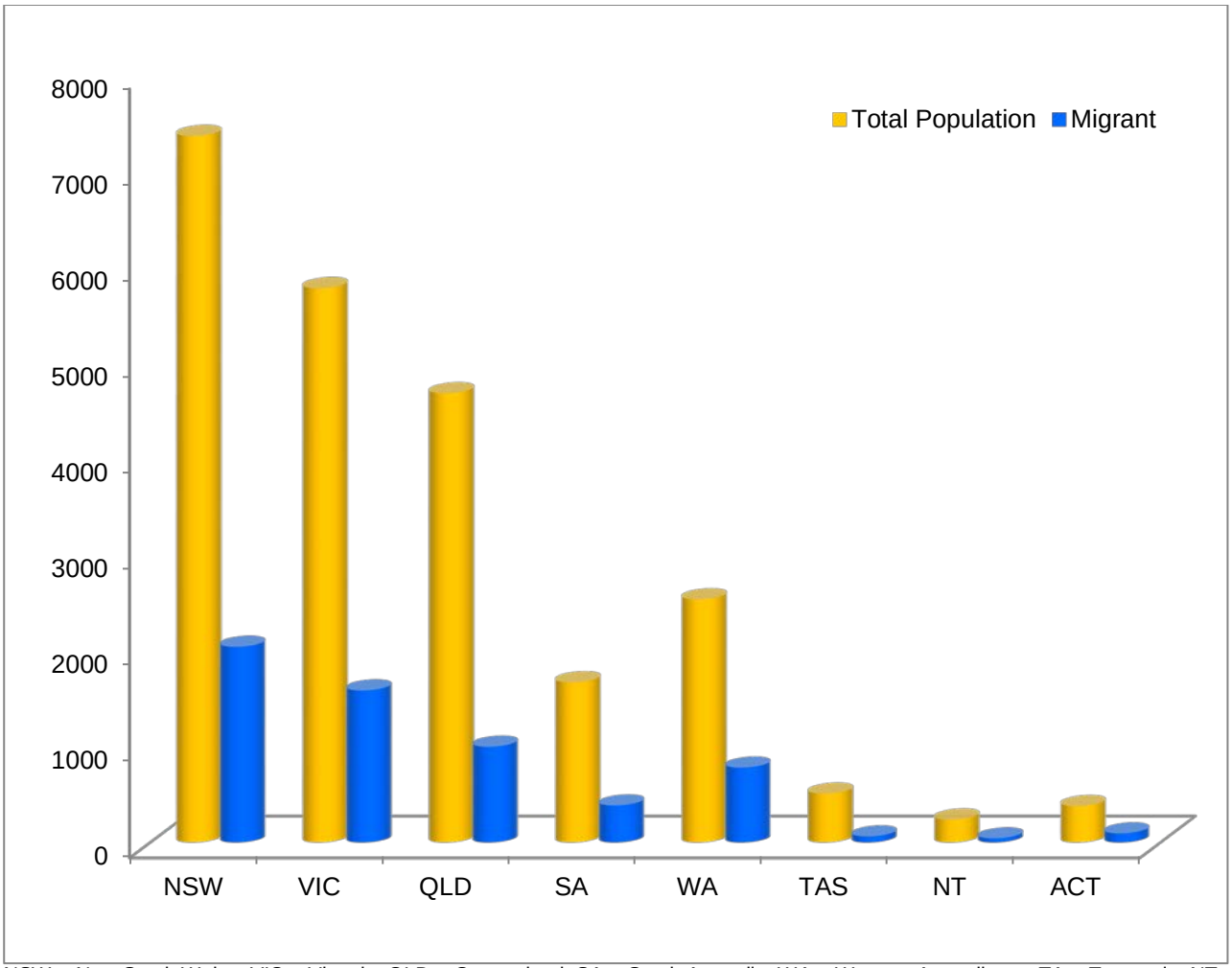
includes the notion where reciprocity, action and accountability are emphasized to improve practice on the basis of cultural differences (National Health and Medical Research Council 2006). Acknowledging Australia's diversity, cultural competence should be normalised into ED nursing practice in order to improve provision of care for our minority and often highly disadvantaged population (Betancourt, Green & carrillo 2002; Brach & Fraserirector 2000; Wish Garrett et al. 2008).

Ensuring optimum care for all those in need is one of the main reasons for our existence, ensuring cultural competence in our emergency department is a key stone of our care, achieving cultural competence can easily be within our grasp.

The end of this publication

Culturally and Linguistically Diverse Migrants in Australia

Australia is one of the most pluralist societies in the world, ranking as the 9th country in terms of receiving international migrants (United Nations 2013c). Currently, the population of Australia has reached 23 million people and almost one-third (28.1%) of the national population was born overseas, accounting for a total of 6.6 million people broken down by state in Figure 1.8 (Australian bureau of Statistics 2015). In addition, the major component of population change among the five largest states in Australia was net overseas migration (Australian Bureau of Statistics 2014). This illustrates the importance of migration to Australia's economic and social environment. On the other hand, the Australian health care system should be prepared to offer appropriate services for these ethnic communities which will allow them to have as high a quality of life as the general population.



NSW = New South Wales, VIC = Victoria, QLD = Queensland, SA = South Australia, WA = Western Australia, TA = Tasmania, NT = Northern territory, AC = Australian Capital Territory.
Source: Australian Bureau of Statistics (2014), Australian Bureau of Statistics (2013a)

Figure 1.8 Total Australian population and migrant population by state

Table 1.5: The top ten countries of birth of migrants in Australia and South Australia

Ranking	Australia Country	(%)*	South Australia Country	(%)**
1	United Kingdom	5.2	United Kingdom	7.9
2	New Zealand	2.6	Italy	1.4
3	China	1.9	India	1.3
4	India	1.7	China	1.2
5	Philippines	1.0	New Zealand	0.9
6	Vietnam	1.0	Vietnam	0.8
7	Italy	0.9	Germany	0.8
8	South Africa	0.8	Greece	0.7
9	Malaysia	0.7	Philippines	0.6
10	Germany	0.5	Netherlands	0.5

Australian Bureau of Statistics (2013a, 2015)
* % of total Australian population, ** % of total South Australian population

Table 1.6: The top ten non-English speaking countries of birth and languages other than English spoken at home in South Australia

Ranking	Country of Birth	(%)*	Language Spoken at Home	(%)*
1	Italy	10.1	Italian	14.5
2	India	9.2	Greek	11.0
3	China	7.8	Mandarin	7.2
4	Vietnam	5.9	Vietnam	7.0
5	Germany	5.6	Cantonese	3.9
6	Greece	4.8	Arabic	3.3
7	Philippines	4.3	German	3.2
8	Netherlands	3.6	Polish	2.7
9	Malaysia	3.4	Spanish	2.1
10	South Africa	3.0	Panjabi	1.9

Multicultural SA (2013b),
* % of total migrants in SA

Population of SA ranked as the 5th largest population both overall and of migrants in Australia. The state comprises people from approximately 200 countries who speak more than 200 languages at home (Multicultural SA 2013a). The top 10 countries of birth in Australia and SA are shown in Table 1.5.There are many migrants who come from non-English speaking countries, accounting for 13% of the total SA population and reaching 25% when the second generation is included (Multicultural SA 2013a, 2013b). The common non-English countries of birth, and languages other than English spoken, in SA are summarised in Table 1.6.

Australia's Future Direction and Implementation Plan for CALD

In Australia, The Heart Foundation and the Cardiac Society of Australia and New Zealand (CSANZ) have established a set of national evidence-based guidelines with an addendum for the management of acute coronary syndrome (ACS). They work collaboratively with government and key health service stakeholders to improve the adoption of the recommendations and ACS health outcomes (National Heart Foundation of Australia 2009b). In 2007, the national acute coronary syndrome implementation forum was established the ACS Implementation and Advocacy Working Group (ACSIAWG), in order to gain consensus from experts and potential perspectives on priority intervention points for improving the management of ACS in Australia (National Heart Foundation of Australia 2008). The current gaps and six highest priority areas were identified below (Brieger, David et al. 2009).

1. Early reperfusion for STEMI
2. Accurate risk stratification for NSTEACS
3. Early invasive management for high-risk NSTEACS
4. Rehabilitation and secondary prevention
5. Equality of access and care for geographically isolated and vulnerable communities
6. Data collection and programs for improving clinical effectiveness

The ACSIAWG concluded that all implementation must be adapted to local conditions and must focus on providing services to regional, rural, and remote areas. The Cardiac Accessibility and Remoteness Index for Australia (Cardiac ARIA) project is a unique innovation that derives important

data about accessibility to cardiac care across Australia by using Geographical Spatial Technology (GIS) (Clark et al. 2012). The project found significant inequities in accessing cardiac services in Australia, information which is valuable for developing a health care plan (Clark et al. 2012).

Difficulties in living in rural and remote areas are substantial barriers for patients to obtain the recommended therapy, albeit there are other potential factors that play a vital role in improving ACS management. Chew et al. (2013) stated that, regardless of improvements in the guidelines for the management of ACS, the evidence-based recommendations have been implemented insufficiently due to variations across Australia and New Zealand. Patient characteristics, including cultural differences, are considered one of the likely factors influencing the time-effectiveness and risk appropriateness of ACS care. According to the National Data Elements for the Clinical Management of ACS, country of birth and ethnicity has been recognised as standard elements of demographics (Chew et al. 2005). This reflects the importance of ethnic and cultural factors for health care plans and implementation strategies. However, CALD populations and cross-cultural practices (excluding Aboriginal and Torres Strait Islanders) have not been addressed in the guidelines for the management of ACS, the priority interventions for improving the management of ACS in Australia, or, the current ACS clinical care standard (Australian Commission on Safety and Quality in Health Care 2014; Brieger, David et al. 2009; Chew et al. 2016). Consequently, inequities in access to evidence-based therapies for ACS, and incomplete implementation of the recommendations, are more likely to remain in the health care system until this missing piece of the jigsaw has been found.

Definitions

Cultural and linguistic diversity (CALD)

The term ‘cultural and linguistic diversity’ (CALD) has been defined by several organisations. National Health and Medical Research Council (2006) refers CALD to that groups and individuals differ according to religion and spirituality, racial backgrounds and ethnicity as well as language. They al also clarified that CALD was used to reflect intergenerational and contextual issues, not just migrant experience.

Federation of Ethnic Communities' Councils of Australia (2015) stated that CALD does include mainly people from a non-English speaking background; it may also include people form English-speaking background whose culture background is different from the Australian main stream such as India, Malaysia and Singapore. This is similar to the definition used by the Ethnic Communities’ Council of Victoria where CALD is defined as those people born overseas, in countries other than those classified by the Australian Bureau of Statistics as “main English speaking Countries” (i.e., Canada, Ireland, New Zealand, South Africa, the UK and the USA) (Ethnic Communities' Council of Victoria 2012) On the other hand, some agencies included people with different culture who were born in Australian as well. Centre for Multicultural Youth (2010) and Francis and Cornfoot (2007) defines CALD as people who were born overseas or who are Australia-born with one or both parents (or grandparents) born overseas. Similarly, Multicultural Youth Advocacy Network (Australia) includes persons born in a CALD country other than Australia and second generation Australian born descendants who has at least one parent born in a CALD country (Hugo et al. 2014).

Additionally, Australian Bureau of Statistics has divided CALD status into four categories: 1) born in Australia, mainly speaks English at home; 2) born in Australia, mainly speaks a language other than English at home; 3) born overseas, mainly speaks English at home; and 4) born overseas, mainly speaks a language other than English at home (Australian bureau of Statistics 2011b). Even though the agencies may defined CALD term based on different aspect, the consistency of these definitions appear to link to the differences in countries of origin, cultures, and languages. To improve the compatibility and comparability of data derived from different sources on cultural and linguistic

backgrounds, the Ministerial Council of Immigration and Multicultural Affairs (MCIMA) and Australian Bureau of Statistics have developed Standards for Statistics on Cultural and Language Diversity, catalogue number 1289.0 for all agencies across Australia (Department of Immigration and Multicultural Affairs 2001). Country of birth of person and main language other than English spoken at home are one of variables included in the core set of these standards (Australian Bureau of Statistics 1999).

According to the standard and retrieved datasets, CALD in this thesis refer to persons born overseas in a country other than countries classified by Australian Bureau of Statistics as a 'main English country', speak a language other than English and may speak English as a second language. There are other terms used in articles included in this study such as non-English speaking background (NESB) and English as a second language (ESL) background, the author keeps the terms as used in the original works throughout the study.

Ethnicity

The TED study has stratified study population using the Standard Australian Classification of Countries, Version 2.2 (Australian Bureau of Statistics 2011c) and also adopted the Standard for Statistics on Cultural and Language Diversity alluded to above (Australian Bureau of Statistics 1999). As a result, this study considers ethnic groups using Australian Standard Classification of Cultural and Ethnic groups (Australian Bureau of Statistics 2000) to ensure the compatibility and comparability of data and data analysis . The details of ethnic group classification are provided in Table 1.7.

There are various terms that appear in a number of studies included in this research such as race, minorities, racial groups and non-white. However, the author interprets all of these terms as ethnicity within this study. Other terms in articles included in this study referred to ethnic groups such as White, Black, Caucasian, African-American, Hispanic, Asian, and South Asian, the author keeps these terms as used in the original works throughout the study.

Table 1.7: Classification of ethnic groups in TED Study based on the Australian Standard Classification of Cultural and Ethnic groups

	Ethnic groups
1	Oceanian
	11 Australian Peoples
	12 New Zealand Peoples
	13 Melanesian and Papuan
	14 Micronesian
	15 Polynesian
2	North-West European
	21 British
	22 Irish
	23 Western European
	24 Northern European
3	Southern and East European
	31 Southern European
	32 South Eastern European
	33 Eastern European
4	North African and Middle Eastern
	41 Arab
	42 Jewish
	43 Other North African and Middle Eastern
5	South-East Asian
	51 Mainland South-East Asian
	52 Maritime South-East Asian
6	North-East Asian
	61 Chinese Asian
	62 Other North-East Asian
7	Southern and Central Asian
	71 Southern Asian
	72 Central Asian
8	People of the Americas
	81 North American
	82 South American
	83 Central American
	84 Caribbean Islander
9	Sub-Saharan African
	91 Central and West Africa
	92 Southern and East Africa

Australian Bureau of Statistics (2000)

Table 1.8: Classification of regions in TED Study based on the Standard Australian Classification of Countries (SACC), version 2.2

	Regions
1	North-West Europe (NWE)
	United Kingdom, Channel Islands and Isle of Man
	Ireland
	Western Europe
	Northern Europe
2	South-East Europe (SEE)
	Southern Europe
	South Eastern Europe
	Eastern Europe
3	North-East Asia (NEA)
	Chinese Asia (includes Mongolia)
	Japan and Koreas
4	South-East Asia (SEA)
	Mainland South-East Asia
	Maritime South-East Asia
5	Southern and Central Asia (SCA)
	Southern Asia
	Central Asia
6	North Africa and Middle East (MDE)
	North Africa
	Middle East
7	Sub-Saharan Africa (SBAF)
	Central and West Africa
	Southern and East Africa
8	Americas (AMC)
	Northern America
	South America
	Central America
	Caribbean
9	Oceania
	New Zealand
	Melanesia
	Micronesia
	Polynesia (excludes Hawaii)
	Antarctica

Australian Bureau of Statistics (2011c)

Migrants

Immigration has been defined by Australian Bureau Statistics as “The process of entering one country from another to take up permanent or semi-permanent residence.

> “An international migrant is defined as "any person who changes his or her country of usual residence" (United Nations 1998). The country of usual residence is the country in which a person lives, that is to say, the country in which he or she has a place to live where he or she normally spends the daily period of rest. A long-term international migrant is a person who moves to a country other than that of his or her usual residence for a period of at least a year (12 months), so that the country of destination effectively becomes his or her new country of usual residence.(Australian Bureau of Statistics 2013a)”

The terms ‘migrant’ and ‘immigrants’ are often interchangeable. However, this thesis use the term ‘migrant’ and its derivatives throughout entire chapters, whereas all information retrieved from other sources, will use the original terms (as used in the documents of these organisations), but has been referred to the term ‘migrant’.

Region

There are many regions referred to in the various reviewed studies included in this thesis depending on the source of information. Some countries are classified into different regions through different definitions; for example, India is a country in South Asia according to the seven continents definition, but it is classified as part of South-East Asia by the World Health Organisation. To address these conflictions, this thesis use the Standard Australian Classification of Countries (SACC), version 2.2 (Australian Bureau of Statistics 2011c) to classified those who were born in other countries than Australia into nine regions. The nine regions have been classified in Table 1.8. Australia has been excluded from these nine regions and is defined as the general population (Control group) of this study. Although the United Nation classification of countries version enables international comparison, the Standard Australian Classification of Countries by the Australian Bureau of Statistics is more likely to be appropriate for research in Australia, as it is relevant to social, economic, cultural, and political criteria. The full list of the SACC is provided in Appendix IV.

Aims and Objectives

Aims

The Time, Ethnicity and Delay (TED) study aimed to determine the ethnic differences in seeking medical care for chest pain among culturally and linguistically diverse (CALD) populations, and examine relationship between ethnicity and that delay.

Research questions

The research questions addressed in this study:

1. Is there association between ethnicity and delay time in seeking medical care for chest pain?
2. Is there difference in presenting characteristics and processing times in ED between culturally and linguistically diverse (CALD) and Australian-born patients?
3. Is there difference in seeking-care behaviours and clinical outcomes between nine ethnic groups and Australian group?

Objectives

1. To establish a systematic review report in relation to the association between ethnicity and delay time in seeking medical care for chest pain among CALD.
2. To determine the differences in presenting characteristics and processing times in ED between CALD and Australian-born patients.
3. To determine ethnic differences in care-seeking behaviours and clinical outcomes among nine ethnic groups and compare to Australian group, and examine the effect of ethnicity on seeking medical care for chest pain.

To achieve the goal, three studies have been designed to address the three research questions in three different levels (Figure 1.9). The research design incorporates a systematic review (World-level), a cross-section analysis of a cohort of emergency department (Nation-level) and a medical record review (Community- level). The details of methodology and methods of each study is presented in Chapter three.

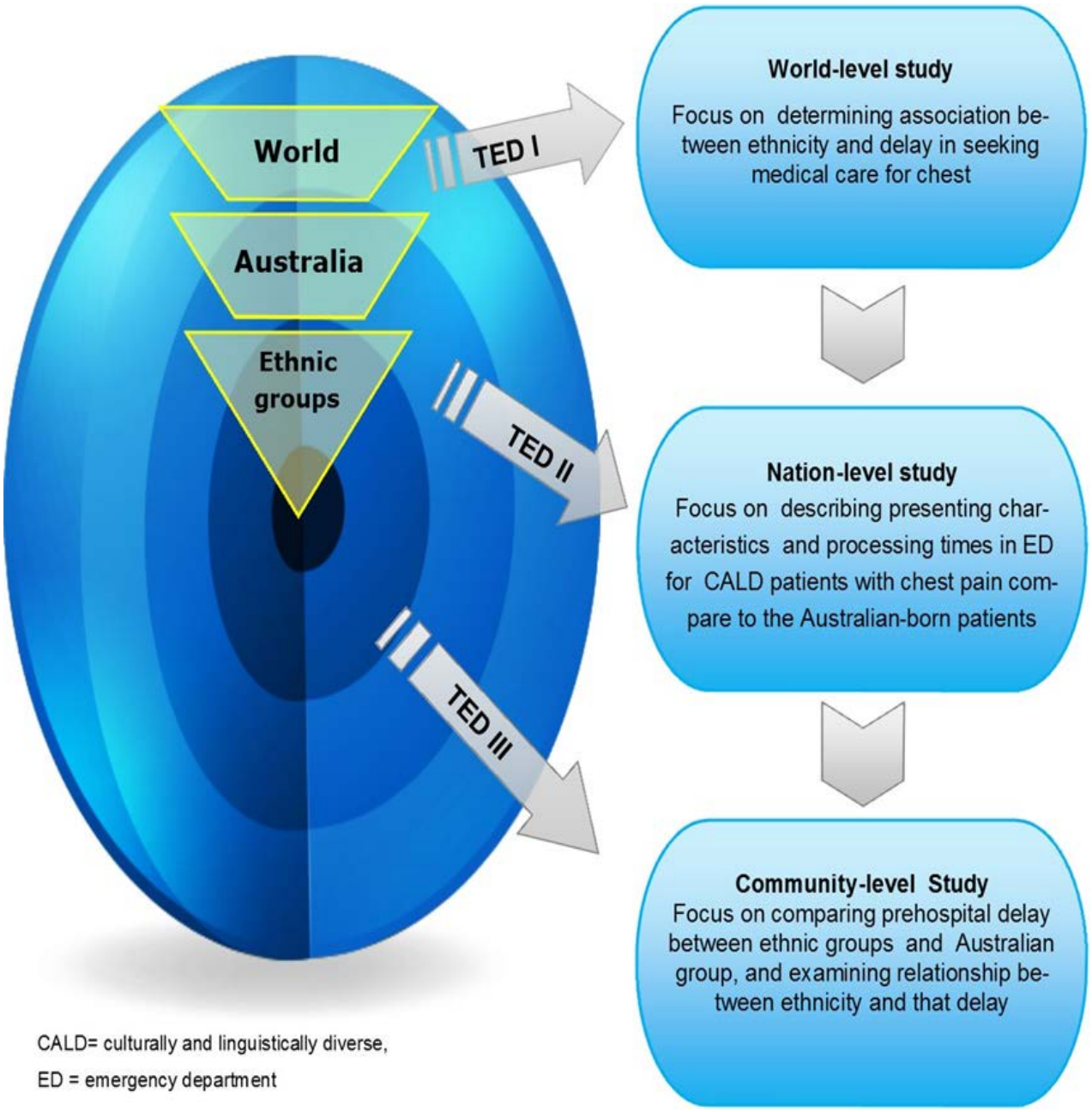


Figure 1.9 Scope and context of research

We hope that the findings from TED study will establish a knowledge of delay in seeking medical care for chest pain among the ethnic populations in Australia, which is essential to understand their seeking care behaviours during the suspected cardiac event. This would form an essential database for the future research in this area.

The expected outcomes of the TED study include:

1. Understanding presenting characteristics and delay in seeking medical care for chest pain among CALD patients in Australia

2. Inform the healthcare providers, public health agencies, and policy-makers in regard to improvements in cardiac services. The findings will be reported to the related organization such as National heart Foundation, main hospitals in South Australia. In addition, the findings will be published in potential journals which will disseminate the information throughout the target audiences.

3. Establishment of an essential database for further study in cardiovascular disease and cardiac care for CALD populations and could be adapted to other health conditions.

CHAPTER 2

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

CHAPTER 2 LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

This chapter provides a literature review covering a number of significant topics related to delay time in seeking medical care for chest pain and ethnicity. The first section demonstrates the existing arguments over emergency medical services utilisation. The second section provides the current situation and relevant global studies on the delay time in seeking treatment for chest pain in the general population. The recent integrative literature review publication rising from this thesis entitled 'Global review of delay time in seeking medical care for chest pain: an integrative literature review' has been present in the part. Factors associated with the delay are presented in the following sections. The fourth sections present the current studies on delay in seeking medical care for chest pain among ethnicity and the gap in the literature in this area. The next section provides a summary and the implications for research from the literature reviews. The final section presents the development of the conceptual framework for this research.

Emergency Medical Services Underutilisation

Considerable research has been conducted on the relationship between emergency medical service (EMS) utilisation and patient outcomes. Evidence shows that transport to hospital by ambulance after, or during, a cardiac event is superior to a private car in terms of rapid identification and the reception of cardiac care (Hemsey & Drew 2012; Hitchcock et al. 2003; Hutchings et al. 2004). Studies have suggested that patients should also call an ambulance rather than contacting their general practitioners in order to reduce delay times (Brown et al. 2000; Johansson, Stromberg & Awahn 2004). Similarly, a study in Australia reported that thrombolysis therapy was delayed if the patient called their doctor instead of an ambulance, and also recommended for general practice to divert the patient to an ambulance if a suspected ACS patient contacts them (Hitchcock et al. 2003).

Brown et al. (2000) noted that it is uncertain whether doctor consultation during the cardiac event decreases patient anxiety and leads to the underutilisation of ambulance services. Nonetheless, 83% of patients contacting their GP in Brown's study were eventually admitted to hospital. These studies were carried out under different circumstances include geographic, socio-demographic (such

as population size), distances from hospital, education levels, income, and ethnicity. Further research on such specific and selected target groups needs to be undertaken. A rapid admission of reperfusion therapy is not the only advantage of EMS, but also the more timely identification of ACS by pre-hospital ECG conducted by emergency medical personnel (Hemsey & Drew 2012; Patel et al. 2012). Weaver, W et al. (1993) argued that pre-hospital initiated ECG, and identification of patients eligible for thrombolysis by paramedics, also contributes to a significant decrease in time from the onset of symptoms to treatment. In addition, their secondary analysis concluded that early treatment, within 70 minutes of onset of symptoms, reduced the infarction process and its complications.

Although EMS utilisation has been shown to provide better outcomes, a huge number of patients with ACS refuse, avoid, or delay calling emergency services (Lozzi et al. 2005). One study found that the major reason patients refrain from calling emergency services is that the symptoms are considered not to be severe enough (Meischke et al. 1995). Another study indicated that demographic, belief, and situational factors, such as indecision, self-management, physician contact, and financial concerns may also be associated with underutilisation of EMS (Brown et al. 2000). Canto et al. (2002) studied the use of EMS in a large population between 1991 and 1998 and found that the reasons for underuse of EMS were unclear, but stated that it is more associated with a lack of knowledge of ACS symptoms. They also suggested further research be undertaken on psychological factors such as patient denial and embarrassment.

To improve the use of EMS, public education programs have been implemented in a number of countries. One study in King County, Washington USA focused on a population 50 years of age and older using a media campaign as an intervention. The results showed a significant increase in EMS utilisation over a short-term period, but tapered off with time after the program had finished (Eppler et al. 1994). A similar study in patients with ACS in the same city, conducted in 1989, concluded that there was no significant increase in EMS use and reduction of time delay, even though knowledge and awareness of EMS had increased significantly (Ho et al. 1989). The study suggested that repeated public education campaigns and identification of the reasons for patient delay are

warranted in order to modify health behaviours that contribute to improving pre-hospital delay in seeking treatment for chest pain.

The Delay in Seeking Medical Care

Timeliness and Timing

Several studies on out-of-hospital cardiac arrest noted that the most common causes of out-of-hospital cardiac arrest are CHD and ACS (Anyfantakis et al. 2009; de Vreede-Swagemakers et al. 1998; Engdahl et al. 2002; Nichol et al. 2008) with a survival rate of 7% (Berdowski et al. 2010). These studies concluded that the interval between collapse and calling an ambulance, and the interval between collapse and medical care are potential factors related to survival rate after out-of-hospital cardiac arrest. There is no doubt that time is a vital component of ACS management as the myocardial infarction progresses with every single minute. Boersma et al. (1996a) found that 65 lives are saved for every 1000 treated patients when the initial treatment is administered within the first hour of symptom of onset. On the other hand, Giusppe et al. (2004) found that the 1-year mortality rate increased by delay time, 1-year mortality rate increased 7.5% for every 30 minutes of treatment delay.

The findings from international trials support the notion that mortality rates and survival rates within 30 days and one year of ACS symptoms are associated with the interval between symptom onset and treatment (Armstrong et al. 1998; GISSI 1986; Weaver, WD et al. 1993). According to Gruppo Italiano per lo Studio della Streptochinasi nell'Infarto Miocardico, GISSI (1986) study-I, the recommended treatment was reach the maximum effect if it initiated within 120 minutes. The survival rate within 30 days of ACS was almost 50% if patients were admitted within 60 minutes. Franzosi et al. (1998) conducted a ten-year follow up study of GISSI-I study and noted the prolonged survival rate was favour of patient with ACS who admitted early, particularly those who received treatment within one hour. They also concluded the early reperfusion has a positive relationship with survival and long-term benefit.

The Definition and the Phases of Delay Time

There was no definitive way to prevent myocardial infarction until the availability of reperfusion therapy which lead to a dramatic decline in the MI mortality rate (Ryan et al. 1999). Unfortunately, the maximum advantage of these treatments has not been realised due to time delays in approaching medical care.

Significant studies in a number of regions have found delay in seeking treatment among patients with ACS (Dracup et al. 2003; Fox et al. 2000; Moser et al. 2005). One trial stated that the mortality rate was 2 lives per hour of delay (Appleby et al. 1994). As a result, understanding the reasons for delay, and the nature and characteristics of delay, has become a major issue in the management of ACS. Lesneski and Morton (2000) have suggested that there are three important factors in analysing the delay in the seeking of medical care for AMI, including definitions of delay, methods of measurement, and the factors that influence the delay. Dracup et al. (1995) argued that, due to the importance of AMI therapy, the delay time should include the amount of time it takes to reach treatment in the hospital as well, rather than only the interval between onset and reaching the actual hospital. They defined the delay time as the interval from the onset of symptoms to the initiation of definitive therapy. This study will use this definition throughout this project.

There are some other definitions of delay time published as below:

1. The interval between the onset of symptoms of AMI and the patient's call for medical assistance (Trent et al. 1995)

2. The interval between the time of the initial symptoms until time of arrival at the hospital (Ottesen et al. 1996)

3. The time it takes a person to interpret their symptoms and then decide to seek medical attention (Zerwic 1998)

In this thesis, the modified version of Alonzo (1984) phases was used, which divides time delay into the following three phases:

1. The patient/bystander recognition and action phase is the interval from onset of symptoms to seeking medical help such as calling an ambulance. This phase also involves the response to chest pain from people around the patient, such as a spouse, or friends and family. This phase is considered as a decision time delay.

2. The pre-hospital action phase is the interval between accessing the emergency response system to the time of arrival at the hospital and referred to as the home-to-hospital delay. Travelling time plays a crucial role in this stage.

3. The hospital action phase encompasses the interval time between arriving at the hospital and receiving definitive therapy. Rapid and accurate clinical decision-making and prompt operation of therapy are key factors in this phase.

Pre-hospital delay time consists of the two components of decision time and home-to-hospital delay which are directly related to the patient's response to chest pain (Dracup et al. 1995). Previous studies concluded that the time it takes for a patient to seek help accounts for the greatest amount of delay time (Finnegan et al. 2000; Taylor et al. 2005). On the other hand, travel time by ambulance plays a minor part in pre-hospital delay time (Perkins-Porras et al. 2009). Another interesting point is that the delay time from symptom onset to therapy initiation affects short-term and also long-term outcomes (Acute Coronary Syndrome Guidelines Working Group 2006; National Clinical Guideline Center 2013).

This section presents the publication arising from this thesis which has been published in Australian Critical Care 2016, published online on 23 April 2016 (Article in press)

Citation: Wechkunanukul, K, Grantham, H & Clark, RA 2016, 'Global review of delay time in seeking medical care for chest pain: An integrative literature review', *Australian Critical Care*. http://dx.doi.org/10.1016/j.aucc.2016.04.002

Global review of delay time in seeking medical care for chest pain: an integrative literature review

Introduction

Coronary heart disease (CHD) accounts for 1.8 million, or one-fifth of all deaths, in Europe annually (Nichols et al. 2014b). In Australia, more than 20,000 deaths were caused by CHD in 2012 (Nichols et al. 2014a), and approximately 190 heart attacks occur each day (Australian Commission on Safety and Quality in Health Care 2014). Chest pain is the most common symptom (75% of presentations) of acute coronary syndrome (ACS) (Nichols et al. 2014a) and is also recognised as one of the most common presentations to emergency departments (ED) (Niska, Bhuiya & Xu 2010). The timely arrival of patients with chest pain to the ED and rapid evidence-based treatment are important factors in patient survival and outcomes.(Steg et al. 2012). Boersma et al. (1996a) found that 65 lives were saved for every 1,000 treated patients when the initial treatment was administered within the first hour of the onset of symptoms. Additionally, the 1-year mortality rate for ACS was found to increase with greater delay time. A current study from Australia and New Zealand found that most patients delay the seeking of medical care for ACS, and therefore, do not receive the potential maximum benefit of their treatment (McKinley et al. 2011).

A number of researchers have focused on the factors which influence delay time in seeking care for chest pain in order to provide a clear picture of healthcare-seeking behaviour for a cardiac event (Clark et al. 2012; Dracup et al. 2003; Fox et al. 2000). Geographic factors related to inequities in access to cardiac healthcare services in Australia affected delay time, and researchers also recommended the development of innovative approaches to improve cardiac care accessibility (Clark et al. 2012). There were variations in the time taken to seek care for chest pain amongst a range of countries, which may be related to socioeconomic status and the standard of the healthcare system in each country (Dracup et al. 2003; McKinley et al. 2004). Social, cognitive, and emotional responses of patients to ACS symptoms played a crucial role in their decision to seek care, such as the pattern of symptoms, failures in symptom recognition, a mismatch between symptom expectations and actual experiences, the absence of chest pain, and a lack of knowledge of the treatments (Moser et al. 2006). They also referred to a number of social factors which were related

to longer delay time, such as the location of the home, living alone, resting or sleeping during the cardiac event, and feelings of embarrassment.

Herlitz et al. (2010b) found that ethnicity was related to increased pre-hospital delays for acute myocardial infarction, and underutilisation of emergency services for acute chest pain. The authors reported that pre-hospital delays for acute myocardial infarction increased among Asian and Latino populations in the USA, while underutilisation of emergency services increased among South Asians in the UK. Researchers have recommended further studies to be carried out in order to gain a deeper insight into patient perspectives on ACS and the influencing factors, particularly on those where little research has been conducted, such as ethnicity in diverse cultural groups (Dracup et al. 2003; Goff et al. 1998; Goldberg et al. 2009) . Researchers recommended that further research should focus on time delays associated with these same influencing factors (Moser et al. 2006)

Aim

The aim of this review is to summarise research from a range of countries describing the differences in time taken to seek medical care for chest pain and factors which contribute to delay times.

Methods

An integrative literature review is a specific review method that summarises the existing empirical and/or theoretical literature to provide a more comprehensive understanding of a particular phenomenon or healthcare problem (Broome 2000). This type of review is an approach that allows for the inclusion of a range of diverse methodologies (i.e. experimental and non-experimental research) and has the potential to play a greater role in evidenced-based practice (Whittemore & Knafl 2005).

Information sources and search

The MEDLINE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Scopus databases were searched for literature published in the period 1994-2014 limited to publication in English only. The keywords used in the search were ‘chest pain’, ‘heart attack’, ‘acute coronary syndrome’, ‘ACS’, ‘myocardial infarction’, ‘myocardial ischemia’, ‘angina’, ‘unstable angina’, ‘delay’, ‘delay time’, ‘seeking care/treatment/help’, ‘healthcare seeking’, and ‘prehospital delay’.

The Boolean operator 'or' and 'and' were used to expand or limit the search respectively. The search terms combined with ‘or’ including set 1: chest pain or ACS or heart attack, heart attack or acute coronary syndrome or ACS, angina or unstable angina or angina pectoris, myocardial infarction or myocardial ischemia or acute coronary syndrome; and set 2: delay or delay time, delay and seeking care, delay or seeking care, seeking care or health care seeking, seeking care or prehospital delay and prehospital or delay. Then the terms in set1 were combined with terms in set 2 with the Boolean operator ‘and’ for specific search. Additional manual search from reference lists of included articles were undertaken and these additional articles were assessed against the eligibility criteria to ensure the literature review was comprehensive. All search results were imported into an EndNote X7 Library, pooled, and then removed the duplicated records.

Eligibility criteria

The eligibility criteria for this literature review included studies that: a) included patients presenting to an emergency department with chest pain; b) had a primary or secondary objective focusing on delay time; c) measured and reported on delay time quantitatively; d) mainly focused on pre-hospital delay; e) was original research, rather than a review or meta-analysis; f) was conducted in a single country rather than in multiple countries in a single study; g) was mainly quantitative in approach within level I to level III of the National Health and Medical Research Council (NHMRC) evidence hierarchy; and h) was available in full-text.

Data analysis and evaluation

This integrative literature review conducted a systematically methodological quality assessment through the updated methodology process defined by Whittemore and Knafl (Whittemore & Knafl 2005) and a checklist for writing an integrative review recommended by Torraco18 in conjunction with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines and checklist for the reporting of systematic reviews (Moher et al. 2015). The data analysis process includes the steps of data reduction, display, and comparison, conclusion drawing, and verification (Torraco 2005; Whittemore & Knafl 2005). The current review performed the data reduction through a sub-group classification of the selected studies based on their research design, including randomised controlled trials and comparative studies. The level I to level III of the National Health

and Medical Research Council (NHMRC) evidence hierarchy included randomised controlled trials (RCT), pseudo-randomised controlled trials, and comparative studies (cohort and case-control studies) (National Health and Medical Research Council 1999). The data from each study was extracted into a manageable spreadsheet using Microsoft Excel® spreadsheet software (KW). The extracted data from the reviewed studies were displayed and compared in tables based on variables of interest, including delay time, factors associated with longer delays, and the effects of ethnicity (KW). Finally, the conclusions of the integrative review were presented in Tables 2.1, 2.2, and 2.3.

Definitions

Pre-hospital delay time is defined as the interval between the time of symptom onset and hospital arrival (Dracup et al. 1995; King & McQuire 2007). Decision time is defined as the interval from the time of symptom onset to accessing the emergency response system or to initiating travel to the hospital (Dracup et al. 1995). This review considered the definition of 'time of symptom onset', defined by Goldberg et.al, as the time during which the patient reported becoming acutely or severely ill, prompting him/her to seek medical care (Goldberg et al. 2002). Finally, the regions used for the analysis were chosen according to the United Nation Classification of Countries (United Nations 2012).

Results

Description of studies

A total of 395 relevant articles were found in the databases. The 57 duplicates were removed and 133 articles were excluded by title/abstract. An additional two articles were found in the reference lists of the initial included studies, yielding a total of 207 full-text articles which were subsequently assessed for eligibility. The 184 full-text articles were excluded as they did not meet the inclusion criteria. Eventually, 23 articles were included in the integrative literature review (Figure 2.1).

Methodological quality

The included studies were conducted in 17 countries in five regions. Six (26.2%) studies were conducted in Europe, five (21.7%) in the Americas, five (21.7%) in Asia, and five (21.7%) in the Middle East. The remaining two (8.7%) studies were conducted in Oceania. Sample size of included studies varied from 8831 to 104,662.43 This review included studies within level I to level III of the

National Health and Medical Research Council (NHMRC) evidence hierarchy, including two RCT studies33-34, ten prospective comparative studies (Dracup, McKinley & Moser 1997; Eshah 2013; Horne et al. 2000; Noureddine et al. 2006; Ottesen et al. 2004; Ottesen et al. 1996; Perkins-Porras et al. 2009; Quinn 2005; Srimahachota et al. 2007; Yan et al. 2009), nine retrospective comparative studies (Atzema et al. 2011; Ayrik et al. 2006; Fukuoka et al. 2005; Khan et al. 2007; Peng et al. 2014; Pitsavos et al. 2006; Tabriz et al. 2012; Taylor et al. 2005; Ting et al. 2010) and two mixed methods studies (Alshahrani et al. 2013; Mussi et al. 2014).

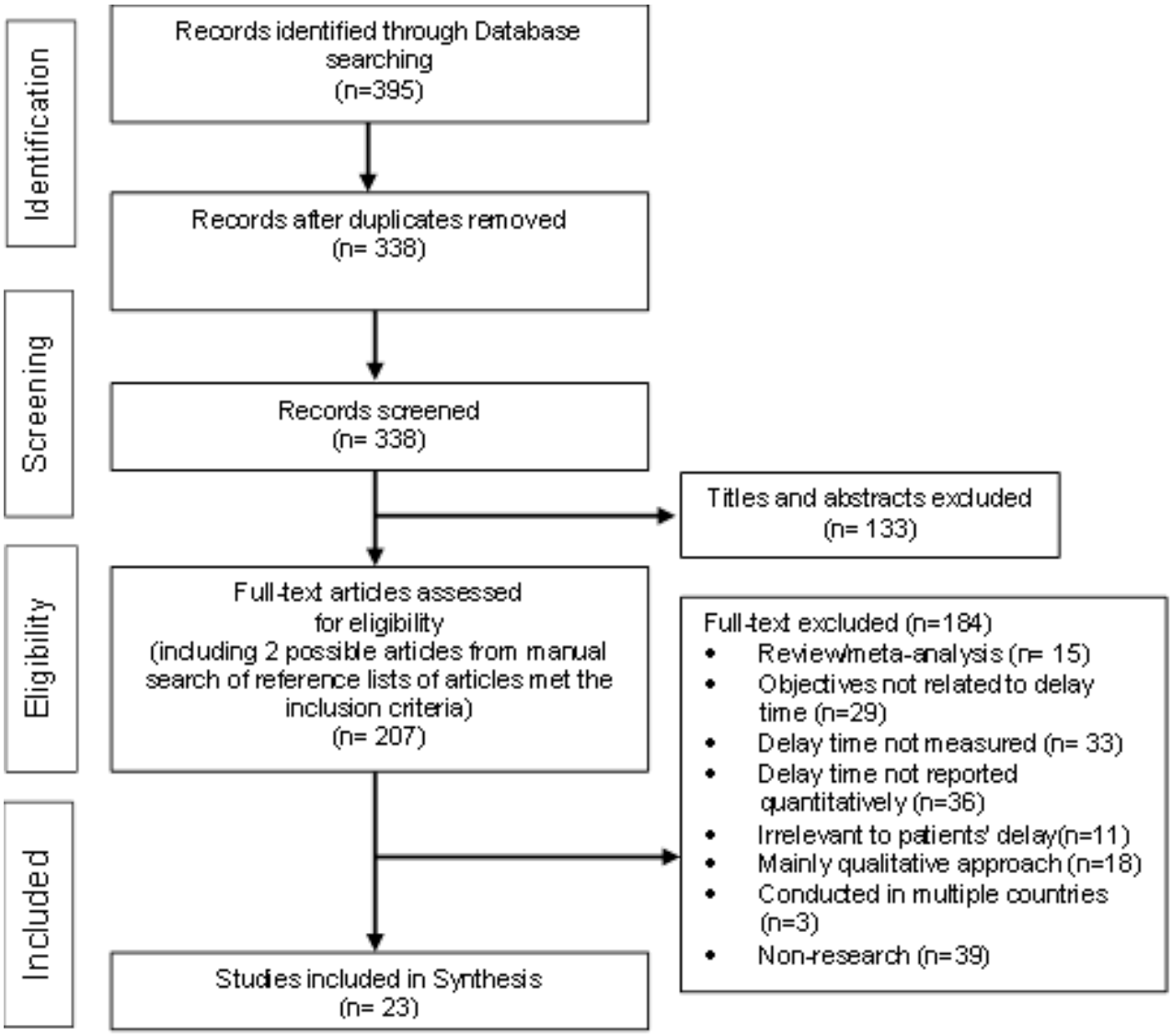


Figure 2.1 The flow diagram of literature search and inclusion of the studies

In total, 153,811 participants were included in this review. The mean age of participants of all reviewed studies ranged from 51.942 to 68.045 years. Male was the majority gender of all 23 studies ranging from 55.7% (Mussi et al. 2014) to 87% (Fukuoka et al. 2005) All 23 studied recruited patients at the same condition (i.e., presented to hospital with chest pain). Statistical analyses were performed appropriately. Continuous variables were presented as mean with standard deviation (SD) or median with Interval Quartile Range (IQR), and t-test were used for comparisons. Categorical variables were presented as frequency and percentage, and Chi-square test were used for comparisons. The outcomes, delay time, were measured and statistically analysed appropriately. For RCT studies, the follow up had been taken at the reasonable period of time 18 months 33 (Luepker et al. 2000) and 24 months (Mooney et al. 2014).

Variability in delay times

There was variability in delay times in all the selected studies. The median pre-hospital delay time in seeking medical care for chest pain varied from country to country, ranging from 1.6 hours in Brazil (Mussi et al. 2014) to 12.9 hours in Saudi Arabia (Alshahrani et al. 2013) (see Table 2.1). The mean of 'median pre-hospital delay time' from 23 studies was 3.4 hours. Nineteen studies (Alshahrani et al. 2013; Atzema et al. 2011; Dracup, McKinley & Moser 1997; Eshah 2013; Fukuoka et al. 2005; Horne et al. 2000; Khan et al. 2007; Luepker et al. 2000; Mooney et al. 2014; Noureddine et al. 2006; Ottesen et al. 1996; Peng et al. 2014; Perkins-Porras et al. 2009; Pitsavos et al. 2006; Quinn 2005; Srimahachota et al. 2007; Taylor et al. 2005; Ting et al. 2010; Yan et al. 2009) from 15 countries in five regions reported a delay time of longer than 2 hours.

The delay time in Europe ranged between 2.0 and 4.0 hours ,(Horne et al. 2000; Mooney et al. 2014; Ottesen et al. 2004; Ottesen et al. 1996; Perkins-Porras et al. 2009; Pitsavos et al. 2006), 1.6 and 3.3 hours for Americas, (Atzema et al. 2011; Luepker et al. 2000; Mussi et al. 2014; Quinn 2005; Ting et al. 2010) and 1.8 and 4.0 hours for Asia (Fukuoka et al. 2005; Khan et al. 2007; Peng et al. 2014; Srimahachota et al. 2007; Yan et al. 2009). Studies from the Middle East region showed the broadest range of delay times being between 1.8 hours and 12.9 hours (Alshahrani et al. 2013; Ayrik et al. 2006; Eshah 2013; Noureddine et al. 2006; Tabriz et al. 2012).

Australia, representing the Oceania region, reported delay times in two studies over 8 years of 6.4 hours in 1997 (Dracup, McKinley & Moser 1997) and 3.1 hours in 2005.(Taylor et al. 2005). The delay time in Europe ranged between 2.0 and 4.0 hours ,(Horne et al. 2000; Mooney et al. 2014; Ottesen et al. 2004; Ottesen et al. 1996; Perkins-Porras et al. 2009; Pitsavos et al. 2006), 1.6 and 3.3 hours for Americas, (Atzema et al. 2011; Luepker et al. 2000; Mussi et al. 2014; Quinn 2005; Ting et al. 2010) and 1.8 and 4.0 hours for Asia (Fukuoka et al. 2005; Khan et al. 2007; Peng et al. 2014; Srimahachota et al. 2007; Yan et al. 2009). Studies from the Middle East region showed the broadest range of delay times being between 1.8 hours and 12.9 hours (Alshahrani et al. 2013; Ayrik et al. 2006; Eshah 2013; Noureddine et al. 2006; Tabriz et al. 2012). Australia, representing the Oceania region, reported delay times in two studies over 8 years of 6.4 hours in 1997 (Dracup, McKinley & Moser 1997) and 3.1 hours in 2005.(Taylor et al. 2005).

Six publications reported on the proportion of patients arriving at a hospital within 1.0 hour (Ayrik et al. 2006; Dracup, McKinley & Moser 1997; Eshah 2013; Fukuoka et al. 2005; Noureddine et al. 2006; Perkins-Porras et al. 2009) ranging from 11.9% in Lebanon (Noureddine et al. 2006) to 28.0% in Jordan (Eshah 2013). Eight studies (Atzema et al. 2011; Dracup, McKinley & Moser 1997; Khan et al. 2007; Ottesen et al. 1996; Peng et al. 2014; Pitsavos et al. 2006; Tabriz et al. 2012; Yan et al. 2009) found that the proportion of patients who presented to an ED within 2 hours ranged from 19.0% in Iran (Tabriz et al. 2012) to 57.2% in China.(Yan et al. 2009). The majority of the literature reported that approximately 40% to 50% of patients delayed presenting to an ED within 6 h of the onset of chest pain (Dracup, McKinley & Moser 1997; Eshah 2013; Fukuoka et al. 2005; Khan et al. 2007; Pitsavos et al. 2006) (Table 2.1).

The components of delay time were also reported on, including decision time. Seven studies (Alshahrani et al. 2013; Mussi et al. 2014; Ottesen et al. 2004; Perkins-Porras et al. 2009; Tabriz et al. 2012; Taylor et al. 2005; Yan et al. 2009) measuring the components of delay time revealed that decision time contributed to the largest proportion of pre-hospital delays, ranging from 40.8% in Iran (Tabriz et al. 2012) to 82.8% in Australia (Taylor et al. 2005) (Table 2.1).

Table 2.1 Pre-hospital delay time and findings from studies in different countries

Author(s) /Year	Country/ size	Median PDT(h)	EMS use (%)	Key findings related to delay time	Ethnicity sub-analysis
Alshahrani et al. (2013)	Saudi Arabia n = 189	5.00 (M) 12.90 (F)	8.0	Median decision time was 2.5 h	N/A
Atzema et al. (2011)	Canada n = 4403	2.00	41.7	46.3% of patients arrived at hospital ≤2 h 73.6% of patients arrived at hospital ≤ 6 h	Chinese 1.4% South Asian 3.9%
Ayrik et al. (2006)	Turkey n = 178	1.83	21.0	22% of patients arrived at hospital ≤ 1 h 74% of patients arrived at hospital > 1 h	N/A
Dracup et al. (1997)	Australia n = 317	6.40	61.0	14% of patients arrived at hospital ≤ 1 h 54% of patients arrived at hospital > 6 h	N/A
Eshah (2013)	Jordan n = 150	4.00	N/A	28% of patients arrived at hospital ≤ 1 h 41.3% of patients arrived at hospital ≥ 6 h	N/A
Fukuoka et al. (2005)	Japan n = 145	3.50	45.0	12% of patients arrived at hospital ≤ 1 h 40% of patients arrived at hospital ≥ 6 h	N/A
Horne et al. (2000)	UK n=88	2.20	45.0	Failure to call ambulance was associated with significantly longer delay time	N/A
Khan et al. (2007)	Pakistan n = 720	3.04	N/A	36% of patients arrived at hospital ≤2 h 34% of patients arrived at hospital ≥ 6 h	N/A
Luepker et al. (2000)	USA n=20,364	2.33	33	No significant differences in delay time between intervention and reference groups	N/A
Mooney et al. (2014)	Ireland n = 1944	4.04	39	Median PDT time post-intervention in Intervention group was 1.7 h, while control group was 7.1 h	N/A
Mussi et al. (2014)	Brazil n = 97	1.62	3.1	96.9% of patients arrived at hospital by car Mean of decision time was 0.94 h	N/A
Noureddine et al. (2006)	Lebanon n = 204	4.52	N/A	11.9% of patients arrived at hospital ≤ 1 h 31.8% of patients delayed between 1-3 h 24.8% of patients delayed >12 h	N/A

Table 2.1 Pre-hospital delay time and findings from studies in different countries (Continued)

Author(s) /Year	Country/ Study size	Median PDT(h)	EMS use (%)	Key findings related to delay time	Ethnicity sub-analysis
Ottesen et al. (1996)[36]	Denmark n = 5978	3.25	N/A	34% of patients arrived at hospital ≤ 2 h 68% of patients arrived at hospital ≤ 6 h	N/A
Ottesen et al. (2004)[45]	Denmark n=250	1.78	N/A	Median decision time was 1.23 h, responsible for 69% of PDT	N/A
Peng et al. (2014)[37]	China n = 1088	2.16	59.1	48.6% of patients arrived at hospital ≤2 h	N/A
Perkins-Porras et al. (2009)[38]	UK n = 228	2.00	45.0	60% of delays attributed to decision time 60.8% of patients had decision time ≤ 1 h 53.7% of patients arrived at hospital ≤ 1 h	N/A
Pitsavos et al. (2006)[39]	Greece n = 2172	3.50	N/A	22% of patients arrived at hospital ≤2 h 38% of patients delay > 6 h,	N/A
Quinn (2005)[40]	USA n = 100	3.30	N/A	Mainly examined the relationship between variables and delay time	White 91% Other 9%
Srimahachota et al. (2007)[41]	Thailand n = 9373	4.00	N/A	Time from symptom onset to admission was considered as sub-optimal	N/A
Tabriz et al. (2012)[47]	Iran n = 513	2.45	EMS only	19% of patients arrived at hospital ≤2 h 9% of patients arrived at hospital ≥ 6 h Decision time was 1 h, 40.8% of PDT	N/A
Taylor et al. (2005) [42]	Australia n = 150	3.17	EMS only	52.7% of patients arrived at hospital >3 h Mean of decision time was 2 hr, responsible for 82.8% of PDT	N/A
Ting et al. (2010)[43]	USA n = 104,662	2.60	N/A	59% of patients arrived at hospital > 2 h Delay time has not changed significantly from 2001-2006,	White 80.5% Black 11.4% Asian 1.1% Hispanic 3.5%
Yan et al. (2009)[44]	China n = 498	1.83	37.3	Median decision time was 60 min 57.2% of patients delay ≤ 2 h	N/A

PDT, prehospital delay time; EMS, emergency medical services; N/A, not applicable

The utilisation of an ambulance to travel to hospital varied from 3.1% in Brazil (Mussi et al. 2014) to 61.0% in Australia (Dracup, McKinley & Moser 1997). Among the European countries, 39.0% (Mooney et al. 2014) to 45.0% (Perkins-Porras et al. 2009) of patients were transported to hospital by ambulance, 37.3% (Yan et al. 2009) to 59.1% (Peng et al. 2014) in Asian countries, and 33.0% (Luepker et al. 2000) to 41.7% (Atzema et al. 2011) in North America. Patients in the Middle East arrived at the hospital by ambulance from 8.0% (Alshahrani et al. 2013) to 21.0% (Ayrik et al. 2006).

Factors associated with longer delay times

There was some similarity in the variables associated with delay time among the reviewed studies. These factors were classified into three domains: socio-demographic and clinical factors, cognitive and emotional factors, and social factors. A summary of the variables associated with longer pre-hospital delay times is presented in Table 2.2. The most common factors reported in the reviewed articles were old age, female gender, history of chronic disease, and history of previous myocardial infarction. Difficulties with symptom assessment and appraisal, and atypical symptoms were also commonly associated with longer delay times, as were the absence of a witness to the episode, and not making a decision to call an ambulance.

Table 2.2 Factors influencing longer delay time in seeking medical care for chest pain

Socio-demographic and clinical factors	Cognitive and emotional factors	Social factors
Single status	Severity of pain	Setting of episode
Old age	Symptom assessment	No witness of episode
Female	Symptom appraisal	Event during daytime
Ethnicity (non-white)	Atypical symptom	Response from others
Low education level	Lack of symptom knowledge	Not calling Ambulance
Low socioeconomic Stats	Worried about bothering others	
History of chronic diseases	Wait for pain to ease	
History of previous MI	Embarrassed to seek help	

Impact of Ethnicity

Of the 23 selected articles, six studies (Atzema et al. 2011; Luepker et al. 2000; Mussi et al. 2014; Perkins-Porras et al. 2009; Quinn 2005; Ting et al. 2010) identified participants from different ethnic backgrounds; however, only three studies (Atzema et al. 2011; Quinn 2005; Ting et al. 2010) included a sub-analysis of ethnicity. A Canadian study (Atzema et al. 2011) included patients from two ethnic groups (Chinese and South Asian) into a sub-analysis and reported that both ethnic groups were a significant predictor of delayed presentation. A study from the USA (Ting et al. 2010) analysed the relationship between delay time and five ethnic backgrounds (White, Black, Asian, Hispanic, and Other), and concluded that non-white ethnic background was associated with longer delay times. Another US (Quinn 2005) study reported that ethnicity (Caucasian and Other) was not related to the time taken to seek care. Three other studies (Luepker et al. 2000; Mussi et al. 2014; Perkins-Porras et al. 2009) only reported findings related to ethnicity according to characteristics.

Discussion

Variability in delay times

In this review we aimed to describe delay times in seeking medical care for chest pain in different countries. The time taken to seek care after suffering chest pain varied between individual countries even within the same region. The variability in the time taken to present to a hospital across countries is consistent with the conclusions of the ENACT study (The European Network for Acute Coronary Treatment) and other multinational studies (Dracup et al. 2003; Fox et al. 2000; McKinley et al. 2004). People in developed countries did not appear to seek help more rapidly than those living in developing countries and vice versa (Table 2.3). Importantly, delay time in all countries was greater than the optimal recommended timeframe for ACS management. There did, however, appear to be a reduction in delay times over the 20 years of this review; however, the included studies were too dissimilar to compare, particularly in relation to the differences in the countries being studied and the methods used. This review showed that decision time to seek help was reported as a major component of the entire delay time, a finding which is consistent with previous studies.(Finn et al. 2007; McKinley et al. 2004; Weaver 1995). Moser et al. (2006) and Dracup et al. (1995) stated that the decision to seek care relates to multiple variables, including demographics, socio-economics,

and cognitive and emotional factors. Other researchers have suggested that these modifiable factors should be focused on in order to diminish pre-hospital delay times (Khraim et al. 2009).

Factors associated with longer delay time

A study conducted by Nguyen et al (Nguyen et al. 2010) found that elderly and female patients were more likely to delay their decision to seek care than other groups, a relationship that is supported by this review.

The REACT (The Rapid Early Action for Coronary Treatment) trial)(Goff Jr et al. 1999) revealed that cultural and low socio-economic statuses were also associated with delay time. Low socioeconomic status may include patients with low education and income levels, and migrant status, which may contribute to a lack of health literacy. Jordan et al. (2013) concluded that health literacy is considered to be a vital element in understanding and accessing healthcare. The marked variation in delay times reported in different countries may relate to the unique social and cultural contexts of each individual nation (Dracup et al. 2003). Differences in the healthcare system, and in health policy, are evident in developed countries such as Australia, Canada, New Zealand, the UK, and the USA, (Blendon et al. 2003; Schoen & Doty 2004) and also between countries in the Asia region such as Japan, South Korea, Taiwan, Hong Kong, and Thailand (Gauld et al. 2006; Hughes & Leethongdee 2007).

Dracup et al. (2003) indicated that the culture and the unique context of each country play a crucial role in people's responses to chest pain. Similarly, the conclusions from other two multinational studies supported that differences in culture and/or the healthcare system may have an impact on care-seeking behaviour for chest pain (Liao et al. 2004; McKinley, Moser & Dracup 2000). In addition, the unique management of ACS across countries may also have an impact on access to ambulance services and emergency care and the relationship to delay time. The GRACE (The Global Registry of Acute Coronary Events) (Fox et al. 2002) and the ENACT study(Fox et al. 2000) noted differences in internal practices and outcomes between various countries, even within the same continent.

Table 2.3 Comparison of pre-hospital delay time between developed and developing countries

Country	Country	Region	Median pre-hospital delay time (hr)		Universal Health Coverage
			Developed country	Developing country	
Dracup et al. (1997)	Australia	Oceania	6.40		✓
Mooney et al. (2014)	Ireland	Europe	4.04		✓
Pitsavos et al. (2006)	Greece	Europe	3.50		✓
Fukuoka et al. (2005)	Japan	Asia	3.50		✓
Quinn (2005)	The USA	Americas	3.30		
Ottesen et al. (1996)	Denmark	Europe	3.25		✓
Taylor et al. (2005)	Australia	Oceania	3.17		✓
Ting et al. (2010)	The USA	Americas	2.60		
Luepker et al. (2000)	The USA	Americas	2.33		
Horne et al. (2000)	The UK	Europe	2.20		✓
Atzema et al. (2011)	Canada	Americas	2.00		✓
Perkins-Porras et al. (2009)	The UK	Europe	2.00		✓
Ottesen et al. (2004)	Denmark	Europe	1.78		✓
Alshahrani et al. (2013)	Saudi Arabia	The Middle East		5.00	✓
Noureddine et al. (2006)	Lebanon	The Middle East		4.52	
Srimahachota et al. (2007)	Thailand	Asia		4.00	✓
Eshah (2013)	Jordan	The Middle East		4.00	✓
Khan et al. (2007)	Pakistan	Asia		3.04	
Tabriz et al. (2012)	Iran	The Middle East		2.45	
Peng et al. (2014)	China	Asia		2.16	✓
Yan et al. (2009)	China	Asia		1.83	✓
Ayrik et al. (2006)	Turkey	The Middle East		1.83	✓
Mussi et al. (2014)	Brazil	Americas		1.62	✓
Mean pre-hospital delay time of group			3.08	3.05	

Impact of Ethnicity

Ethnic groups are often excluded or under-represented from research thereby creating a lack of information about the behaviour of these populations (Mason et al. 2003; Ranganathan & Bhopal 2006; Sheikh et al. 2009; Sheikh et al. 2004). As well, a relatively small proportion of ethnic groups within a sample may impede a sub-analysis of this issue in some studies. Language barriers provide an additional impediment to research in non-English speaking background populations. Thus, research in patients from ethnic populations or migrant backgrounds is limited (Moser et al. 2006; Ranganathan & Bhopal 2006).

Sheikh et al. (Sheikh et al. 2009) noted that a researcher's own attitudes towards the recruitment of ethnic groups play a key role in the inclusion of ethnicity. The same study also found that US researchers were more positive than UK academics about including ethnic groups in their research. Ranganathan and Bhopal (2006) and Mason et al. (2003) noted the consistency of underrepresentation and inequality in research participation among ethnic groups which might due to investigator's bias, conceptual bias and proportion of ethnic participants. Individuals do not appear to differ in their willingness to participate in research. One study found that there was no significant difference in willingness to participate in research between a range of ethnic groups and Caucasians (Wendler et al. 2006). This review identified only three studies that considered culture and ethnicity, and we submit that further work in this area is called for.

Recommendations for practice and research

A set of guidelines for the management of, and clinical care standards for, ACS have been developed and updated by many health organisations in order to advance the safety and quality of care to improve patient outcomes (Amsterdam et al. 2014; Australian Commission on Safety and Quality in Health Care 2014; Windecker et al. 2014). A number of campaigns and health education programs have been conducted by health agencies worldwide with the aim of shortening delay times. The PROMOTION study (Patient Response to Myocardial Infarction Following a Teaching Intervention Offered by Nurses) is an example of a multinational randomised controlled trial using a single face-to-face educational experience in conjunction with reinforcement by telephone to encourage patients to respond quickly when confronted with ACS symptoms (Dracup et al. 2009).

Disappointingly, they reported that this educational and counselling intervention did not help in reducing delay times or improving the rate of ambulance service utilisation. Other researchers suggested that public education campaigns alone are an inadequate strategy for decreasing delay times, and those more effective strategies to address the predictors of delay time need to be considered (Luepker et al. 2000; Meischke et al. 1994; Pattenden et al. 2002b).

The timely management of chest pain is a well-understood concept, with the phrase 'time is muscle' often being quoted. While a great deal of effort has been invested in improving the efficiency of the health system once contact has been made, a large proportion of the avoidable delay occurs prior to the decision to call for help. Therefore, further study on factors influencing patient delay times, and their decision delay times, is warranted, particularly the impact of ethnicity on patient's care-seeking behaviours when experiencing chest pain.

Limitations

Although this integrative literature review has involved studies conducted in a range of countries, only 23 eligible articles were included. Therefore, the outcomes of the review may not reflect all regions and may not represent genuine delay times across the globe. However, we have analysed the available data on delay times which reveals that there are differences in the countries studied in the selected articles. Restricting the search to only English language publications is another limitation of this review. However, van Weijen Van Weijen (2012) noted that approximately 80% of all articles are published in English and that most researchers prefer to publish their work in English rather than in their native language. Other studies also support the increasingly global trend of research being published in English (Kirchik, Gingras & Larivière 2012; Lira et al. 2013; Montgomery 2013). Although research in other languages may contribute to the data on ethnicity, the majority of studies on this topic have been conducted in developed countries which are popular destinations for migrants such as the USA, the UK, Australia, and Canada (United Nations 2013c). Articles from these countries are generally published in English. Only published peer review papers were included in this review, abstracts and non-peer reviewed conference papers were not included.

Conclusion

On a global basis, the time taken to seek medical care for chest pain varies from country to country and does not appear to be related to any particular region or national development status. However, delay times in all of the reviewed studies were longer than the recommended ideal delay time. The differences in socio-demographics, and the social context of each country could be the underlying cause of variability in delay times. Additionally, cognitive and emotional factors were also thought to play a crucial role in time delays. To improve care for all patients experiencing chest pain, further investigations of potential predictors is warranted, particularly of ethnicity and culture in multicultural countries.

The end of this publication

Factors Associated with the Delay times

As mentioned in the previous section, decision time is a major component of the total delay in seeking medical care for chest pain (Alshahrani et al. 2013; Finnegan et al. 2000; Mussi et al. 2014; Perkins-Porras et al. 2009; Tabriz et al. 2012; Yan et al. 2009). Consequently, improvements aimed at lessening patient delay may help diminish the delay to hospital and thereby shorten the time to treatment which finally will lead to better patient outcome (Goff et al. 1998; Goldberg et al. 2009; Herlitz et al. 2010a; Johansson, Stromberg & Awahn 2004). EMS utilisation is a significant factor that improves pre-hospital delay, and this warrants a focus on public awareness and knowledge of emergency medical care for chest pain (Canto et al. 2002; Hutchings et al. 2004; Patel et al. 2012; Zhang et al. 2009). In addition to EMS, there are a variety of potential factors which contribute to pre-hospital delay for chest pain which vary from study to study.

A recent review of studies from different countries conducted during the last two decades (Wechkunanukul, Grantham & Clark 2016) reveals the factors influencing the delay time in seeking medical care for chest pain (Table 2.2). Factors influencing delay fall into three distinct domains:

1. Socio-demographic and clinical factors
2. Cognitive and emotional factors
3. Social factors

Sociodemographic and Clinical Factors

Herlitz et al. (2010a) and (Perkins-Porras et al. 2009) agree that socio-demographic and clinical factors are significant factors associated with pre-hospital delay. Many studies in different countries have demonstrated some potential influencing factors on delay times, including old age, female gender, low socioeconomic status, low education level and ethnicity (Atzema et al. 2011; Dracup et al. 1997; Goldberg, Gurwitz & Gore 1999; Horne et al. 2000; Kentsch et al. 2002; Krairtchareon et al. 2010; Moser et al. 2005; Motalebi & Iranagh 2013; Taghaddosi et al. 2010; Taylor et al. 2005). Clinical factors that are associated with longer delay time include chronic disease such as diabetes mellitus, hypertension and high cholesterol, as well as high risk factors of CVD such as smoking and prior AMI or angina (Horne et al. 2000; Ottesen et al. 2004; Rucker, Brennan & Burstin 2001)

Cognitive and Emotional Factors

Despite the socio-demographic characteristics, a number of other studies have concluded that the cognitive and emotional response of patients to ACS symptoms plays a crucial role in delay (Ayrik et al. 2006; Dracup, McKinley & Moser 1997; Finnegan et al. 2000; McKinley, Moser & Dracup 2000; Pattenden et al. 2002b). Symptom recognition, knowledge of ACS, symptom assessment and symptom appraisal are considered as influencing factors on decision time delay leading to poor treatment outcomes (Johansson, Stromberg & Awahn 2004; Motalebi & Iranagh 2013; Pattenden et al. 2002b; Ruston, Clayton & Calnan 1998; Taylor et al. 2005). Patients who believed their chest pain was related to their heart have a shorter delay time than those who believe their symptoms were related to other body parts (Cooper et al. 1986; Perkins-Porras et al. 2009; Zerwic 1998). Some studies noted that experience and interpretation of symptoms plays a key role in seeking medical care behaviour and contributes to a less efficacy of reperfusion therapy (Herlitz et al. 2010a; Horne et al. 2000; Løvlien, Schei & Hole 2007; Ottesen et al. 2004).

Bunde and Martin (2006) found that patients with depression are more likely to have longer decision time delay. Furthermore, a number studies support that emotional and psychological factors related to longer delay time which impact on the clinical outcomes of ACS patients (Dracup, McKinley & Moser 1997; Kentsch et al. 2002; Kenyon et al. 1991; Moss & Goldstein 1970; Perkins-Porras et al. 2008). Some studies revealed significant reasons influencing delay time such as ‘embarrassing to ask for help’, ‘do not want to bother others’, ‘wait for the pain to ease’ and ‘fear of the consequence of chest pain’ (Ayrik et al. 2006; Dracup, McKinley & Moser 1997; Dracup & Moser 1997; Kentsch et al. 2002; McKinley, Moser & Dracup 2000; Perry et al. 2001)

Social Factors

Many studies have indicated that family and bystanders who witness a cardiac event were one of the influencing factors in reducing pre-hospital delay time (Alonzo 1986; Dracup & Moser 1997; Henriksson et al. 2011; Henriksson, Lindahl & Larsson 2007; Krairtchareon et al. 2010; Raczynski et al. 1999; Reilly, Dracup & Dattolo 1994). Other researchers support above statement as they found patients who live alone and being alone during the cardiac episode have a longer time delay

to reach hospital (Bouma et al. 1999; Perry et al. 2001). Patients' and bystanders' recognition and knowledge of the symptoms and their complications were also considered as potential influencing factors in pre-hospital delay (Alonzo 1986; Henriksson et al. 2011; Ruston, Clayton & Calnan 1998).Furthermore, bystanders tend to favour calling an ambulance more than the patient who experiences chest pain, if they do not know each other (Brown et al. 2000). Henriksson, Lindahl and Larsson (2007) and Herlitz et al. (2010a) have noted that relatives are more eager to seek help than victims, which also results in shorter decision times. Nonetheless, Henriksson, Lindahl and Larsson (2007) found that the majority of relatives preferred a private car to an ambulance as they thought that a car was a faster mode of transport, which is different finding from previous studies.

In summary there are various predictors associated with delay time in seeking medical care when patients experience chest pain (Table 2.2). These include sociodemographic, clinical, cognitive, emotional and social factors. Although most studies found similar factors, some factors have different impact on the delay in different studies as mentioned above.

A number of salient factors, such as income, education, health insurance, history of illness, gender, culture, ethnicity, and lifestyle may all play different roles in each study due to the social context, the environmental context, and the health care system of each individual country (Dracup et al. 2003; Fukuoka et al. 2005; Goldberg et al. 2009; Widimsky et al. 2010). For example, it would seem that there are some differences between the characteristics of the population in a developed country and a developing country, by which the findings of the studies may not be comparable to each other. Divergences of both health care system and policy are evident in many developed countries (Table 2.3) such as Australia, Canada, New Zealand the UK and the USA (Blendon et al. 2003; Schoen & Doty 2004) and also among countries in the Asia region such as Japan, South Korea, Taiwan, Hong Kong and Thailand. (Gauld et al. 2006; Hughes & Leethongdee 2007) In addition, the unique management of ACS across countries may have impacts on provision related to delay time such as ambulance service and emergency care. The GRACE registry(Fox et al. 2002) and the ENACT study(Fox et al. 2000) noted the differences in internal practices and outcomes between countries even within the same continent.

To reduce the mortality rate from cardiac chest pain, improvements in pre-hospital delay are warranted (Boersma et al. 1996a; Giusppe et al. 2004; Moser et al. 2006; United Kingdom Heart Attack Study (UKHAS) Collaborative Group 1998). Therefore, a number of community interventions and public health programs have been implemented (Gibson et al. 2008; Greenlund et al. 2004; Khraim & Carey 2009; Luepker et al. 2000; Schmidt & Borsch 1990). Additionally, Kopec et al. (2010) have suggested that routine advice from general practitioners may help to improve patient knowledge and attitudes to ACS which will also contribute to improvements in delay. Disappointingly, despite dedicated effort of researchers over the last two decades contributing to the studies on delay time in seeking medical care for chest pain, the long-term trend in delays are stilling occurring worldwide (Dracup et al. 2003; Goldberg et al. 2009; McGinn et al. 2005). Researchers have recommended further studies be carried out in order to gain a deeper insight into the patients' perspectives on ACS and the influencing factors, particular on those where little research has been conducted, such as ethnicity in diverse cultural groups (Dracup et al. 2003; Goff et al. 1998; Goldberg et al. 2009).

Ethnicity and the Delay

Existing evidence of a longer delay among ethnic populations

Ethnicity is one of the significant non-modifiable risk factors of CVD (Australian Institute of Health and Welfare 2011a). There are only a few studies which provide evidence regarding the delay in responding to chest pain among ethnic groups, particularly migrants from different backgrounds (Dassanayake et al. 2009; Yusuf et al. 2001b). Ethnicity has been found to be associated with delay time in seeking medical care for chest pain (Dracup & Moser 1991; Greenlund et al. 2004; Meischke, Eisenberg & Larsen 1993). The majority of studies have focused on a general population who share the same culture, language, and beliefs in the same social and environmental context. There are a few studies which focus on patients from different ethnic backgrounds and these are summarised in Table 2.4 and Table 2.5. Likewise, a few studies of seeking medical care for CVD revealed that patients in different ethnic groups express different perceptions of disease and the health care system which has a significant impact on their care seeking patterns (Forouhi & Sattar 2006; McKinley, SM, Moser & Dracup 2000; Renzaho 2007).

Table 2.4 Prehospital delay time and finding from different ethnicity studies

Authors/ year/	Data Source/ sample size	Ethnic Group (%)	PDT (hr)	EMS (%)	Key findings
Ben-Shlomo et al 2008 UK	The MINAP n = 162 516	Caucasian= 73 South Asian = 3	3.10	81.4	No ethnic differences in PDT, but there are ethnic differences in seeking care behaviour. Asian underuse of ambulance may reflect cultural differences.
Canto et al 1998 USA	NRMI 2 n = 275 046	White = 86 Hispanic= 3 Asian= 1 Native <1	2.25	44	Ethnic groups presented later to hospital, and used ambulance lesser than white. Cultural and socioeconomic factors may influenced symptom perception
Clark et al1992 USA	Patients admitted to King County Hospital n = 315	White = 10 Black= 75 Hispanic= 14 Asian = 2	3.2	NA	The long delays >24 hours reported in blacks and Hispanics. Patients arrived by ambulance present earlier than those used other mode.
Goff Jr et al1999 USA	REACT n = 3783	White = 71 Black = 8 Hispanic = 7	2	34.4	Delay time was longer among Hispanics and black than white. Socioeconomic/ cultural barriers impede rapid seeking care
Goldberg et al 1999 USA	NRMI 2 n = 364 131	White = 86 Black = 6 Hispanic = 3 Asian = 1	2.1	NA	Ethnicity were significantly more likely to delay longer than white
Henderson et al 2001 USA	Patients admitted to hospitals in Los Angeles County, n = 335	White = 10 Black = 15 Hispanic = 70 Asian = 5	8.8	36.5	Asian and Hispanics had a significant delay in presentation for AMI care Socioeconomic, language and cultural practice were barriers to access health care in the event of AMI
Kendall et al 2013 UK	The BCIS n = 672	White= 77 South Asian =23	2.05	NA	South Asians were more likely to had longer delay time and a longer post- hospital delay and entire delay (pre- and post-) than white

Table 2.4 Prehospital delay time and finding from different ethnicity studies (continued)

Authors/ year	**Data Source/ sample size**	**Ethnic group (%)**	**PDT (hr)**	**EMS (%)**	**Key findings**
Lee et al 2000 USA	Patients admitted to hospitals in Midwestern, USA n = 128	White = 68 Black = 32	1	NA	Blacks delayed twice as long as white to present to hospital within 1 hr Ethnicity was predictive of prehospital delay
McSweeney et al2007 USA	Retrospective survey from 15 medical centers n = 1270	White = 49.6 Black = 50.4	1	NA	There were positive interactions between ethnicity and symptom attribution to AMI and eligibility for public insurance. No ethnic differences in PDT,
Richards et al 2000 USA	Patients admitted to Yale-New Haven hospital n = 231	White = 82.7 Black = 17.3	6	NA	Blacks tended to delay longer than whites The small number of black participants may account for lack of observed racial difference in delay in seeking treatment
Taylor et al 1998 USA	NRMI 2 n = 275 046	White = 86 Black = 6	2.1	NA	Blacks presented later to hospital than white and more likely to received their first ECG and reperfusion later than whites Disparities in care not fully explained by measured clinical variables
Ting et al 2008 USA	NRMI 1 n = 482 327	White = 86.2 Black = 5.1 Hispanic = 2.9 Asian = 1.4	1.9	NA	Black and Hispanics ethnicity were associated with the longer delay time Combination of ethnicity, DM and older exhibited much greater magnitude effect on delay time
Ting et al 2010 USA	CRUSADE n = 104 622	White = 80.5 Black = 11.4 Hispanic = 3.5 Asian = 1.1	2.6	NA	Non-white ethnicity was associated with longer delay time

PDT= prehospital delay time, AMI= acute myocardial infarction, , MINAP= Myocardial Ischaemic National Audit Project, NRMI= National Registry of Myocardial Infarction , REACT= Rapid Early Action for Coronary Treatment, BCIS= British Cardiovascular Intervention Society, ARIC = Atherosclerosis Risk in Community, CRUSADE= Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes with Early Implementation, STEMI= ST-segment elevation myocardial infarction, NSSTEMI= Non- ST-segment elevation myocardial infarction

Table 2.5 Prehospital delay time, and mean age of different ethnic groups

	Median prehospital delay time (hours)				Mean Age (years)			
Authors/ year	White	Black	Asian	Hispanic	White	Black	Asian	Hispanic
Ben-Shlomo et al 2008	3.1		3.1					
Canto et al 1998	2		2.1	2.3*	67		68*	65*
Clark et al 1992	2	3		4				
Goff Jr et al 1999	2	3.3		2.2				
Goldberg et al 1999	2.1	2.4	2.2	2.3				
Henderson et al 2001	3.2	3.5*	12.*	9.2*	57	55	57	57
Kendall et al 2013	2.1		2.6		63		58*	
Lee et al 2000	2.6	6.5*			67	65		
McSweeney et al 2007	1.5	1.0			67	63*		
Richards et al 2000	5	11*			69	57*		
Taylor et al 1998	2	2.4			67	63		
Ting et al 2008	2	2.4*	2.1	2.3*				
Ting et al 2010	2.6	2.9*	3*	2.8*				
Mean	2.5	3.9	3.9	3.6	67	63	58	61

Table 2.6 Factors associated with longer delay time within ethnic groups

Associated factors
Atypical symptoms
Severity of pain
Higher risk of heart disease
Difference in seeking care behaviour
Cognitive and emotional factors
Culture and languages as barriers impede rapid seeking care
Differences in electrocardiogram presentation
Underuse of ambulance
Eligibility of public insurance
Cultural and socioeconomic status

(Ben-Shlomo, Naqvi & Baker 2008; Canto et al. 1998; Goff Jr et al. 1999; Henderson et al. 2001; Kendall et al. 2013; Lee et al. 2000; McSweeney et al. 2007; Taylor et al. 1998)

Previous studies concluded some potential factors that were associated with longer delay time within ethnic groups (Table 2.6). Some studies in diverse Asian, Hispanic and African-American populations in the USA concluded that these ethnic groups were more likely to delay in seeking medical care for CVD compared to the majority population (Deshmukh et al. 2011; Ryan & Shaw 2010). Zerwic et al. (2003) stated that ethnicity was not even counted as a unique variable of time delay in the statistics, even though it is a significant predictor of decision-making in a cardiac event.

Understanding delay time among CALD populations

Research on ethnicity and the migrant population is found less than research on the general population, many studies in cardiology and other diseases have excluded participants who were unable to read and write in the native language (Dracup, McKinley & Moser 1997; Fukuoka et al. 2005; Herlitz et al. 2010a; Horne et al. 2000). There is an ambiguity of clinical presentation distinction among different ethnic groups such as Latino/Hispanic, African-American, Asian and Native American (Canto et al. 1998; Goff et al. 1998; Meshack et al. 1998). Also, they might have different perceptions of chest pain and its severity which may contribute to differences in seeking care behaviour (Brown et al. 2000; Klingler et al. 2002). Importantly, differences in culture may contribute to differences response to chest pain and different in coping strategies (Banks & Dracup 2007; Ben-Shlomo, Naqvi & Baker 2008; Deshmukh et al. 2011).

Therefore, researchers have suggested further study on ethnic groups in order to understand the relationship between ethnicity and the delay and reducing the delay time among these groups (Bradley et al. 2004; Chew et al. 2013; Deshmukh et al. 2011; Goldberg et al. 2009; Moser et al. 2006). To improve the implementation of recommended therapy from guidelines, the deep insight into the impact of cultural factors on the delay in seeking medical care for chest pain is a potential issue (Chew et al. 2013; Goff et al. 1998; Moser et al. 2006; Renzaho 2007).

Summary and Implications

Acute coronary syndromes is a leading cause of death globally and a rapid response to chest pain is a must for patients during a cardiac episode (Acute Coronary Syndrome Guidelines Working Group 2006; National Clinical Guideline Center 2013; O'Gara et al. 2013a). There is strong evidence

that indicates an association between time delay and patient outcomes. It is recognised that a shorter interval between symptom onset and treatment, results in a greater chance of survival (Boersma et al. 1996b; Franzosi et al. 1998; GISSI 1986). Decision time delay and home-to-hospital delay play vital roles in total delay (Alshahrani et al. 2013; Finnegan et al. 2000; Mussi et al. 2014; Perkins-Porras et al. 2009). Patients' cognitive and emotional perceptions are the main influencing factors that have a major bearing on decision-making delay (Ayrik et al. 2006; Cooper et al. 1986; Dracup & Moser 1997; Finnegan et al. 2000; McKinley et al. 2012; Pattenden et al. 2002b). A number of studies have also revealed different delay times and influencing factors in patients from different groups, including those from differing ethnic backgrounds (Banks & Dracup 2007; Ben-Shlomo, Naqvi & Baker 2008; Deshmukh et al. 2011).

According to the literature, the number of international migrants who reside outside of their home countries has increased substantially worldwide (United Nations 2013a). In Australia, one-third of the total population were considered as migrants, and the proportion shows a rapid growth (Australian Bureau of Statistics 2013a). Unfortunately, there is a lack of knowledge regarding the relationship between ethnicity and delay time for chest pain, particularly among CALD migrants (Bradley et al. 2004; Chew et al. 2013; Deshmukh et al. 2011; Goldberg et al. 2009).

Although some studies have found that cultural factors have a significant impact on delay time in seeking medical care for chest pain, a clear explanation of the impact and perceptions among migrants are less known (Bradley et al. 2004; Brown et al. 2000; Canto et al. 1998; Goff et al. 1998; Meshack et al. 1998; Moser et al. 2006). There is a significant gap in the literature regarding ACS management for CALD migrants that needs to be closed (Moser et al. 2006).

Firstly, the lack of a database on, and an evidence-base about, ethnicity and delay time in seeking medical care for chest pain is apparent, since ethnic groups are often excluded from cardiology research (Gill et al. 2013; Ranganathan & Bhopal 2006). Secondly, knowledge of the impact of culture, beliefs, attitudes, and other cultural factors, on delay time in seeking medical care for chest pain is ambiguous and needs further research (Banks & Dracup 2007; Chew et al. 2013; Moser et al. 2006). Finally, a clear insight into perceptions about different health care systems and their

implications on health behaviour among CALD migrants is little known, and requires further study and embedding into the health care system (Brown et al. 2000; Klingler et al. 2002)..

This study aims to explore the association between ethnicity and time taken to seek care for chest pain from the existing literature. Other aims are to determine the differences in, delay times between CALD migrants and Australian-born population, to determine relationship between ethnicity and the delay time in seeking medical care, and to examine the effect of ethnicity on the presentations at ED and time taken to seek care when they experienced chest pain.

We hope that the findings from this study will establish a database of delay time in the seeking of medical care for chest pain for the CALD migrants in Australia, which is essential to understand the presentation delays among the CALD migrants. This would be a great benefit to healthcare providers, public health agencies, and policy-makers in regard to improvements in healthcare services for acute coronary syndromes for these vulnerable groups. Finally, the findings of this study will form a basis for further research in this area. This will benefit CALD migrants across Australia and worldwide. The findings of this project have potential significance for the health care system in closing the gap in inequities and accessibility of emergency medical services and cardiac services between the dominant and CALD populations.

Conceptual Framework

The Common-Sense Model of Illness Behaviour (CSM) was chosen as the theoretical framework to guide the study design for this thesis. CSM conceptualizes an individual (patient) as a capable and effective problem solver who has common-sense beliefs (illness representations) which lead their behaviour in response to a health threat (symptoms) (Diefenbach & Lebventhal 1996; Levental, Nerenz & Steele 1984; Leventhal & Cameron 1987). The influencing factors on an individual's common-sense comprise both internal and external factors. In other words, an individual will make sense of, and cope with, health and illness based on these influences.

Internal influences include socio-demographic factors, clinical factors, experience with health and illness, expectations and knowledge, beliefs and attitudes, and social and cultural roles (Diefenbach

& Lebventhal 1996). External influences include social networks and social support, such as family, friends, and health providers. These sources may have positive impacts which promote prompt actions in seeking care, or they could be negative influences in preventing action against illness (Leventhal & Cameron 1987). Common-Sense Model of Illness Behaviour has primarily been used in research on various diseases which focus on the patient's perceptions of, and how they cope with, illness. Previous studies have used CSM in research on a range of illnesses such as diabetes, and back pain, but also in self-care management (Foster et al. 2008; Fowler et al. 2007; Hagger & Orbell 2003; McAndrew et al. 2008). This theoretical framework has also been used broadly in research on the association between the seeking of medical care or treatment and decision-making (Dracup & Moser 1997; Dracup et al. 1995; Goff et al. 1998; Leviton et al. 1999; McKinley, Moser & Dracup 2000; Quinn 2005; Ryan & Zerwic 2003; Yan et al. 2009; Zerwic 1998; Zerwic et al. 2003).

Concepts within the Common-Sense Model of Illness Behaviour

According to the CSM, cognitive and emotional representations of illness, coping processes, and the idea of appraisal are the main concepts that comprise the CSM. The concepts are present throughout the three stages of mental representation of health threat, coping action, and appraisal of the coping action (Diefenbach & Lebventhal 1996; Levental, Nerenz & Steele 1984). This process begins with a patient perceiving the health threat such as chest pain or their overall physical condition, and progresses through the first stage, the mental representation of the health threat i.e. the cognitive and emotional representations of illness. This stage is affected by the patient's experience and sense of harm or vulnerability, awareness and knowledge about the disease, and their cultural beliefs. Additionally, people surrounding the patient, such as spouse, family, and friends have an impact on the patient's representations. These will shape the coping actions for the particular patient and their condition which will finally be evaluated and compared with the expected outcomes (Diefenbach & Lebventhal 1996). The coping and appraisal stages are a two-way process from the bottom-up and the top-down (Cameron, Leventhal & Leventhal 1993). To illustrate this point, when a patient has acute chest pain, they will think about the cause or the possible condition such as heavy lifting, muscle pain, heartburn, or heart attack. After this, they may think about how to cope with chest pain such as stopping an activity and having a rest,

taking medication, calling the doctor for advice, or calling an ambulance. Finally, the patient may take an antacid, but if this does not relieve the pain, they may rethink their coping action and call an ambulance if they feel that the condition has become life-threatening. The cognitive and emotional representations of illness are the most important part of the CSM model which is defined as a parallel process of an individual's perceived reality of the health threat (symptoms) and the emotional response to that condition (Leventhal & Cameron 1987).

The Individual Personal Context - Somatic & Psychological Input

Personal history and memory of illness prior to the health threat have a significant impact on the parallel response and in shaping the coping and appraisal process (Cameron, Leventhal & Leventhal 1993; Levental, Nerenz & Steele 1984). Keller et al. (1989) have noted that when the physical change or new experience occurs among individuals in older aged groups, they attempt to distinguish between signs of aging and signs of illness. Genetic, biological, and psychological characteristics will influence the response, but only if the individual acknowledges that there is a problem (Diefenbach & Lebventhal 1996). For example, an individual may have a susceptibility to heart disease after they become aware of having a family history of this condition. Personal traits also have an impact on the response and coping processes in unique ways (Leventhal & Cameron 1987). There is evidence of different perceptions of, and behaviour towards, illness among people from different cultural backgrounds. According to Edwards, Fillingim and Keefe (2001) and (Campbell, Edwards & Fillingim 2005), there is an association between ethnicity and pain response. Individuals from particular cultures express pain in different ways and show different levels of pain tolerance (Bates 1987). This study focuses on the individual context, including the ethnicity, age, gender, the history of ACS, family history, risk level of ACS, and the care, of the ACS patient.

The Social and Cultural Context/Input

The social environment and people surrounding the patient play a key role in the representations of illness, in addition to the patient themselves and their beliefs and attitudes related to the culture and society they live in and learn from (Diefenbach & Lebventhal 1996). This study will focus on various factors, including education and income levels, the community surrounding the patient, language, and number of years in Australia.

The Five Components of Cognitive Illness Representations

The cognitive representation of illness consists of five components, including identity, cause, timeframe, consequences, and controllability. All five concepts of cognitive representations define the nature of the illness and make up the action plan and goals for, and the evaluation of, the outcomes (Leventhal, Leventhal & Contrada 1998).

1. The concept of identity concerns symptoms, the label attributed to the health threat, as well as the perception of the link between the health threat and the symptoms. This is based on past experience and expectations of the disease (Diefenbach & Lebventhal 1996).

2. The concept of cause relates to the concept of identity and the patient's beliefs about the possible health threat. The likely causes of illness may be emotional and psychological, biological, and/ or environmental (Hagger & Orbell 2003).

3. The concept of timeframe connects the expected timeframe to the health threat and the expected recovery period. This is about the patient's beliefs about the duration of the physical condition and whether it is acute, chronic, or cyclic (Leventhal, Leventhal & Contrada 1998).

4. The concept of consequences involves perceptions about short-term and long-term outcomes. The anticipated repercussions of the illness could involve social, economic, and physical aspects (Diefenbach & Lebventhal 1996).

5. The concept of controllability is about the individual's beliefs of the control over, or cure of, the progression and prevention of, and recovery from, the disease (Leventhal, Leventhal & Contrada 1998).

Emotional Representations of Illness

Emotional representations are one of the essential elements of process of the health threat within the parallel response model (Levental, Nerenz & Steele 1984; Leventhal 1970). Emotional reactions in response to the health threat can include uncertainty, anger, anxiety, worry, stress, and fear (Diefenbach & Lebventhal 1996). Although this response occurs simultaneously with the cognitive response, they may complement each other and result in the taking of action against the illness, or

they may stop the patient from progressing through the coping process which, in turn, may lead to a delay in seeking help (Diefenbach & Lebventhal 1996).

The Coping Process and Appraisal

The coping process comprises the cognitive and behavioural actions the individual takes (or does not) in order to manage the health threat. The cognitive coping process deals with the perceived susceptibility of the health threat, while the emotional coping process is related to eliminating emotional reactions. The final stage of the model is the concept of appraisal where the individual evaluates the coping plan in terms of both the perceptions of success, and the barriers in diminishing the health threat (Diefenbach & Lebventhal 1996; Levental, Nerenz & Steele 1984). Appraisal may be the trigger to return to the first stage, the mental representation of the illness.

Rationale for Model Selection

There are reasons for choosing the Common-Sense Model of Illness Behaviour as the theoretical framework for this study. As mentioned earlier, there has been some success in using this model to explain health behaviour in relation to validated diseases, including cardiovascular disease. In addition, this model has been tested in various aspects for decades. Within the context of the delay in seeking care for ACS, many studies have used the Common-Sense Model of Illness Behaviour to guide their research in explaining the causes of delay in seeking help (Dracup & Moser 1997; Kentsch et al. 2002; King & McQuire 2007; Krairtchareon et al. 2010; Moser et al. 2005; Quinn 2005; Taylor et al. 2005; Yan et al. 2009). Dracup and Moser (1997) findings support the use of the CSM in determining the factors that influence the delay in seeking treatment for AMI. Similarly, King and McQuire (2007) agreed that the use of the CSM is very useful in examining the presentation of symptoms and the time to seek care.

Furthermore, the association between the concepts in this model and the patient's interpretations and actions when experiencing a health threat makes this model useful for examining delays in seeking treatment for AMI (Lesneski & Morton 2000). Additionally, Dracup et al. (1995) noted that the explanatory power of the encounter of the unknown cause of symptoms is a unique contribution of this model which may help to articulate an understanding of a patient's responses to AMI.

Leventhal, Leventhal and Contrada (1998) suggested that an individual's view of themselves and their environment also emphasise representations. This is also associated with the reality of the situation in at least three ways: 1) the dimensions of the physical world; 2) Common-sensual though they may be; and 3) the accumulated experiences of other people where cultural and social information has an influence on the representation, selection, and performance of the coping process (Leventhal, Leventhal & Contrada 1998). This model concerns both the personal, and the social and cultural, context in generating or adapting health behaviour. Overall, the CSM is very useful in addressing the differences in representations of illness among different ethnic groups. However, this is not the only advantage, as the model will also assist in guiding the pathway towards the possible reasons for patients' responses (Diefenbach & Lebventhal 1996).

The studies within this thesis focus on the personal, and the social and cultural, context that may influence coping actions and the evaluation process among migrants from different ethnic backgrounds. Deep insights into the factors that have an influence on, and the reasons for, seeking care for ACS among migrants may contribute to the development of health promotional and educational programs, and health policy for these groups. Finally, it is envisaged that this may also lead to optimal patient outcomes, an increase in the survival rate, and reductions in mortality and disability from ACS among ethnic populations.

Limitations of the Model

Despite the strong evidence that supports the use of this theoretical framework, there are a number of limitations, a common issue for every theoretical position. Firstly, the emotional coping response focuses on feelings of fear, insecurity, uncertainty, and anxiety, which reflects the reality of immigrants in relation to cardiac health issues. These are, however, not major components of the model. Nonetheless, the context that influences the processes (the social and cultural contexts and the personal context) and cognitive coping process are the major components of this study. Secondly, even though the concepts associated with CSM are reasonable and understandable, there are many concepts that present in various layers which make the model quite complex.

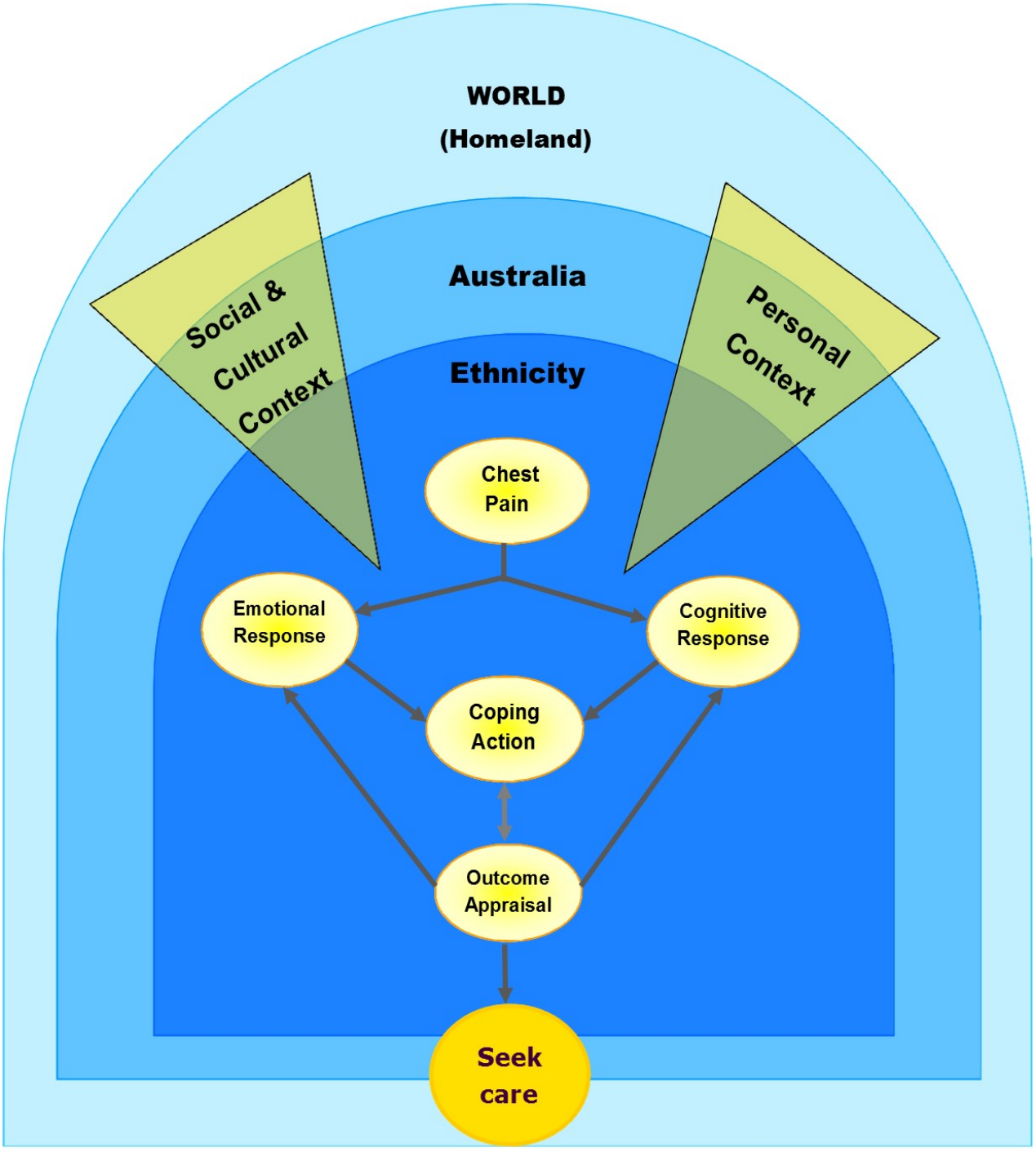


Figure 2.2 Theoretical Framework

The model needs to be modified for this research project and this is presented in Figure 2.2. The modified model emphasizes the context/input of the influences in order to reflect the research question. Although the individual context varies greatly, ethnicity, age, gender, history of ACS, history of high risk, and the caring context of the ACS patient are included. The social and cultural context includes education and income level, community context (in Australia), language, and number of years living in Australia. The global and Australian layers have been added to the original model because the population of this study are migrants who are influenced by a bicultural context from their motherland, with Australia as the context layered on top. In addition, this study focuses on the influence of culture on the decision to seek care for ACS, resulting in an emphasis on cultural components. Seeking care has been placed after the appraisal process, as the decision-making process of seeking medical care for chest pain is the desired outcome of this study.

CHAPTER 3
METHODOLOGY

CHAPTER 3 METHODOLOGY

This chapter presents the methodology used to conduct TED study. Aims, objectives of research are described in the first section. The following section details the general methodology and research designs where the definitions and rationale of methodology choice are provided. The next three sections specifically describe each study, including aims, objectives, hypotheses, research questions, methods, study design, participant, setting, instruments, statistical analysis and expected outcomes. The published protocol of systematic review is presented in this Chapter. The last section details the ethics approval consideration and the process of ethics application.

Aims

To determine the ethnic differences in seeking medical care for chest pain among culturally and linguistically diverse (CALD) populations, and examine relationship between ethnicity and that delay.

Objectives

1. To establish a systematic review report in relation to the association between ethnicity and delay time in seeking medical care for chest pain among CALD.

2. To determine the differences in presenting characteristics and processing times in ED between CALD and Australian-born patients.

3. To determine ethnic differences in seeking-care behaviours and clinical outcomes among nine ethnic groups and compare to Australian group, and examine the effect of ethnicity on seeking medical care for chest pain.

Methodology and Research Design

Research design

Triangulation in research refers to the combination of two or more theories, data sources, methods or investigators in one study of a single phenomenon (Denzin 1989). Shih (1998) identified two purposes for triangulation: 1) completeness or holism of data; and 2) confirmation of data. Foss and Ellefsen (2002) stated that distinct epistemological frameworks have an equal importance in offering

insights across its nature of knowledge. Denzin (1989) identified four forms of triangulation:

1. Data triangulation: gathering data through several sampling strategies.

2. Investigator triangulation: using more than one researcher in gathering and interpreting data.

3. Theoretical triangulation: using more than one theoretical position in interpreting data.

4. Methodological triangulation: using more than one method for gathering data.

Kimchi, Polivka and Stevenson (1991) identified the fifth form as analysis triangulation where more than one approaches of analysis are used to analyse the same set of data for the validation purpose.

Methodological triangulation

Triangulation of methods is defined as the use of more than one kind of methods to study a phenomenon and is classified into two types of methodological triangulation: across method and within-method (Casey & Murphy 2009; Denzin 1989). Across-method triangulation (also known as between-method) combines two research strategies of data collection, quantitative and qualitative, in one study (Casey & Murphy 2009; Kimchi, Polivka & Stevenson 1991). Within-method triangulation refers to the studies involve two or more data collection methods from one research tradition, quantitative or qualitative, but not both (Casey & Murphy 2009; Kimchi, Polivka & Stevenson 1991).

There is strong evidence support the benefit of utilising triangulation in healthcare research. Adoption and utilisation of triangulation in research can help reducing the deficiencies of an individual method and strengthening the outcome of the study (Sharif & Armitage 2004). Halcomb and Andrew (2005) supported that triangulation for completeness could yield more comprehensive and insightful data. Triangulation has been found beneficial in providing in-depth understanding of the phenomenon and insight into complex concepts (Foss & Ellefsen 2002; Razum & Gerhardus 1999; Sim & Sharp 1998). Bekhet and Zauszniewski (2012) concluded that using methodological triangulation can enhance the data analysis and broaden the researchers' insight into the phenomena and Jones and Bugge (2006) added that it may improve researcher skill and ability as well. Entwistle et al. (2004) also concluded

the clear value of triangulation for health service research in patients' participation and quality of decision making study.

Considering the potential advantages of triangulation, TED study has adopted a within-method methodological triangulation incorporating three distinct methods to investigate the delay time in seeking medical care for chest pain among culturally and linguistically diverse (CALD) migrants (Figure 3.1). The methodological triangulation of the TED study involves:

1. TED I: a systematic review which determined the existing data if there is the evidence of association between ethnicity and delay time.

2. TED II: a cross-sectional analysis of an emergency department cohort of patients presenting with chest pain, which focused on differences in presenting characteristics, process times and clinical outcomes in emergency department between CALD migrants and Australian-born patients.

3. TED III: a retrospective medical record review which emphasised the differences in characteristics, presentations, and delay times, between migrant subgroups from different regions and Australian patients.

The research plan is presented in Figure 3.2 and the research time line is available in Appendix V.

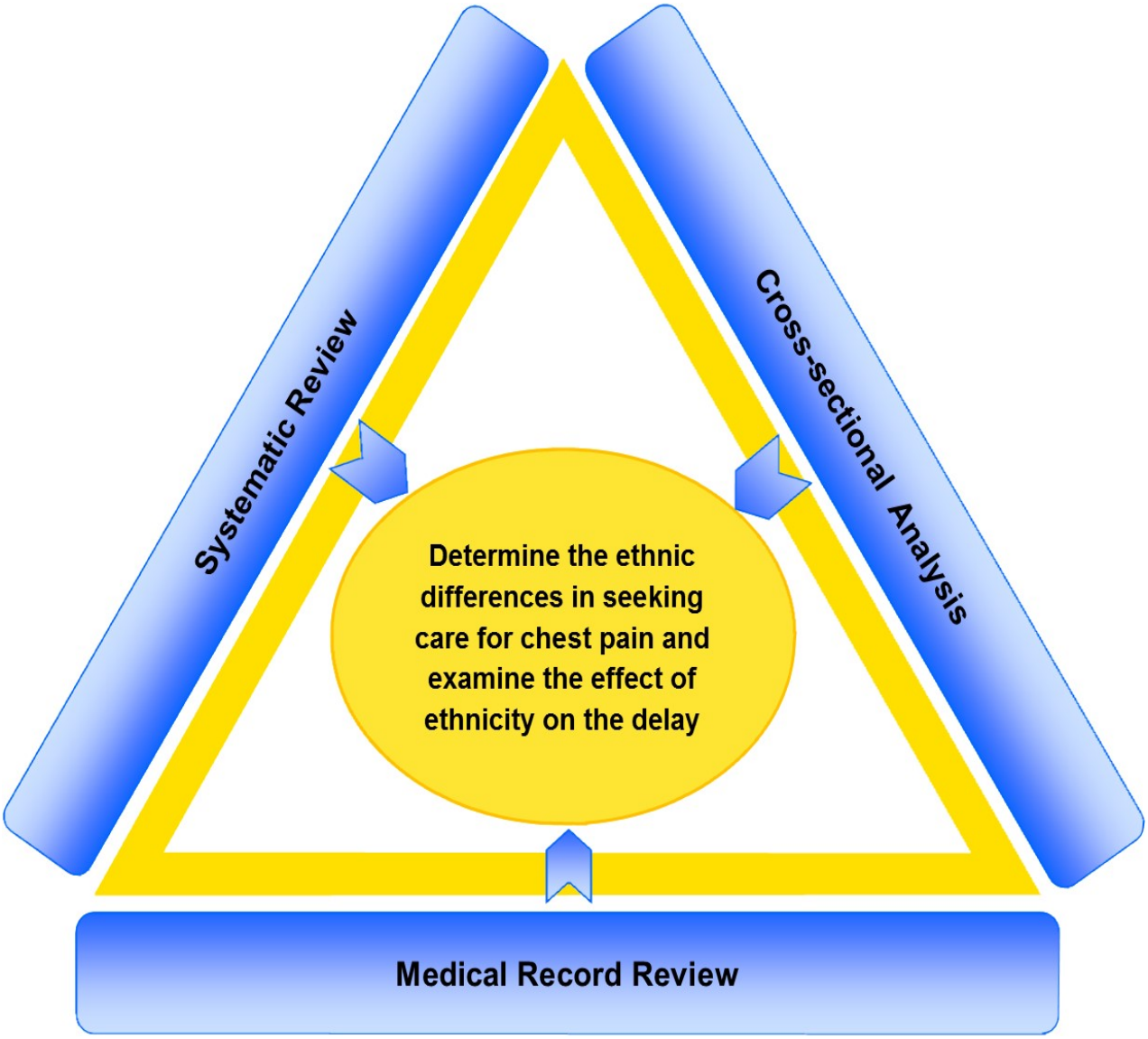


Figure 3.1: Research design

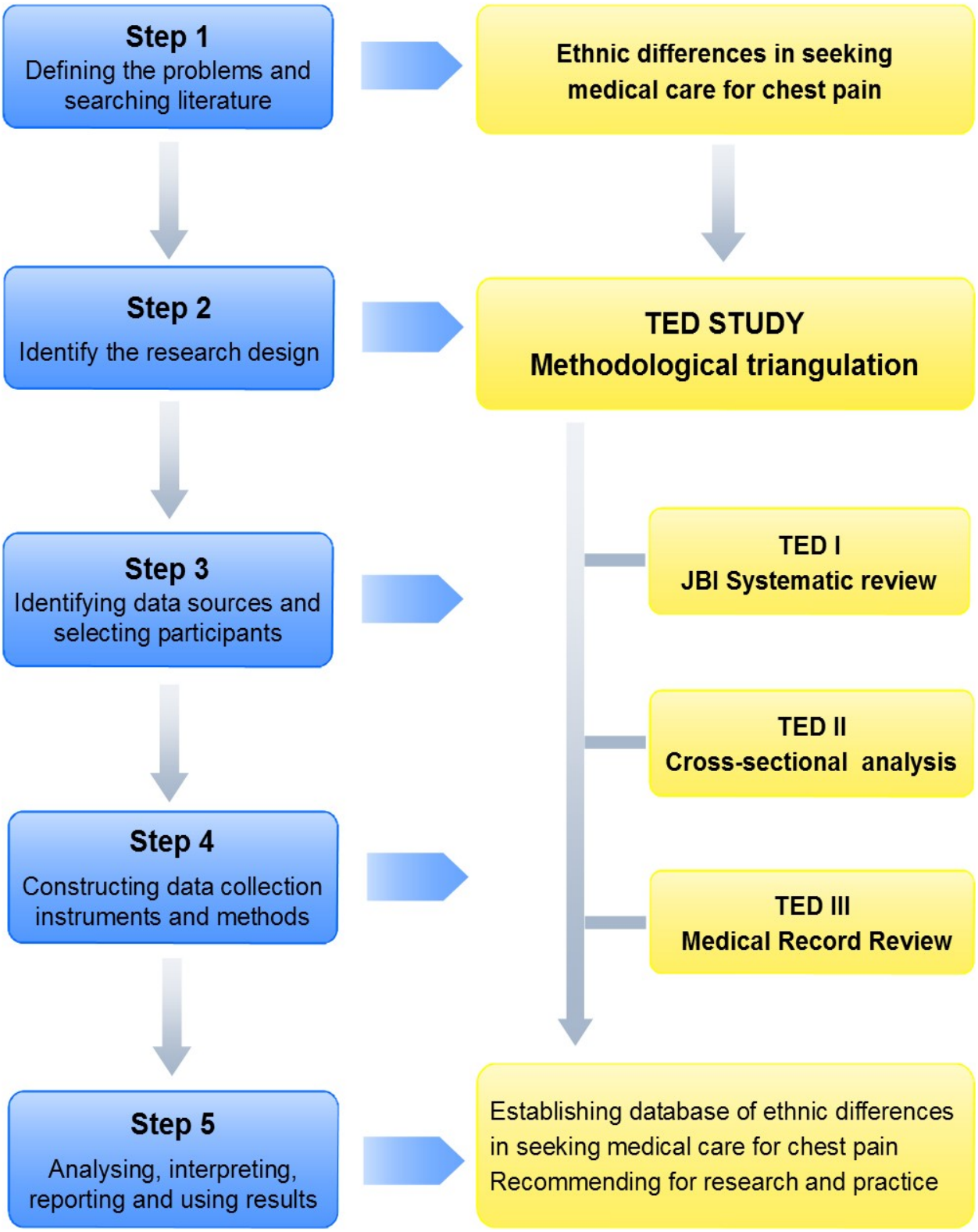


Figure 3.2: Research flow chart

TED study I: The association between ethnicity and delay in seeking medical care for chest pain: a systematic review

Systematic Review

Systematic review (SR) is a research method undertaken to evaluate existing literature in certain clinical questions or practices for in-depth answers and to keep abreast of current research that could guide to the best practice (Gough, Oliver & Thomas 2012, pp. 1-2; Holly, Salmond & Saimbert 2012, pp. 13-14; Manheimer & Berman 2005). Fox (2005) and Lavis et al. (2005) has noted that SR is a vital tool for decision making in preventive medicine and public health due to its superior quality over a single primary study. Furthermore, the precise estimate of effect from meta-analysis lead to a high quality of evidence based practice guidelines (Mullan et al. 2009), and assessing existing primary evidence contribute to quantity and sophisticated information(Handoll & Smith 2003; Mulrow 1994)

Basically, SR address a defined question or issue and use a structurally, systematic method that make SR different from narrative review which describe the study in general without specific questions (Mullan et al. 2009; Mulrow 1994; Schneider et al. 2007). SR use an explicit method to identify, critical appraisal, assessing, analysing all relevant research and then summarizing and interpreting the outcomes (Gough, Oliver & Thomas 2012; Holly, Salmond & Saimbert 2012; Khan et al. 2003; Mulrow 1994; Schneider et al. 2007). The studies included in SR can be quantitative, qualitative and mixed method studies; however, each SR must be conducted on a similar study design. The explicit process of SR is important for minimisation of bias and reliability (Holly, Salmond & Saimbert 2012, p. 15; Khan et al. 2003; Schneider et al. 2007, p. 53). As a result, several authors have created the steps of conducting SR. The eight-step process of Holly, Salmond and Saimbert (2012) is use as an example of SR method described in table 3.1 and Figure 3.3.

Table 3.1: General process of systematic review

Step	Activity
Step1: Formulating a Question	Specific and served as the framework for the search, selection and synthesis of the studies. Use PICO as a guide to specify **P**opulation, **I**ntervention, **C**omparison and **O**utcome. Use PICO as a guide to writing a question
Step 2: Establishing the inclusion Criteria	Set as boundaries on the articles selected into the study. Inclusion criteria for studies: types of study design, dates, languages Inclusion criteria for participants: demographic characteristics of population, disease or condition of interest, the setting and context for qualitative studies Inclusion criteria for Interventions/Phenomena of Interest: interventions of interest and the comparator intervention (if any) that could be active and inactive control interventions Inclusion Criteria for Outcomes: delineate outcomes of interest for the review such as survival, clinical events, knowledge levels, patient's report outcome, economic outcomes and adverse events
Step 3: Developing a Search Strategy/Performing the Search	Comprehensive, unbiased search is the hallmark of the SR Planning for the search, components of the search, managing the citations, keeping the search current and documenting the search
Step 4: Selection of Articles to Be Included in the Systematic Reviews	The first step in the study selection is screening of titles and abstracts for its fit to the PICO The next steps is critical appraisal of retrieved studies, usually scored yes, no, can't tell, met, unmet or unclear The review performs independently by two investigators and the compare the independent appraisals. If the two reviewers cannot reach agreement, the third party will be involved
Step 5: Data Extraction	Sourcing and recording relevant information from the original article conducting by two reviewers by using a standardized approach
Step 6: Data Synthesis	Provide data about the included studies and summarize the findings of included studies trough a statistic analysis, Meta-analysis, qualitative synthesis or narrative descriptive synthesis
Step 7: Recommendations and Writing	Draw conclusions from the data, discuss the limitation of primary studies
Step 8: Updating the Systematic Review	Incorporate new evidence into a previous completed review The literature should be reviewed every two years

Figure 3.3: Basic flow chart of systematic review

JBI Systematic Review

The Joanna Briggs Institute (JBI) was established in 1996 as a not-for-profit organisation who develop and support evidence-based information and expert systems to implement and evaluate these resources for health professionals and health services (The Joanna Briggs Institution 2011). The procedure of review focus on the evidence of feasibility, appropriateness, meaningfulness and effectiveness (FAME) (Holly, Salmond & Saimbert 2012; The Joanna Briggs Institution 2011)JBI, the Cochrane Collaboration and the Campbell Collaboration work together through the effectiveness reviews which included meta-analysis of the results of randomised controlled trials (RCTs) (The Joanna Briggs Institution 2011). On the other hand, JBI provides pluralistic approaches to other study designs such as correlation studies, cohort and case-controlled studies under their hierarchy of evidences (Holly, Salmond & Saimbert 2012; Pearson, Wiechula & Lockwood 2005; The Joanna Briggs Institution 2011). In addition to quantitative research, JBI has also developed a system for

systematic review of qualitative research (Holly, Salmond & Saimbert 2012; Pearson 2004; Pearson, Wiechula & Lockwood 2005).

This study adopted the JBI system for systematic review. There are three main rationales of selection. Firstly, RCTs may not apply into all research areas, particularly health care research (The Joanna Briggs Institution 2011) where the difficulty of setting a control group can occur. As a result, other study designs i.e. observational study designs play a key role in data resources for systematic review. Secondly, JBI provides a broad inclusive approach to varieties of quantitative evidences that is definitely useful for evaluating the association between health care and cultural and socioeconomic factors. Finally, JBI provides specific instruments for the different study designs that could help reducing biases (Holly, Salmond & Saimbert 2012; Pearson 2004).

A systematic review protocol

This section presents the systematic review protocol of TED I which has been published in *the JBI Database of Systematic Reviews & Implementation Reports* 2014, volume 12, issue 9, pages 21-35.

Citation: Wechkunanukul, K, Grantham, H, Damarell, R & Clark, RA 2014, 'The association between ethnicity (culturally and linguistically diverse migrants) and the time taken in seeking medical care for chest pain: a systematic review protocol', *The JBI Database of Systematic Reviews and Implementation Reports*, vol. 12, no. 9, pp. 21-35.

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The association between ethnicity and delay in seeking medical care for chest pain: a systematic review protocol

Review question/objective

The objective of this review is to determine if there is an association between ethnicity and delay in seeking medical care for chest pain among culturally and linguistically diverse (CALD) migrants.

Background

Approximately 5.5 million emergency department (ED) visits in the USA present with chest pain (Bhuiya & McCaig 2010). Six-and-a-half million Australians visit emergency departments nationwide each year (Australian Institute of Health and Welfare 2013). South Australia Ambulance reported 9.9% of all emergency cases were related to cardiac causes (SA Ambulance Services 2010). In Australia, 34% of hospitalisations for cardiovascular disease in 2007 were related to coronary heart disease (CHD). In addition, CHD responsible for 17% of all deaths of which approximately 50% of all CHD deaths were attributed to acute myocardial infarction (Australian Institute of Health and Welfare 2011a; Brieger, David et al. 2009).

Acute coronary syndrome (ACS) is a leading cause of mortality and morbidity worldwide, particularly among industrialized countries (The GRACE Investigators 2001). ACS is a spectrum of clinical manifestations of CHD ranging from unstable angina (UA), non-ST-segment elevation myocardial infraction (NSTEMI) and ST-segment elevation myocardial infraction (STEMI) (DeVon & Ryan 2005). Chest pain is recognized as one of the most common symptoms of acute coronary syndrome (Mittal 2005; Weber 2010). Classic or typical cardiac chest pain has been described as heaviness, pressure, aching, crushing, burning or squeezing and might be associated with sweating, breathlessness, abdominal pain, back pain, jaw pain and arm pain (DeVon & Ryan 2005; Hanson et al. 2013). Although the presentation of chest pain is the central hallmark of ACS, chest pain is not always associated with cardiac conditions (Chin & Connolly 2008; Jaffery & Grant 2010). Patients presenting to emergency departments may be diagnosed with cardiovascular disease or other non-cardiac causes of chest pain including gastroesophageal reflux, peptic ulcer disease, pulmonary embolus, herpes zoster, neuropathic pain or panic attack (Kumar & Cannon 2009). Dracup et.al defined the delay time as the interval from the onset of symptoms to the initiation of definitive medical care

(Dracup et al. 1995). Alonzo (1984) has divided the time delay into the following three phases:

1. The patient/bystander recognition and action phase is the interval from onset of symptoms to seeking medical help such as calling an ambulance. This phase also involves the response to chest pain from people around the patient, such as a spouse, or friends and family. This phase is considered as a decision time delay.

2. The pre-hospital action phase is the interval between accessing the emergency response system to the time of arrival at the hospital and is referred to as the home-to-hospital delay. Travelling time plays a crucial role in this stage.

3. The hospital action phase encompasses the interval time between arriving at the hospital and receiving definitive therapy. Rapid and accurate clinical decision-making and prompt operation of therapy are key factors in this phase.

Definitive treatment for ACS should be started as soon as possible after onset of symptoms. According to the international guidelines for management of ACS, reperfusion therapy should be administered to all patients presenting with ACS within 12 hours (Acute Coronary Syndrome Guidelines Working Group 2006; National Clinical Guideline Center 2013; O'Gara et al. 2013a). Delay in responding to chest pain symptoms has been proven to be a substantial factor impacting on patients' outcomes. Boersma et al. found that 65 lives are saved for every 1000 treated patients when the initial treatment is administered within the first hour of symptom of onset (Boersma et al. 1996a). The findings from international trials support the notion that mortality rates and survival rates within 30 days and one year of ACS symptoms are associated with the interval between symptom onset and treatment (Armstrong et al. 1998; GISSI 1986; Weaver, WD et al. 1993).

Factors influencing delay from a number of studies have demonstrated three distinct domains; 1) socio-demographic and clinical factors; 2) cognitive and emotional factors; and 3) social factors (Alonzo 1986; Dracup, McKinley & Moser 1997; Dracup & Moser 1997; Goff et al. 1998; Henriksson et al. 2011; Herlitz et al. 2010a; Horne et al. 2000; O'Brien et al. 2012; Ottesen et al. 2004; Pattenden et al. 2002b; Perkins-Porras et al. 2009; Quinn 2005; Ruston, Clayton & Calnan 1998).

Herlizt, Thuresson and Perkins-Porras et al. agree that socio-demographic and clinical factors are significant factors associated with pre-hospital delay (Herlitz et al. 2010a; Perkins-Porras et al. 2009). Despite the socio-demographic characteristics, a number of other studies have concluded that the cognitive and emotional response of patients to ACS symptoms plays a crucial role in delay (Ayrik et al. 2006; Dracup, McKinley & Moser 1997; Finnegan et al. 2000; McKinley, Moser & Dracup 2000; Pattenden et al. 2002b). These factors include recognition of signs and symptoms, genders, education levels, income, and emotional and social factors. Early access to definitive care, usually by attending an emergency department, has a profound effect on survival from acute coronary syndrome; consequently, delay in seeking medical care for chest pain is an issue requiring a serious action and implementable policy (Acute Coronary Syndrome Guidelines Working Group 2006; National Clinical Guideline Center 2013; O'Gara et al. 2013a; Parsonage, Cullen & Younger 2013).

Ethnicity, often categorised or described by country of birth,(Australian Bureau of Statistics 1995) is one of the significant non-modifiable risk factors for cardiovascular disease (Alwan 2011; World Health Organisation 2013). Ethnicity has been found to be associated with delay in seeking medical care for chest pain and underutilisation of emergency services (Dracup & Moser 1991; Greenlund et al. 2004; Meischke, Eisenberg & Larsen 1993). In addition to the effect of ethnicity on accessing medical care, previous studies stated that risks of CVD, mortality and morbidity rates vary among ethnic groups (Australian Institute of Health and Welfare 2011a; Balarajan 1991; Khattar et al. 2000; World Heart Federation 2012). Interestingly, populations of Asian or African ancestry have higher risks of developing CVD than other racial groups (Dassanayake et al. 2009; World Heart Federation 2012; Young & Coles 1992). Unfortunately, the majority of studies in delay to seek medical care for chest pain have focused on a general population who share the same culture, language, and beliefs in the same social and environmental context (Dracup, McKinley & Moser 1997; Herlitz et al. 2010a; Ottesen et al. 2004; Saczynski et al. 2008; Yan et al. 2009). There are only a few studies which provide evidence in regard with the delay in responding to chest pain among differing ethnic groups, particularly culturally and linguistically diverse migrants (Dassanayake et al. 2009; Yusuf et al. 2001b).

Multicultural societies have been acknowledged and accepted in many countries. International migrants living abroad worldwide have reached a total of 232 million people, accounting for 3.2% of the world's population (United Nations 2013a). Australia is one of the most pluralist societies in the world, ranking as the 9th country in terms of receiving international migrants (United Nations 2013c). Currently, the population of Australia has reached 23 million people and almost one-third of the population was born overseas, accounting for a total of 6.2 million people (Australian Bureau of Statistics 2013a). An international migrant is defined as any person who changes his or her country of usual residence (United Nations 1998). Their journeys inevitably end with a change of lifestyle, including food, activities, jobs, fashion, socialisation, and health care (Frisbie, Cho & Hummer 2001; Gilbert & Khokhar 2008). Nevertheless, they may keep their culture, beliefs, and attitudes in many aspects of their lives, such as language, ceremonies, traditional foods, traditional medicine, and social activities (Berry 1997).

Although public health promotion and national plans have been implemented in multicultural communities, the disparities in access to care and unequal care provision have still occurred to some extent and further action and policies are needed to close the gap (Anderson, Green & Payne 2009; Gushulak & Williams 2004; Kelaher & Manderson 2000). For health care providers, not only does the system need to be developed and improved, but an understanding of immigrants from all aspects would be helpful in meeting their needs by including cultural care and cultural competence in health practice (Lancellotti 2008; Leininger 2006; McFarland & Eipperle 2008; Sobralske & Katz 2005). Consequently, it is important to study the delay in seeking medical care in migrants to understand their delay and key factors that influence accessibility and equality in acute care services for cardiac conditions. These findings could provide further information to health providers, public health agencies and policy makers in order to establish health promotion programs, health campaigns and health policies that match the needs of ethnic groups (Yusuf et al. 2001a).

This review aims to establish if there is an association between ethnicity and delay in seeking medical care for chest pain among migrants. The findings of this study may provide information supporting future research of cardiac care between general population and ethnicity, particularly migrants.

Keywords

Chest pain; acute coronary syndromes; migrant; ethnicity, delay; seeking medical care

Inclusion criteria

Types of participants

This review will consider studies that include migrants with different ethnic backgrounds who present with chest pain at an emergency department. The review will exclude participants who:

1. were born locally;
2. are indigenous populations

These populations will be excluded in order to determine them as the general population.

Types of exposure

This review will consider studies that evaluated the effects of ethnicity that may have contributed to delay in seeking medical care for chest pain among culturally and linguistically diverse migrants compare to the delay in local populations. The review will look at the delay time between onset of symptoms and hospital arrival.

Types of outcomes

This review will consider studies that include time in seeking medical care for chest pain as an outcome measure. The time will be measured as the interval between the time of symptom onset and time to reach emergency department.

Types of studies

This review will consider quantitative studies including randomized controlled trials, non-randomized controlled trials, quasi-experimental, before and after studies, prospective and retrospective cohort studies, case control studies and analytical cross sectional studies that evaluate the effects of ethnicity on delay in seeking medical care for chest pain. For a broad range of studies, this review will set no limits on the date of publication.

Search strategy

The search strategy aims to find both published and unpublished studies. A three-step search strategy will be utilized in this review (The Joanna Briggs Institute 2014). An initial limited search of

MEDLINE and CINAHL will be undertaken followed by analysis of the keywords contained in the title and abstract, and of the index terms used to describe articles. A second search using all identified keywords and index terms will then be undertaken across all included databases. Thirdly, the reference lists of all identified reports and articles will be searched for additional studies. Due to a lack of resources, time and facilities for translation, only studies written in the English language will be considered. The databases to be searched include: MEDLINE, PubMed, EMBASE, CINAHL, The Cochrane Central Register of Controlled Trials, PsycINFO, Sociological Abstracts, ProQuest (health subsets only), Informit, Scopus, and Web of Science.

The search for unpublished studies will include: Trove, Networked Digital Library of Theses and Dissertations (NDLTD), PQDT Open, World Health Organization, National Institute for Health and Care Excellence (NICE), NHMRC, National Institute of Clinical Studies (NICS), clinicaltrials.gov, Open-Grey, Grey Literature Report, relevant conference/congress websites, Google (advanced search), Google Scholar.

Initial keywords to be used will be: Ethnicity, migrant, 'culturally and linguistically diverse', CALD, immigrant, minority, ethnic background, ethnic groups, race, racial, chest pain, ACS, AMI, heart attack, delay, time to call, time to seeking care, emergency department, ED, ambulance, emergency medical services, EMS.

Assessment of methodological quality

Papers selected for retrieval will be assessed by two independent reviewers for methodological validity prior to inclusion in the review using standardized critical appraisal instruments from the Joanna Briggs Institute Meta-Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI) (Appendix VI). Any disagreements that arise between the reviewers will be resolved through discussion, or with a third reviewer.

Data collection

Data will be extracted from papers included in the review using the standardized data extraction tool from JBI-MAStARI (Appendix VI). The data extracted will include specific details about populations, study methods and outcomes of significance to the review question and specific objectives.

Data synthesis

Data synthesis is the process of combining and reporting data which can be descriptive (narrative summary) or statistical (meta-analysis). This review will conduct two separate data syntheses based on the study design that has been selected for inclusion in the review.

1. Experimental (e.g. RCT, quasi-experimental): papers will, where possible, be pooled in statistical meta-analysis using JBI-MAStARI. All results will be subject to double data entry. Effect sizes expressed as odds ratio (for categorical) and weighted mean differences (for continuous data) and their 95% confidence intervals will be calculated for analysis modify text as appropriate. Heterogeneity will be assessed statistically using the standard Chi-square. Where statistical pooling is not possible the finding will be presented in narrative form including tables and figures to aid in data presentation where appropriate.

2. Observational (e.g. cohort/case control): papers will, where possible, be pooled in statistical meta-analysis using JBI-MAStARI. All results will be subject to double data entry. Effect sizes expressed as relative risk for cohort studies and odds ratio for case control studies (for categorical) and weighted mean differences (for continuous data) and their 95% confidence intervals will be calculated for analysis modify text as appropriate. A random effects model will be used and heterogeneity will be assessed statistically using the standard Chi-square. Where statistical pooling is not possible the finding will be presented in narrative form including tables and figures to aid in data presentation where appropriate.

TED Study II: Presenting characteristics and processing times for culturally and linguistically diverse (CALD) patients with chest pain in an emergency department: Time, Ethnicity, and Delay (TED) II

Aims

The aim of this study was to conduct a sub-analysis of an existing emergency department dataset to describe the presenting characteristics and processing times in ED for CALD patients with chest pain compared to the Australian-born population, and to examine the relationship between CALD status and guideline concordance.

Objectives

1. To describe the presenting characteristics of, and the processed times in ED for, CALD and Australian-born patients suffering from chest pain.

2. To describe presenting symptoms at ED of CALD and Australian-born patients suffering from chest pain.

3. To compare presenting characteristics between CALD and Australian-born patients suffering from chest pain.

   H_0: There was no difference in presenting characteristics between CALD and Australian-born patients suffering from chest pain.

4. To compare presenting symptoms at ED between CALD and Australian-born patients.

   H_0: There was no difference in presenting symptoms at ED between CALD and Australian-born patients.

5. To compare 'first medical contact' between CALD and Australian-born patients

   H_0: There was no difference in 'first medical contact' between CALD and Australian-born patients.

6. To compare processing times in ED (time to treatment, ATS admission time and ED stay) between CALD and Australian-born patients.

H_0: There was no difference in process times in ED between CALD and Australian-born patients.

7. To compare guideline concordance with three chest pain related standards from the two guidelines between CALD and Australian-born patients.

   H_0: There was no difference in guideline concordance with three chest pain related standards from the two guidelines between CALD and Australian-born patients.

8. To determine predictors of the guideline concordance with three chest pain related standards from the two guidelines.

Research questions

1. What are the characteristics, presentations and processing times in ED of CALD patients suffering from chest pain and presenting to metropolitan hospital ED?

2. Are there differences in presentations and processing times in ED between CALD and the Australian-born patients?

3. What are the predictors of the guideline concordance with three chest pain related standards from the two guidelines?

Study design

This study was a cross-sectional analysis of a cohort of emergency presentations to a metropolitan hospital Emergency Department (ED) between 1 July 2012 and 30 June 2014. A cohort is defined as a “group of people with defined characteristics who are followed-up to determine incidence of, or mortality from, some specific disease, all causes of death, or some other outcome” (Morabia 2004).

A cross-sectional study incorporates an observational research design which measures data collected at one point in time with the same participants, which then uses inferential statistics to deduce the relationship between two or more variables of interest in the data (Schneider et al. 2007, p. 161). A cross-sectional study aims to provide information on the frequency or level of the attribute of interest in a defined population at a particular point in time. Such studies are also beneficial in

assessing attitudes and beliefs, knowledge, patterns of mortality, and utilisation of healthcare services by a population in relation to various health events (dos Santos Silva 1999).

A retrospective study often requires the analysis of existing document repositories that have been originally collected for reasons other than for research purposes (Hess 2004; Jansen et al. 2005). Such studies are conducted after the outcomes have actually occurred through the existing repositories such as an ambulance service patient reports, emergency room reports, physician and nursing notes, admission and discharge documentation (Lesser 2012, p. 63). A retrospective study can be conducted through a range of study designs, such as retrospective cohort studies, case-control studies, and cross-sectional studies (Panacek 2007).

Setting

The study was conducted in a 593-bed specialist referral public teaching hospital and medical school in the Adelaide metropolitan area. This hospital was established in 1976 and is collocated with university and the private hospital. It is accredited by the Australian Council on Healthcare Standards and has earned an international reputation and as a centre for research excellence. In addition, the hospital became part of the Southern Adelaide Local Health Network (SALHN) in July 2011. There are approximately 3,500 skilled staff providing an extensive range of services for patients of all ages across Australia from Darwin in the Northern Territory to Mount Gambier in South Australia's south-east.

The ED of this setting provides emergency medical services 24-hours a day, 7 days a week. There are approximately 75,000 ED visits annually with an admission rate of 40%. Of these visits, 5.5% (4,000) visits presented with chest pain. One-third of the patients who presented to the ED with chest pain were born overseas. The ED is accredited for training by the Australasian College for Emergency Medicine, and is a designated state trauma centre. The department is divided into adult and paediatric areas. There are two streams in the adult area, including a section for patients likely to be admitted, and another for patients likely to be discharged. Additionally, there is a co-located short-stay ward for patients requiring up to 24 hours of care, such as patients presenting with chest pain. The Department of Cardiovascular Medicine provides services in clinical cardiology and cardiac

surgery. This department provides a wide range of specialist services, such as a chest pain assessment unit, a cardiac care unit, angiography, and a Percutaneous Intervention Service (PCI).

Participants and study size

The cohort of Emergency Department Information System (EDIS) dataset included 151,249 patients who presented to the ED between 1 July 2012 and 30 June 2014. This study reviewed a subset of 8,225 (5.5%) patients who presented to the ED with chest pain as their primary presenting complaint. (Figure 3.4)

Inclusion Criteria

The inclusion criteria for this cross sectional analysis included:

1. chest pain presented as the chief complaint;
2. time of presentation (triage time) was recorded; and
3. country of birth was stated

Exclusion criteria

The exclusion criteria included patients for whom countries of origin were classified as the 'main English-speaking countries' based on Australian Bureau of Statistics definition including the United Kingdom, Ireland, New Zealand, Canada, the United States of America and South Africa (Australian Bureau of Statistics 2011d).

Variables

The variables are categorised into three domains: 1) demographics; 2) presentations and processing times; and 3) clinical outcomes. A full list and details of all variables is presented in Appendix VII.

Demographics variables

Demographic variables included age; gender; health insurance; distance from hospital; socio-economic status; and CALD status. Age was categorised into six groups (<45, 45-55, 56-65, 66-75, 76-85, and >85 years old), where <45 years of age was nominated as the first cut-off point based on the guidelines for the management for absolute cardiovascular disease risk (National Vascular Disease Prevention Alliance 2012). Gender refers to male and female.

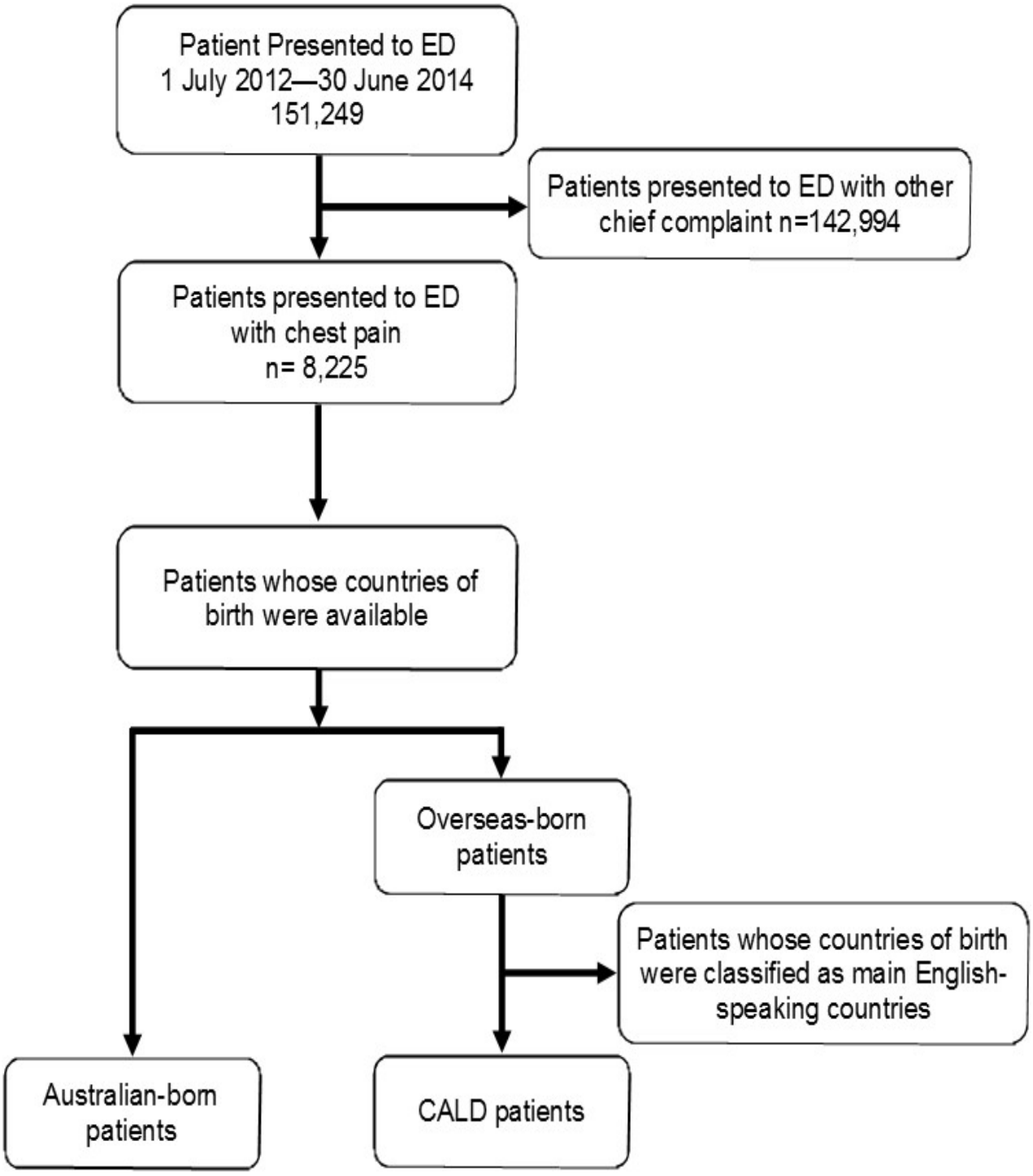

Figure 3.4: Study flow diagram

Health insurance was categorised into two groups: Medicare (Universal Health Coverage), and non-Medicare. Distance from hospital was defined as distance between the patient's residence and the hospital, based on the postcode of the patient's residence. Socioeconomic status ranked from 1 to 10 based on the Socio-Economic Indexes for Areas (SEIFA): Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) (Australian Bureau of Statistics 2013b).

Country of birth was classified into Australia, 'main English-speaking countries', and CALD countries, based on the Australian Bureau of Statistics classifications, which is based on the concept of geographical proximity and social, cultural, economic, and political similarities (Australian Bureau of Statistics 2011c). The definitions for country of birth and ethnicity have been described in Chapter One. A full list of classification of countries of birth is available in (Appendix IV). CALD status was classified as dichotomous variable, 'yes' and 'no'.

Presentations and processing time in ED variables

The presentations and process time variables were presenting symptoms, first medical contact, day and time of presentation to ED, time to treatment, Australasian Triage Scale (ATS) admission time and ED stay. Presenting symptoms in this study were defined as symptoms of patients recorded at triage. There were 21 variables extracted from the dataset, including central chest pain, right/left chest pain, tightness, arm pain, back pain, throat pain, jaw pain, shoulder pain, neck pain, rib pain, calf/leg pain, shortness of breath, diaphoresis, dizziness, palpitation, nausea/vomiting, abdominal pain, fatigue, headache, collapse and heart burn. All symptom variables were categorised as dichotomous variables, 'yes' and 'no'. First medical contact was categorised into four groups, ambulance, ED, GP and ED/TF (presented to another ED and been transferred to this study site), and all groups were categorised as dichotomous variables, 'yes' and 'no'. Time of day at presentation was defined as business hour (9.00 to 17.00) and after hour (17.01 to 8.59) based on the operation hours of the study site. Day of presentation was defined as Monday to Sunday.

Definitions of processing times and term related to the processing times used in TED II is presented in Table 3.2.

Table 3.2 Definitions of times used in TED II

Term	Definition	Reference	Expected timeframe
Triage time	the time at which a patient is assessed to determine the urgency of their problem, and their priority of care	Australian Institute of Health and Welfare (2012b)	
Time seen by doctor in ED	the time of first contact between the patient and the ED doctor who is initially responsible for their care	Australasian college for Emergency Medicine (2013)	
First medical contact	the point at which the patient is either initially assessed by a paramedic, physician, or other medical personnel in the pre-hospital setting, or when the patient arrives at the hospital emergency department	Steg et al. (2012)	
Time to treatment	the interval between triage time and the time of medical treatment/assessment initiation in ED (seen by doctor in ED)	Australasian college for Emergency Medicine (2013)	10 minutes
ATS Admission	the amount of time patient spent in the ED before the decision to admit was taken	Australian Institute of Health and Welfare (2014)	4 hours
ED stay	the period between when patient presents at an ED and when that person is recorded as having physically departed the ED	Australian Institute of Health and Welfare (2014)	

ED= emergency department, ATS= Australasian Triage Scale

Time to treatment was classified into '≤ 10', '> 10' minutes based on the Guidelines on the Implementation of the Australasian Triage Scale in an Emergency Department (Australasian college for Emergency Medicine 2013). Admission to hospital from ED was classified into two categories, including '≤ 4', '>4' based on the National health Reform Agreement, National Partnership Agreement on Improving Public Hospital Services (National Health Performance Committee 2011). ED stay was categorised into two groups: '≤ 4)', and '>4)' based on the National Health Performance (NHP) indicator #21b (National Health Performance Committee 2011).

Clinical outcome variables

The clinical outcome variables comprised triage priority, episode end status, length of hospital stay and guideline concordance. Priority of care (triage priority) was defined as an Australasian Triage Scale (ATS), category 1 to 5, based on the guidelines on the implementation of the Australasian

Triage Scale in emergency department (Australasian college for Emergency Medicine 2013). A full detail of Australasian Triage Scale and description of category is presented in Appendix III. 'Episode end status' was defined as the status of patient at the end of the non-admitted patient ED service episode (Australian Institute of Health and Welfare 2014). In this study, length of hospital stay was defined as amount of time patient spent in hospital since they presented to ED until physically departed from hospital.

Guideline concordance was a variable created from three variables available in the EDIS dataset that relevant to the chest pain related standards from guidelines for management of ACS and the guidelines on the implementation of the Australian Triage Scale in emergency department, including 1)ambulance as first medical contact (Acute Coronary Syndrome Guidelines Working Group 2006); 2) triage priority 1 or 2; and 3) time to treatment within 10 minutes (Australasian college for Emergency Medicine 2013). Each variable was weighted one point equally, if all three variables were met, that Individual case was considered meeting the 'guideline concordance'. This variable was categorised as dichotomous variables, 'yes' and 'no'.

Quantitative variables

The quantitative variables were extracted from the ED documentation. The distance from hospital was calculated from the place of residence to the hospital. Postcode of residence was used to estimate the place of residence. It is acknowledged that this may not always be the location of the health event. Time to treatment was calculated from the documented date and triage time and time seen by doctor. Admission to hospital from ED was calculated from the documented date and triage time and the time of the admission. ED stay was calculated from the documented date and triage time and the date and time patient physically departed from ED. The 'length of hospital stay' was calculated from the documented triage date and separation date and time. Time variables in this study were based on the ED computer clock, other variables were based on the ED documentation.

Data sources/measurement

Data from a unique Emergency Department Information System (EDIS) was automatically captured in a Microsoft Access (Microsoft Corporation, Washington) database which contained information on

every ED visit from June 1993 onwards. The dataset contains basic demographic information about each patient, as well as ED functional information such as triage time, time of doctor treatment initiation, time of medical treatment initiation, time of admission to hospital, and the time of ED disposition (whether discharge to home or admission to hospital). It also contains diagnostic/complaint information recorded at the point of triage in the form of 100 triage codes, one of which is chest pain.

Quality review and security of data

A regular research team meeting was held on a monthly basis to deal with all problems that occurred throughout the study period. All the information from EDIS database was electronically recorded by secure data entry software and managed on the university server for the analysis. To secure the data, passwords, restricted access was established for only researcher team. In addition, electronic database were destroyed at the end of this study and no paper copy was released. The security strategies include;

1. Firewall
2. De-identified data
3. Secure office
4. Restricted access data by listed person
5. Only summary and aggregated data published of report
6. Hospital will also be de-identified

Bias

Bias is systematic error in research where the estimation of a data association from a biased study differs from the true association in the source population of the study (Rothman, Greenland & Lash 2008). This study was a retrospective study that may have inherent biases in data selection, collection, and analysis (Schneider et al. 2013; Ward & Brier 1999).

This study was conducted in one metropolitan hospital in Australia; as a result, the characteristics of the population may not reflect the national population. However, CALD group in TED II made up approximately 18% of all patients, which was similar to the proportion of the CALD (born overseas except for the 'main English speaking countries) population nationwide of 14% (Australian bureau of Statistics 2011b). The number of patients presenting to the ED with chest pain may also vary in different seasons. This study reviewed data throughout the year to address this bias. Another possible bias was in the classification of countries of birth and ethnicity. To manage this bias, the author categorised countries of birth classified according to the Standard Australian Classification of Countries, Version 2.2, based on the concept of geographical proximity and social, cultural, economic, and political similarities (Australian Bureau of Statistics 2011c).

Statistical methods

Data was analysed using IBM SPSS Statistics Version 22.0, and the level of significance was set at $p < 0.05$ or 95% confidence interval. Data were stratified by CALD status. Categorical variables were described as frequencies and percentages and the Chi-square test was used to compare differences between CALD and Australian-born groups. Continuous variables with normal distribution were presented as mean and standard deviation (SD), and the independent t-test was used for comparisons. If distribution was sked, data were presented as median (25^{th},75^{th} percentile) and using the Mann-Whitney U tests for comparisons.

The logistic regression model was used to model the predictors associated with the guideline concordance variable, and to establish whether CALD status was an independent predictor of guideline concordance after controlling for covariates, including demographic and presenting factors. The summary of research questions statistical tests and relevant variables are available in Table 3.3.

Table 3.3 Summary of research questions, variables and statistical tests

Research Question	Variable	Statistical Test	Outcome
1. What are the characteristics, presentations and processed times in ED of CALD suffering from chest pain and presenting to metropolitan hospital ED?	Age Gender Medicare Distance form hospital Symptoms (21 variables) First medical contact Day/time of presentation Time to treatment ATS Admission time ED stay Length of hospital stay Guideline concordance	Descriptive Frequency	Summary of profile
2. Are there differences in presentations and process times in ED between CALD migrants and the Australian-born patients?	CALD status Symptoms (21 variables) First medical contact Day/time of presentation Time to treatment ATS Admission time ED stay ED stay indicator Length of hospital stay Guideline concordance	Independent t-test Mann-Whitney U test Chi square	Differences between the two groups
3. What are the predictors of the concordance with guidelines for management of chest pain in ED	Guideline concordance* Age Gender Distance from hospital Low socioeconomic status CALD status Central chest pain Presentation day Presentation time	Logistic regression	Independent predictors of guideline concordance*

CALD= culturally and linguistically diverse, ED = emergency department, ATS = Australasian Triage Scale
*Guideline concordance with three chest pain related standards from the two guidelines

Outcomes and Significance of the Study

Many studies suggest that ethnicity and culture may play a key role in delay time in seeking help, and in the underutilisation of emergency medical services when experiencing chest pain (Ben-Shlomo, Naqvi & Baker 2008; Bradley et al. 2004; Johnson et al. 2004; McKinley, Moser & Dracup 2000; Renzaho 2007). This study examined CALD who were born overseas in countries other than 'main English-speaking countries' but who are currently living in Australia. The primary aim of TED II was to established data of the differences in the characteristics, processing times and clinical outcomes between CALD and Australian-born patients and emphasized on processing times in ED and guideline concordance with management of chest pain in the ED. The secondary aim was to

understand the effect of CALD status on the concordance with the guidelines for management of acute coronary syndrome and the guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments. The findings of TED II could be a reflection of the differences in presenting characteristics and the amount of time to access emergency services between these two populations.

It is important to gain an insight into the distinguished presentations and processing time in ED of CALD patients, and the differences from the general population. These findings could provide essential information for health providers and public health agencies in order to provide appropriate healthcare, and to enhance accessibility and equality among the CALD populations. In addition, the findings will form a crucial database for further study on the delay in seeking medical care for chest pain among CALD populations.

TED study III: Prehospital delay, mode of transport and clinical outcomes of 607 patients with chest pain from 74 countries within nine ethnic groups (2012-2014): Time, Ethnicity, and Delay (TED) Study III

Aim

This study aimed to perform the analysis of combined datasets of Emergency Department Information System (EDIS) and medical record review to determine presenting characteristics, prehospital delay, and clinical outcomes of patients from nine ethnic groups who presented with chest pain to emergency department (ED), and to examine relationship between ethnicity and delay times.

Objectives

1. To describe the presenting characteristics, prehospital delay, and clinical outcomes of patients from nine ethnic groups who presented with chest pain to ED.

2. To compare 'decision time' between patients from nine ethnic groups and Australian patients.

   H_0: There was no difference in 'decision time' between patients from nine ethnic groups and Australian patients.

3. To compare 'prehospital delay time' between patients from nine ethnic groups and Australian patients.

   H_0: There was no difference in 'prehospital delay time' between patients from nine ethnic groups and Australian patients.

4. To compare 'ambulance use as first medical contact' between patients from nine ethnic groups and Australian patients.

   H_0: There was no difference in 'ambulance use as first medical contact' between patients from nine ethnic groups and Australian patients.

5. To compare clinical outcomes between ethnic patients and Australian patients.

H_0: There was no difference in clinical outcomes between ethnic patients and Australian patients.

6. To examine relationship between ethnicity and decision time to seek care for chest pain within one hour.

7. To examine relationship between ethnicity and the 'ambulance use as first medical contact'.

Research questions

1. What are the presenting characteristics, prehospital delay, and clinical outcomes of patients from nine ethnic groups who presented with chest pain to ED?

2. Are there differences in the presenting characteristics, prehospital delay, and clinical outcomes between patients from nine ethnic groups and Australian patients?

3. Is ethnicity had impact on the decision time?

4. Is ethnicity had impact on 'ambulance use as first medical contact'?

5. Is there association between care-seeking behaviours (decision time and ambulance use) and clinical outcomes?

Study design

TED III was a retrospective, medical record review which analysed the randomly selected samples of patients who presented to a metropolitan hospital emergency department (ED) with chest pain between 1 July 2012 and 30 June 2014. Retrospective study often requires the analysis of existing databases that have been originally collected for another reason other than research purposes (Hess 2004; Jansen et al. 2005), and is conducted after the exposures and the outcomes have occurred (Lesser 2012, p. 63). Retrospective study can be conducted in various forms of study designs such as retrospective cohort study, case-control study and cross-sectional study (Panacek 2007). These existing database include ambulatory and emergency room reports, physician and nursing notes, admission and discharge documentation, laboratory and diagnostic testing reports

and other clinical or administrative data (Gearing et al. 2006; Gregory & Radovinsky 2012). Medical record review is a common technique used to obtain data for retrospective research in many field such as emergency medical literature (Eder et al. 2005; Gearing et al. 2006; Panacek 2007; Worster et al. 2005). Approximately 25% of published emergency medicine studies and 53% of emergency medical services studies deployed medical record review (Gilbert et al. 1996; Worster & Haines 2004).

Medical record review or chart review is defined as any study that uses pre-recorded patient-focused data as the primary source of information to answer a research question (Worster & Haines 2004). It is determined as the gold standard in study identifying demographic factors, clinical data variables, and patient mortality and morbidity (Cassidy et al. 2002; Murray et al. 2003). There are advantages of medical record review over the prospective studies in several circumstances such as: 1) participants cannot be randomized; 2) rare events; 3) studies of pattern of behaviour or disease over prolong period; and 4) pilot studies (Hess 2004; Worster & Haines 2004). In addition, a retrospective medical record review is less expensive and less time consuming compare to the prospective study and can be performed at any convenience time (Badcock et al. 2005; Gearing et al. 2006; Panacek 2007).

Setting

This study was conducted in the same setting as the TED II. The details of this setting have been described previously in the setting section of TED II. In brief, the setting is a specialist referral public teaching hospital and medical school in the Adelaide metropolitan area. The ED in this setting provides emergency services 24 hours a day, 7 days a week. There are approximately 75,000 ED visits annually and 5.5% (4,000) of patients presented with chest pain. One-third of the patients who presented to the ED with chest pain were born overseas. There is a co-located short-stay ward for patients requiring up to 24 hours of care, such as patients presenting with chest pain. The Department of Cardiovascular Medicine provides a wide range of specialist services, such as a chest pain assessment unit, a cardiac care unit, angiography, and PCI.

Participants

The EDIS database identified patients who presented to the ED between 1 July 2012 and 30 June 2014. Patients were randomly selected from ten ethnic groups, including Australian from 8,225 patients who presented to ED with chest pain between the two-year periods based on their countries of birth and the Australian Standard Classification of Cultural and Ethnic groups (Table 3.4).

Inclusion Criteria

The inclusion criteria for this medical record review were:

1. chest pain was reported as a chief complaint;
2. country of birth was recorded;
3. time of arrival (triage time) was recorded

Exclusion criteria

The exclusion criteria included:

1. Patients for whom countries of birth were unclassified;
2. Patients whose triage time was not available; and
3. Patients whose medical records were not available

Sample Selection and study size

This study deployed stratified random sampling as the method to obtain a random samples. A computer program was used to generate random lists for this purpose. The population of this study is made up of 8,225 patients who presented to the ED with chest pain between 1 July 2012 and 30 June 2014. The population were classified into two groups based on their countries of origin as ethnic group and Australian group. Ethnic group was categorised into nine subgroups based on the Australian Standard Classification of Cultural and Ethnic groups (Australian Bureau of Statistics 2000) (Table 3.4). Individuals within each ethnic group were randomly selected (Figure 3.5). The details of study size calculation and power analysis were provide in the study size section. The sample size was based on previous study “Treatment seeking for acute myocardial infarction (AMI) symptoms” that evaluated the effects of whether African Americans delayed longer than non-Hispanic Whites during an AMI.

In brief, a stratified design, which dividing the sample among 9 strata, is analysed using the two-sided, Cochran-Mantel-Haenszel test. Sample sizes, summed across all strata, of 276 in group 1 (treatment group) and 276 in group 2 (control group) achieve 80% power to reject the odds ratio set by the null hypothesis of 1.000 when the odds ratio is actually 2.020. The significance level of the test was set at 0.0500 (Table 3.5 and Table 3.6).

Table 3.4: Classification of ethnic groups based on the Australian Standard Classification of Cultural and Ethnic groups

Group	Ethnic group	Narrow group
1	Oceanian	Australian Peoples New Zealand Peoples Melanesian and Papuan Micronesian Polynesian
2	North-West European	British Irish Western European Northern European
3	Southern and East European	Southern European South Eastern European Eastern European
4	North African and Middle Eastern	Arab Jewish Other North African and Middle Eastern
5	South-East Asian	Mainland South-East Asian Maritime South-East Asian
6	North-East Asian	Chinese Asian Other North-East Asian
7	Southern and Central Asian	Southern Asian Central Asian
8	People of the Americas	North Americas South American Central American Caribbean Islander
9	Sub-Saharan African	Central and West Africa Southern and East Africa

Australian Bureau of Statistics (2000)

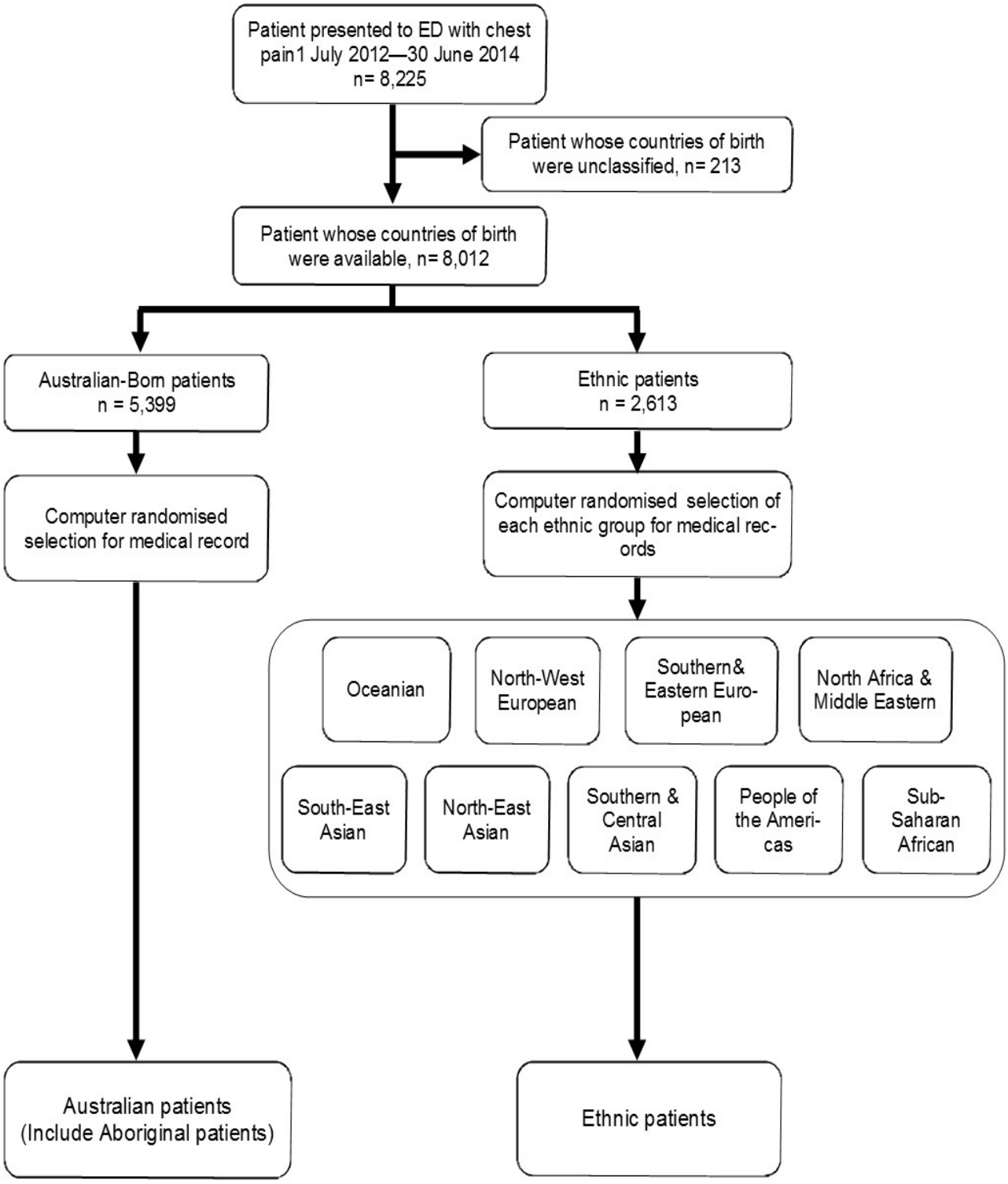

Figure 3.5: Diagram of study sample and random selection

Table 3.5: Summary of study size and sampling

power	Total sample size (N)	Sample size multiplier (M)	Sample size of group 1 (N1)	Sample size of group 2 (N2)	H0 Odds Ratio (OR0)	Actual Odds Ratio (OR1)	Signif* Level Alpha	Beta
0.800	552	30.617	276	276	1.000	2.020	0.0500	0.200

*Signif =significant
Lachin (2000); Nam (1992); Woolson, Bean and Rojas (1986)

Report Definitions
Power: the probability of rejecting a false null hypothesis. It should be close to one.
N: the total sample size summed across all groups and strata.
M: the factor by which the values of R1 and R2 are multiplied.
N1 and N2: the sample sizes from groups 1 and 2 summed across all strata.
OR0: the odds ratio [P1/(1-P1)] / [P2/(1-P2)] assuming the null hypothesis (H0).
OR1: the value of the odds ratio at which the power is computed.
Alpha: the probability of rejecting a true null hypothesis.
Beta: the probability of accepting a false null hypothesis.
In a treatment vs. control design, the treatment group is 1 and the control group is 2.

Table 3.6: Strata-Details report

Number of strata	Proportion of total sample in each strata	Proportion of this strata in Group 1	Proportion of this strata in group 2	Group 1 multiplier (R1)	Group 2 Multiplier (R2)	Strata probability of success
9	0.11111	0.5000	0.5000	1.000	1.000	0.1100

Variables

The variables from the EDIS database have been previously described and defined in TED II. The additional variables from the medical record review comprised of four domains: 1) demographics; 2) medical history; 3) presentation and time variables: and 4) clinical outcomes. A full list of variables and details is presented in Appendix VIII.

Demographic variables

Age, gender, healthcare insurance, distance from hospital, socioeconomic status and country of birth have been previously described and defined in TED II. The additional demographic variables were marital status, ethnic group and language barriers between patients and clinical staff. Marital status was classified as married, never married, divorce, separated, and widowed based on the medical record documentation. Ethnic group was classified into nine groups described in table 3.4 and Australian was allocated as a reference group.

Medical history variables

Medical history variables were derived from medical records review, including family history of CHD, patient's history of CHD, hypertension, diabetes mellitus, hyperlipidaemia, smoking, alcohol, prior ACS and treatments, prior stroke/Transient Ischaemic Attack (TIA), prior Chronic Heart Failure (CHF). These variables were extracted as risk factors of CVD based on the guidelines for the management of absolute for cardiovascular disease risk (National Vascular Disease Prevention Alliance 2012). These variables were classified as dichotomous variable, 'yes' and 'no'.

Presentation and time variables

Presenting symptoms, first medical contact, ambulance use, day and time of presentation to ED, have been previously defined and described in the TED II. The presentation and time variables retrieved from medical records were pain score, 'time of symptom onset', 'day of symptom onset', 'activity during symptom onset', 'location of event', 'decision time', 'prehospital delay time', 'heart rate', 'systolic blood pressure', ' troponin T level', ' creatinine serum', 'CHF at present', and 'cardiac arrest at present'. Pain score was defined as self-report of pain from patient based on a numeric rating scale (NRS) ranking from 1 to 10 (Herr et al. 2006; M. McCaffery & Pasero 1999). 'Pain score' in this study obtained from ED documents including ambulance services patient report form and ED record. The GRACE Score has been defined in Chapter One. The GRACE Score was calculated from demographics, presenting and medical history variables (Appendix II), including age, heart rate, systolic blood pressure, Killip class, creatinine serum level, ST-segment, troponin level and cardiac arrest history by using the GRACE 2.0 ACS Risk Calculator app, web version (The Global Registry of Acute Coronary Events). Location of event was defined as the place at which the patient first experienced the chest pain and self-reported to hospital staff. It was categorised into five groups: home, work place, public, and nursing home based on ED documentation and medical records. Activity during the onset is classified into two groups: active activities, and non-active activities. Definitions of times used in TED study III are presented in Table 3.7. The cut-off' of 1 hour for the decision time was chosen to categorise patients who made a timely decision when experiencing chest pain based on the guidelines for the management of acute coronary syndromes and previous studies (Bray et al. 2015; Chew et al. 2016; Goldberg et al. 2009).

Table 3.7: Definitions of times used in TED study III

Term	Definition	Reference	Expected timeframe
Time of symptom onset	the time during which the patient reported becoming acutely or severely ill, prompting the patient to seek medical care	Goldberg et al. (2002)	
First medical contact	the point at which the patient is either initially assessed by a paramedic, physician, or other medical personnel in the pre-hospital setting, or when the patient arrives at the hospital emergency department	Steg et al. (2012)	
Triage time	the time at which a patient is assessed to determine the urgency of their problem, and their priority of care	Australian Institute of Health and Welfare (2012b)	
Decision time	the interval from the time of symptom onset to accessing the emergency response system or to initiating travel to the hospital	Dracup et al. (1995)	≤ 1 hour
Prehospital delay time	the interval between the time of symptom onset and the triage time	(Dracup et al. 1995)	≤ 1 hour

Clinical outcome variables

The clinical outcome variables included in TED III were angiography, PCI, hospital discharge diagnosis, and readmission. Angiography and PCI were derived from medical records and were classified as dichotomous variable, 'yes' and 'no'. Hospital discharge diagnoses were classified by the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM) and were categorised into two groups: cardiac (including chest pain) and non-cardiac. Readmission was categorised as dichotomous variable; 'yes' and 'no. Readmission time in this study was defined as interval between separation date from hospital and the first following readmission date during the period of study between 1 July 2012 and 30 June 2014. Readmission cause was categorised into two groups; cardiac and non-cardiac based on ICD-10-AM. Readmission time was categories into two groups, ≤ 30 days and > 30 days based on the ACS clinical care standard (Australian Commission on Safety and Quality in Health Care 2014).

Quantitative variables

Age and distance from hospital, have been previously described in TED II. The time variables for this study were extracted from the ED documentation and medical records. Decision time was

calculated from the documented date and time of symptom onset and the documented date and time of first medical contact. 'Prehospital delay time' was calculated from the documented date and time of symptom onset and the documented date and triage time. Readmission time was calculated from the documented separation date and date of the first following readmission during the period of study between 1 July 2012 and 30 June 2014.

Data sources/measurement

The database for TED study III was created by combining two datasets. The primary dataset was derived from the EDIS which has been described in TED II. In brief, the EDIS contained information on every ED visit from June 1993 onwards including basic demographic and ED functional information such as age, gender, triage time,. The secondary dataset was extracted from medical records which were randomly selected by computer program for the reviews.

Data collection

The randomly selected medical records were reviewed by the first reviewer (KW) using a structured review form (Appendix IX). During the medical records review, any doubts about the data occurred; the second judgement was sought from the second reviewer (HG or DT). Any conflicting opinions occurred between the two reviewers, the judgement of the third reviewer (RC) was sought.

Quality review and security of data

A regular research team meeting were held on a monthly basis to deal with all problems that occurred throughout the study period. All the information from two databases were electronically recorded by secure data entry software and managed on the university server for the analysis. The secure passwords for accessing data were provided for only researcher team. At the end of this study, electronic database were destroyed and no paper copy was released. The security strategies include;

1. Firewall
2. De-identified data
3. Secure Office
4. Restricted access data by listed person

5. Only summary and aggregated data published of report
6. Hospital will also be de-identified

Bias

This study was a retrospective study that may have inherent biases in data selection, collection, and analysis (Schneider et al. 2013; Ward & Brier 1999).

Although this study was conducted in one metropolitan hospital in Australia; ethnic patients in the cohort made up approximately 32% of all patients, which is similar to the proportion of ethnic population nationwide (Australian Bureau of Statistics 2013a). Another possible bias may be in the classification of the countries of birth and ethnicity. To manage this bias, the author categorised the ethnic groups according to the Standard Australian Classification of Countries, Version 2.2, which is based on the concept of geographical proximity and social, cultural, economic, and political similarities (Australian Bureau of Statistics 2011c) and the Australian Standard Classification of Cultural and Ethnic groups(Australian Bureau of Statistics 2000). Furthermore, missing and undocumented data in the datasets may potentially bias the number of excluded cases and, as a result, may have an impact on the sample size. Therefore, participants whose country of birth is not documented, and whose triage time was not reported, were excluded from the study.

Statistical methods

Data was analysed using IBM SPSS Statistics Version 22.0. Significant levels were set at *p value* < 0.05 or 95% CI. Presenting characteristics, medical history, and prehospital delay variables were stratified by nine ethnic groups and Australian. Clinical outcomes were stratified by ethnic status (Ethnicity and Australian). Categorical variables were described as frequencies and percentages and the Chi-square test was used to compare the differences between each ethnic group and Australian. Continuous variables with normal distribution were described as mean with standard deviation (SD), and compared by the Independent sample t-test. For variables with the skewed distribution, median (25th, 75th percentile) was presented and the Man- Whitney U test was used for comparisons.

Table 3.8: Summary of research questions, variables and statistical tests

Research Question	**Variable**	**Statistical test**	**Outcome**
1. What are the presenting characteristics, prehospital delay, and clinical outcomes of patients from nine ethnic groups who presented with chest pain to ED?	Age Gender Marital status Healthcare insurance Distance from hospital Ethnic group Family history of CHD History of CHD Hypertension Diabetes Mellitus Hyperlipidaemia Smoking Alcohol Prior MI Prior stroke/TIA Prior CHF First medical contact Decision time Prehospital delay time Day/time of presentation GRACE score Language barriers barrier	Descriptive Frequency	Summary of profile
2. Are there differences in the presenting characteristics, prehospital delay, and clinical outcomes between patients from nine ethnic groups and Australian patients?	Age Gender Marital status Healthcare insurance Distance from hospital Ethnic group Family history of CHD History of CHD Hypertension Diabetes Mellitus Hyperlipidaemia Smoking Alcohol Prior MI Prior stroke/TIA Prior CHF First medical contact Decision time Prehospital delay time Day/time of presentation GRACE score Language barriers barrier	Independence sample t-test Man-Whitney U Test Chi square	Differences between ethnic groups and Australian
3. Is ethnicity had impact on the decision time?	Ethnic group Decision time Presenting variables	Logistic regression (two models)	Independent predictors of decision and prehospital delay time
4. Is ethnicity had impact on ‘ambulance use as first medical contact’?	Ethnic group Ambulance use as first medical contact Presenting variables	Logistic regression	Independent predictors of ambulance use as first medical contact
5. Is there association between care-seeking behaviours (decision time and ambulance use) and clinical outcomes?	Ethnic status Hospital discharge diagnosis Angiography Percutaneous coronary intervention Readmission	Independence t-test Man-Whitney U Test Chi square	Differences between ethnic and Australian patients

ED = emergency department, CHD = coronary heart disease, MI= myocardial infarction, CHF= chronic heart failure, GRACE = global registry of acute coronary events, TIA = transient ischemic attack, PCI: Percutaneous Coronary Intervention

The relationship between ethnic status and clinical outcomes, adjusted for age, was examined using the general linear model. The three binary logistic regression models were used to determine the Independent predictors of decision time ≤ 1, and ambulance use as first medical contact, and to examine the effect of ethnic status on delay time. The summary of research questions statistical tests and relevant variables are available in Table 3.8.

Outcomes and Significance

The delay time is the amount of time taken from the onset of symptoms to the definitive treatment which consist of patient delay, transport delay, and in-hospital delay (Dracup et al. 1995). Over the last few decades, numerous studies have documented that the longest phase is patient delay (Dracup, McKinley & Moser 1997; Finnegan et al. 2000; Motalebi & Iranagh 2013; Mumford et al. 1999; Pitsavos et al. 2006). Many studies have concluded that various factors, such as socio-demographic and clinical factors, cognitive and emotional factors, and social factors are associated with delay time (Dracup et al., 1997; Finnegan et al., 2000; Ayrik et al., 2006' Pattenden et al., 2002; McKinley et al., 2000); however, most of these studies focused on the dominant population. There are only a few studies that were carried out across a range of ethnic groups which found a potential relationship between delay time and ethnicity (Banks & Dracup 2006; Ben-Shlomo, Naqvi & Baker 2008; Bradley et al. 2004; McKinley, Moser & Dracup 2000; Zerwic et al. 2003).

TED III involved data of ethnic patients from all ethnic groups living in Australia. The aims were to describe and compare the presenting characteristics, prehospital delay and clinical outcomes between ethnic and Australian patients who presented to ED with chest pain. Also, we aimed to determine the relationship between ethnicity and prehospital delay, and the effect of ethnicity on the seeking-care behaviours during the suspected cardiac events.

We hope that the findings from this study will establish a database of prehospital delay in seeking medical care for chest pain among ethnic populations in Australia. This would be a great benefit to healthcare providers, public health agencies, and policy-makers in regard to improvements in healthcare services for acute coronary syndromes for these disadvantage groups. Finally, the findings of TED III will form an essential base for further research in this area.

Ethical Considerations

Human research is research conducted with or about people, or their data or tissue (National Health and Medical Research Council, Australian Research Council & Committee 2007). All human research need to consider the ethical issues that may have impacts on individual participate in the study. In Australia, the National Statement on Ethical Conduct in Human Research is the major guidelines for the ethical consideration of all human research. The essential aspects of ethics are the values and principle of ethical conduct which consists of respect, merit and integrity, justice and benefience.

This research project consisted of three studies with three different study designs. The first study (TED I) was a sytematic review where is no direct human involvement. As a result, this study considered ethics approval not applicable. The other two studies did not involved human recruitment, but was using pre-existing database of emergency department and medical records. These two studies are considered as human research because it was related to human data.

Data is defined as pieces of information which may be collected, stored or disclosured in three forms (National Health and Medical Research Council, Australian Research Council & Committee 2007).

1. Individually identifiable data, where the identity of a specific individual can reasonably ascertained

2. Re-identifiable data, from which the identifiers have been removed and replaced by a code, but it remains possible to re-identify a specific individual by using code or linking different data sets

3. Non-identifiable data, which have never been labelled with individual identifiers or from which identifiers have been permanently removed.

The second study (TED II) used only non-identified data from dataset of Emergency Department Information System (EDIS). The third study (TED III) used re-identifiable data of EDIS in order to link to medical records before transforming final data to non-identified data. The identifiers of

individual from EDIS were removed and replaced with codes. All codes were maintained as confidential with restricted access. All data were collected by the research team only. The electronic data were stored in the university secure server system, and the paper-based data were stored in a specific locked cabinet in the research office in the university. At the end of project, all data was destroyed.

Regarding only database usage, the two studies were less likely to encounter the burden of risks. The possible risk that may occur was accessing individuals' information directly. This made the studies eligible to be classified as a low and negligible risk (LRN) project based on the National Statement on Ethical Conduct in Human Research. The ethical consideration of this study involved the databanks/database (National Health and Medical Research Council, Australian Research Council & Committee 2007). The ethics approval applications for both studies were submitted separately to the Southern Adelaide Clinical Human Research Ethics Committee (SAC HREC) (Appendix X). The Site Specific Assessment (SSA) forms were also submitted along with the ethics approval applications. (Appendix X). The insurance and indemnity has been arranged by Flinders University and has been accepted by the SA Health (Appendix XI).

Having granted the ethics approval and Site Specific Assessment approval (Appendix XII); a letter of approval was submitted to Flinders University before commencing the data collection at the research site. The flow chart of ethics consideration and applications is presented in Figure 3.6.

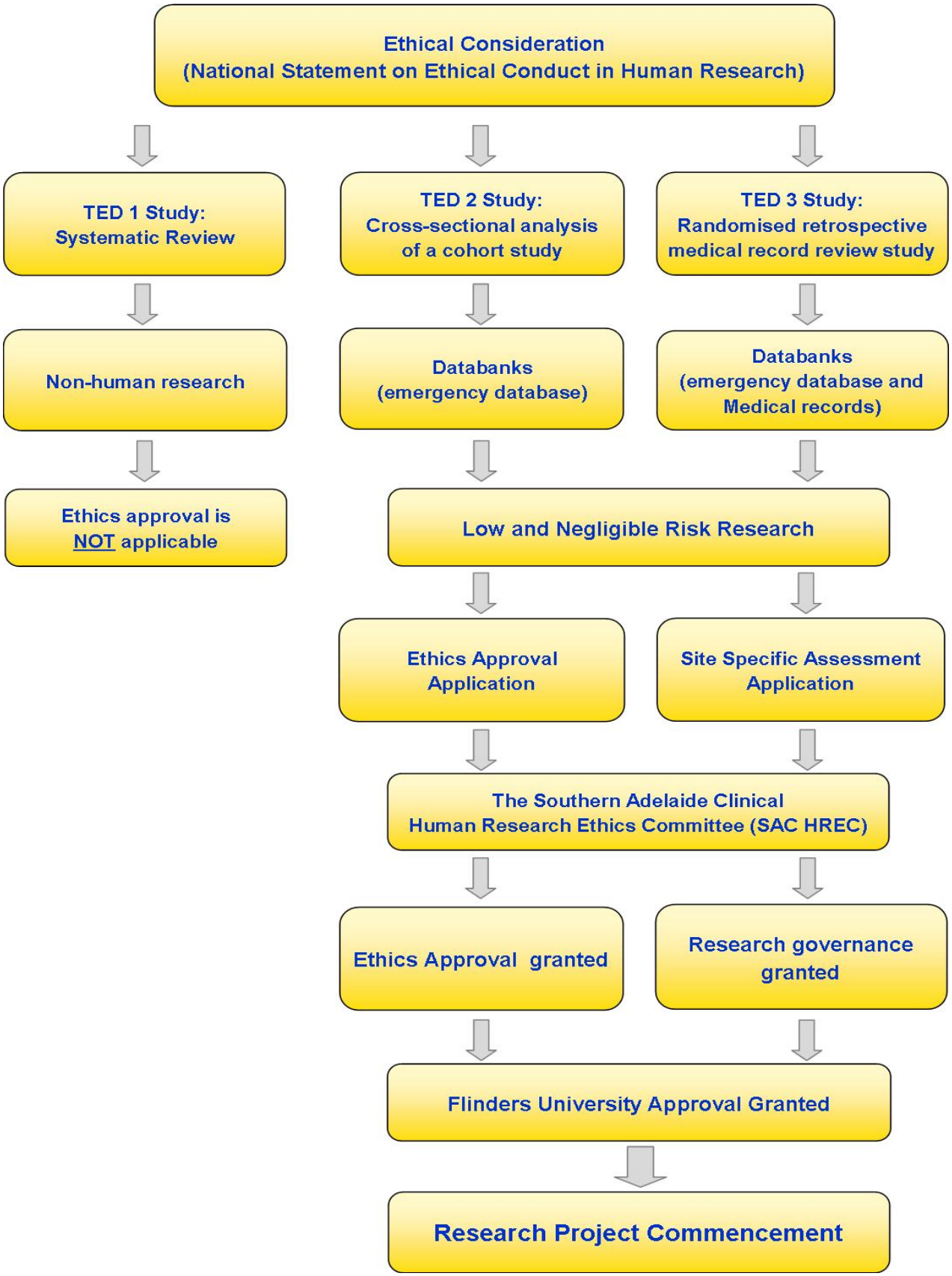

Figure 3.6: Flow chart of ethical consideration and ethics approvals

CHAPTER 4
RESULTS

CHAPTER 4 RESULTS

This chapter presents the outcomes of Time, Ethnicity and Delay (TED) Study**,** including; results from the three studies (i.e., TED I, TED II and TED III). The results of three studies have been produced as manuscripts separately and submitted to international journals. The details of each study are presented in this chapter as published in the certain journals, including abstract, background, aims, results, discussions and conclusions. The status of publication is presented in Table 4.1.

Table 4.1 Publications integrated into this Chapter

Study and title	Publication status*
TED I: The association between ethnicity and the delay time in seeking medical care for chest pain: a systematic review	Published
TED II: Presenting characteristics and processing times for culturally and linguistically diverse (CALD) patients with chest pain in an emergency department: Time, Ethnicity, and Delay (TED) Study II	Published
TED III: Prehospital delay, mode of transport and clinical outcomes of 607 patients with chest pain from 74 countries within nine ethnic groups (2012-2014): Time, Ethnicity, and Delay (TED) Study III	Manuscript

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Time, Ethnicity and Delay Study I

This section presents results of TED I which has been published in the JBI Database of Systematic Reviews & Implementation Reports 2016, volume 14, issue 7, pages 208-235.

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The association between ethnicity and delay in seeking medical care for chest pain: a systematic review

Executive summary

Background

Acute coronary syndrome is a leading cause of mortality and morbidity worldwide and chest pain is one of the most common symptoms of acute coronary syndromes. A rapid response to chest pain by patients and appropriate management by health professionals are vital to improve survival rates. People from different ethnic groups are likely to have different perceptions of chest pain, its severity and the need for urgent treatment. These differences in perception may contribute to differences in response to chest pain and precipitate unique coping strategies. Delay in seeking medical care for chest pain in the general population has been well documented; however limited studies have focused on delay times within ethnic groups. There is little research to date as to whether ethnicity is associated with the time taken to seek medical care for chest pain. Consequently, addressing this gap in knowledge will play a crucial role in improving the health outcomes of culturally and linguistically diverse patients suffering from chest pain and for developing appropriate clinical practice and public awareness for these populations.

Objectives

This review aimed to determine if there is an association between ethnicity and delay in seeking medical care for chest pain among culturally and linguistically diverse populations.

Inclusion criteria

Types of participants

Patients from different ethnic minority groups presenting to emergency departments with chest pain.

Types of exposure

This review examined studies that evaluated the association between ethnicity and delay in seeking medical care for chest pain amongst culturally and linguistically diverse populations.

Types of studies

This review considered quantitative studies including randomized controlled trials, non-randomized controlled trials, quasi-experimental, before and after studies, prospective and retrospective cohort

studies, case control studies and analytical cross sectional studies.

Outcomes

This review considered studies that measured delay time as the main outcome. The time was measured as the interval between the time of symptom onset and time to reach an emergency department.

Search strategy

A comprehensive search was undertaken for relevant published and unpublished studies written in English with no date restriction. All searches were conducted in October 2014. We searched the following databases: Medline, PubMed, Cochrane Central Register of Controlled Trials (CENTRAL), Embase, Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsycINFO, ProQuest (health databases only), Informit, Sociological Abstracts, Scopus, and Web of Science. The search for unpublished studies included a wide range of 'grey literature' sources including national libraries, digital theses repositories, and clinical trial registries. We also targeted specific health research, specialist cardiac, migrant health, and emergency medicine organizational websites and/or conferences. We also checked the reference lists of included studies and contacted authors when further details about reported data was required to make a decision about eligibility.

Methodological quality

Papers selected for retrieval were assessed by two independent reviewers for methodological validity prior to being included in the review. Validity was assessed using standardized critical appraisal instruments from the Joanna Briggs Institute. Adjudication was produced by the third reviewer.

Data extraction

Data was extracted from included articles by two independent reviewers using the standardized data extraction tool from the Joanna Briggs Institute.

Data synthesis

The extracted data was synthesized into a narrative summary. Meta-analysis could not be performed due to the heterogeneity of study protocols and methods used to measure outcomes.

Results

Ten studies, with a total of 1,511,382 participants, investigating an association between ethnicity and delay met the inclusion criteria. Delay times varied across ethnic groups, including Black, Hispanic, Asian, South Asian, Southeast Asian, and Chinese. Seven studies reported delay in hours and ranged from 1.90 hours to 3.10 hours. Delay times were longer among culturally and linguistically diverse populations than the majority population. The other three studies reported delay time in categories of time (e.g. < 1 hour, < 4 hours, < 6 hours) and found larger proportions of later presentations to the emergency departments among ethnic groups compared to the majority groups.

Conclusions

There is evidence of an association between ethnicity and time taken in seeking medical care for chest pain, with patients from some ethnic minorities (e.g. Black, Asian, Hispanic and South Asian) taking longer than those of the majority population. Health promotions and health campaigns focusing on these populations are indicated.

Recommendations for practice

A future public health agenda in cardiovascular disease should target culturally and linguistically diverse populations and health professionals should be aware of ethnicity and its impacts on health. Guidelines and standard care for acute coronary syndromes should integrate recommended practice for patients with different ethnic backgrounds.

Recommendations for research

Further research in this area is recommended, particularly to study delay among culturally and linguistically diverse migrants in multicultural countries. The exploration of seeking care behaviours of these populations is also essential.

Keywords

Chest pain; acute coronary syndromes; culturally and linguistically diverse; ethnicity; delay; seeking medical care

Introduction

Background

Coronary heart disease (CHD) is the world's biggest killer causing 7.4 million deaths globally in 2012 (World Health Organisation 2015). It accounted for one-fifth of all deaths in Europe annually (Nichols et al. 2014b), and it also caused one of every six deaths in the USA in 2009 (Go et al. 2014). In Australia, more than 20,000 deaths were caused by CHD and approximately 50% of all CHD deaths were attributed to acute coronary syndromes (ACS) in 2012 (Nichols et al. 2014a). Acute coronary syndromes are a leading cause of mortality and morbidity worldwide, particularly among industrialized countries.(The GRACE Investigators 2001). Acute coronary syndromes are a spectrum of clinical manifestations of CHD ranging from unstable angina (UA), non-ST-segment elevation myocardial infraction (NSTEMI) and ST-segment elevation myocardial infraction (STEMI) (DeVon & Ryan 2005). Chest pain is the most common symptom of ACS and also recognized as one of the most common presentations to an emergency department (ED) (Niska, Bhuiya & Xu 2010). The timely arrival of patients with chest pain to an ED after the onset of symptoms, and a rapid evidence-based treatment is important for patients' survival and outcomes (Steg et al. 2012).

Definitive treatment for ACS should be started as soon as possible after onset of symptoms. According to international guidelines for management of ACS, reperfusion therapy should be administered to all patients presenting with ACS within 12 hours (Chew et al. 2016; National Clinical Guideline Center 2013; O'Gara et al. 2013b). Delay in responding to chest pain symptoms has been proven to be a substantial factor impacting on patients' outcomes. Boersma et al. (1996a) found that 65 lives are saved for every 1000 treated patients when the initial treatment is administered within the first hour of symptom onset. The findings from international trials support the notion that mortality rates within 30 days and one year of ACS symptoms was increased with the greater interval between symptom onset and treatment (Armstrong et al. 1998; GISSI 1986; Weaver, WD et al. 1993). The National Heart Foundation of Australia has promoted the 'Heart Attack Action Plan' to help reduce the delays. When patients experience chest pain or warning signs of heart attack for 10 minutes, and the symptoms get progressively worse, they are encouraged to call emergency number immediately and ask for an ambulance (National Heart Foundation of Australia 2009a).

ACS management includes the process from the initiation of symptom onset to in-hospital care which may consist of presentation of the patient with chest pain, working diagnosis, electrocardiogram (ECG), cardiac biomarker tests, final diagnosis and therapies (Chew et al. 2016). Early access to definitive care, usually by attending an emergency department, has a profound effect on survival from acute coronary syndrome; consequently, delay in seeking medical care for chest pain is a serious issue requiring an urgent action and implementable policy (Acute Coronary Syndrome Guidelines Working Group 2006; National Clinical Guideline Center 2013; O'Gara et al. 2013a; Parsonage, Cullen & Younger 2013). Factors influencing delay have been grouped into three domains; i) socio-demographic and clinical factors; ii) cognitive and emotional factors; and iii) social factors (Alonzo 1986; Dracup, McKinley & Moser 1997; Dracup & Moser 1997; Goff et al. 1998; Henriksson et al. 2011; Herlitz et al. 2010a; Horne et al. 2000; Kenyon et al. 1991; O'Brien et al. 2012; Ottesen et al. 2004; Pattenden et al. 2002b; Perkins-Porras et al. 2009; Quinn 2005; Ruston, Clayton & Calnan 1998). These factors include recognition of signs and symptoms, gender, ethnicity, education levels, income, and emotional and social factors.

Ethnicity, often categorized or described by country of birth, (Alwan 2011; Australian Bureau of Statistics 1995) is one of the significant non-modifiable risk factors for cardiovascular disease (Greenlund et al. 2004; Meischke, Eisenberg & Larsen 1993; World Health Organisation 2013). Previous studies have demonstrated that there were differences in prevalence, incidence, occurrence, risk factors and mortality rate of acute coronary syndromes amongst culturally and linguistically diverse (CALD) populations (Balarajan 1991; Cappuccio et al. 1997; Chiu et al. 2010, 2011; Dassanayake et al. 2009; Gadd et al. 2006; Hedlund, Lange & Hammar 2007; Khattar et al. 2000; Lu & Nordin 2013). Unfortunately, the majority of studies on delay in seeking medical care for chest pain have focused on majority populations who share the same culture, language, and beliefs in the same social and environmental context (Dracup, McKinley & Moser 1997; Herlitz et al. 2010a; Ottesen et al. 2004; Saczynski et al. 2008; Yan et al. 2009). There are only a few studies which provide evidence in regards to the delay in responding to chest pain among differing ethnic groups, particularly CALD groups (Dassanayake et al. 2009; Yusuf et al. 2001b).

International migrants living abroad worldwide have reached a total of 232 million people, accounting for 3.2% of the world's population (United Nations 2013a). A CALD migrant is defined as any person who changes his or her country of usual residence (United Nations 1998). Their journeys inevitably end with a change of lifestyle, including food, activities, jobs, fashion, socialization, and health care (Frisbie, Cho & Hummer 2001; Gilbert & Khokhar 2008). Nevertheless, they may keep their culture, beliefs, and attitudes in many aspects of their lives, such as language, ceremonies, traditional foods, traditional medicine, and social activities (Berry 1997). CALD groups are prone to face settlement hardships including education, employment, taxation system and a different health care system (Wechkunanukul, Grantham & Clark 2014). Furthermore, the difficulties communicating between patients and health professionals attributed to the language barrier can impact health care provision. These may cause CALD patients to be less likely to access primary, preventive care and emergency care such as ambulance and follow up visit (Kirkman-Liff & Mondragón 1991).

Although public health promotion and national plans have been implemented in multicultural communities, the disparities in access to care and unequal care provision are still occurring to some extent. Further actions and policies are needed to close the gap (Anderson, Green & Payne 2009; Gushulak & Williams 2004; Kelaher & Manderson 2000). For health care providers, not only does the system need to be developed and improved, but also an understanding of migrants in every aspect would be helpful in meeting their needs (Lancellotti 2008; McFarland & Eipperle 2008; Wechkunanukul, Grantham & Clark 2014). In recognition of this issue, it is important to understand medical care seeking behaviour among migrants and key factors that influence their delay when experiencing chest pain. These findings could provide further information to health providers, public health agencies and policy makers in order to establish health promotion programs, health campaigns and health policies that match the needs of CALD groups (Yusuf et al. 2001a).

The aim of this review was to establish if there is an association between ethnicity and delay in seeking medical care for chest pain among migrants with different ethnic backgrounds. The findings of this study will provide further information supporting future research on cardiac care between the majority population and ethnicity, particularly CALD populations.

This systematic review was performed based on a prior published protocol using the methods of the Joanna Briggs Institute (Wechkunanukul et al. 2014).

Definition of concepts

1. This systematic review defined delay time as the interval between time of symptom onset and hospital arrival (Dracup et al. 1995; King & McQuire 2007).

2. Decision time was defined as the interval from the time of symptom onset to accessing the emergency response system or to initiating travel to the hospital (Dracup et al. 1995).

3. Time of symptom onset was defined as the time during which the patient reported becoming acutely or severely ill, prompting the patient to seek medical care (Goldberg et al. 2002).

4. Categories of ethnic groups in this systematic review refer to the terms used in the original studies Including Caucasian/White, Black, Hispanic, Asian, South Asian, Southeast Asian, and Chinese. Caucasian/White group was defined as a majority population in this systematic review based on the original articles and the countries of origin.

Objectives

The objective of this review was to determine if there is an association between ethnicity and delay in seeking medical care for chest pain among CALD populations.

Inclusion criteria

Types of participants

This review considered studies that included primary analysis or secondary analysis of patients with different ethnic backgrounds who presented with chest pain at an emergency department. Therefore the review excluded studies that focused on the outcomes for total population or indigenous populations

Types of exposure

This review considered studies that evaluated the association between ethnicity and delay in seeking medical care for chest pain among CALD populations compared to the delay in majority populations. This review places the emphasis on the delay between onset of symptoms and hospital arrival.

Types of studies

This review considered quantitative studies including randomized controlled trials, non-randomized controlled trials, quasi-experimental, before and after studies, prospective and retrospective cohort studies, case control studies and analytical cross sectional studies.

Outcomes

The current review considered studies that measured delay time in seeking medical care for chest pain. The time was measured as the interval between time of symptom onset and time to reach an emergency department (King & McQuire 2007). Time was measured as a continuous variable (in hours) or as a categories of times (e.g. >1 hour, >4 hours, >6 hours).

Search strategy

A comprehensive search was performed for all English-language published and unpublished studies relevant to the review question. No date restrictions were imposed at the searching stage to keep the strategy as broad as possible. Before developing the final search strategy, a preliminary search of Medline (OvidSP) and CINAHL was conducted to identify subject headings such as Medical Subject Headings (MeSH) in Medline. We also sought useful textwords contained in article titles and abstracts. Once this was done, a detailed search was constructed in Medline (OvidSP) and then accurately translated for each subsequent database. The search strategy comprised a wide range of synonyms for each concept to ensure maximum search sensitivity. A combination of textwords and subject headings were used in databases supporting controlled vocabulary searching. Textwords alone were used where controlled vocabulary searching was not an option. The searches were run between the 20th and 23rd of October 2014 in the following databases: Medline (OvidSP, In Process & Other Non-Indexed Citations and Ovid Medline 1946-); PubMed (non-indexed subset only); Cochrane Central Register of Controlled Trials (Cochrane Library, Issue 9 of 12, Sept 2014); Embase (OvidSP, 1974-); CINAHL (EbscoHOST, 1981-); PsycINFO (OvidSP, 1806-); ProQuest Health & Medicine databases; Sociological Abstracts (ProQuest, 1952-); Scopus; Web of Science (Core Collection, 1900-); and Informit. A simplified version of the database search strategy was used for web search engines Google Scholar (Advanced) and TRIP (Turning Research Into Practice) in

order to find additional published studies. Search strategies for the Medline, Embase and CINAHL databases are available as Appendix XIV.

The search for unpublished studies was conducted between the 3rd and 6th of October 2014. We first targeted multidisciplinary sources of grey literature including Trove (National Library of Australia), WorldCat, Networked Digital Library of Theses and Dissertations (NDLTD), PQDT Open, Open-Grey, Grey Literature Report, and OpenDOAR. The websites of key Australian and international health organizations such as the World Health Organization (WHO), National Institute for Health and Care Excellence (NICE), National Health and Medical Research Council Australia (NHMRC), National Institute of Clinical Studies (NICS), Department of Health and Ageing (Australia), and Australian Institute of Health and Welfare (AIHW) were then searched. The clinical trials registers - clinicaltrials.gov and Australian New Zealand Clinical Trials Registry (ANZCTR) were also searched for ongoing clinical trials.

A more subject-focused search for relevant abstracts or publications was then conducted targeting the conference websites, webpages, and/or research repositories of the following organizations: Heart Foundation, American Heart Association, European Society of Cardiology, British Heart Foundation, GRACE: The Global Registry of Acute Coronary Events, The Office of Minority Health Resource Center (OMHRC) Knowledge Center (US Department of Health and Human Services, Office of Minority Health), Minority Health & Health Equity Archive (University of Pittsburgh, US), Paramedics Australasia (including its conferences and online journal). To supplement the grey literature search, we also conducted a Google (Advanced) search on the 4th of October 2014 and examined the first 200 websites. All database and Google Scholar search results were imported into an EndNote X7 Library, pooled, and then subsequently deduplicated. Finally, the reference lists of all included studies were checked for additional relevant studies and study authors were contacted when additional data or clarification about data was sought.

Method of the review

Papers selected for retrieval were assessed by two independent reviewers (KW and HG) for methodological validity prior to inclusion in the review using standardized critical appraisal

instruments from the Joanna Briggs Institute Meta-Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI) (Appendix VI). Any disagreements that arose between the reviewers (KW and HG) were resolved through discussion, or with a third reviewer (RC).

Data extraction

Data was extracted from papers included in the review using the standardized data extraction tool from JBI-MAStARI (Appendix VI). The data extracted included specific details about populations, study methods and outcomes of significance to the review question and specific objectives. A list of included studies is presented in Appendix XIV.

Data synthesis

In this review, only observational studies met the criteria and were subsequently included. There were differences in outcome measurement, with some studies measuring time as a continuous variable (in hours) and other studies recording categories of time (e.g. >1 hour, >4 hours, >6 hours), which hindered statistical pooling of the results. Therefore, meta-analysis was not appropriate and the findings are presented in a narrative summary in accordance with the JBI methodology (The Joanna Briggs Institute 2014).

Results

Description of studies

The database and Google Scholar searches identified 8824 citations. Grey literature and Google searching identified a further 234 studies for consideration. In total, we identified 9058 citations through all methods of searching (Table 4.2).

After removing duplicates, 5696 citations were reviewed against the eligibility criteria. Of these, 5390 were eliminated based on title/abstract. Full text articles were obtained for the remaining 306 citations. Based on full text review, a further 289 studies were eliminated. The remaining 17 studies were included for critical appraisal of their methodological quality. When information was missing, the corresponding authors were contacted. Seven articles were excluded after critical appraisal leaving ten articles which were included in this systematic review (Figure 4.1). The list of excluded studies and reasons for exclusion are provided in Appendix XIV.

Table 4.2 Results of database, grey literature, and web searches

Resources searched	No. results
Medline (*In Process & Other Non-Indexed Citations* and *Ovid Medline*)	2002
PubMed (non-indexed subset only)	93
Cochrane Central Register of Controlled Trials (CENTRAL)	36
CINAHL	600
Scopus	920
PsycINFO	614
Web of Science	608
Informit	14
ProQuest (health databases)	949
Embase	2770
Sociological Abstracts	18
Turning Research Into Practice (TRIP)	0
Google Scholar	200
Google	200
Combined other grey literature searches (e.g. National Libraries, theses repositories, organizational websites, etc.)	34
Total before deduplication	9058
Duplicates	3362
Total after deduplication	5696

Participants

This review included 1,511,382 participants from ten selected studies. All participants in this review presented to the ED with chest pain. The majority of the reviewed studies were conducted in the USA (7) (Canto et al. 1998; Goldberg, Gurwitz & Gore 1999; McGinn et al. 2005; Sheifer et al. 2000; Syed et al. 2000; Ting et al. 2008; Ting et al. 2010), two studies were conducted in the UK (Ben-Shlomo, Naqvi & Baker 2008; Kendall et al. 2013) and one study was performed in Canada(King, Khan & Quan 2009). Of all ten included studies, males were the dominant gender ranging from 53.6% (Sheifer et al. 2000) to 75.6% (Kendall et al. 2013) The mean age of participants of the ten reviewed studies varied from 59.0 years (Syed et al. 2000) to 76.5 years (Sheifer et al. 2000).

The ten studies included seven ethnic groups; Caucasian/White (Ben-Shlomo, Naqvi & Baker 2008; Canto et al. 1998; Goldberg, Gurwitz & Gore 1999; Kendall et al. 2013; King, Khan & Quan 2009; McGinn et al. 2005; Sheifer et al. 2000; Syed et al. 2000; Ting et al. 2008; Ting et al. 2010), Black (Goldberg, Gurwitz & Gore 1999; McGinn et al. 2005; Sheifer et al. 2000; Syed et al. 2000; Ting et

al. 2008; Ting et al. 2010), Hispanic (Canto et al. 1998; Goldberg, Gurwitz & Gore 1999; Ting et al. 2008; Ting et al. 2010), Asian (Canto et al. 1998; Goldberg, Gurwitz & Gore 1999; Ting et al. 2008; Ting et al. 2010), South Asian (Ben-Shlomo, Naqvi & Baker 2008; Kendall et al. 2013; King, Khan & Quan 2009), Southeast Asian (King, Khan & Quan 2009) , and Chinese (King, Khan & Quan 2009).

The proportions of ethnic groups varied between studies. Caucasian/White was the majority group for all included studies ranging from 28.8%(King, Khan & Quan 2009) to 90.9% (Sheifer et al. 2000) of the total population of individual studies. Six studies(Goldberg, Gurwitz & Gore 1999; McGinn et al. 2005; Sheifer et al. 2000; Syed et al. 2000; Ting et al. 2008; Ting et al. 2010) included Black people ranging from 5.1% (Ting et al. 2008) to 33.0% (Syed et al. 2000) of the total population of individual studies. Hispanics were included in four studies (Canto et al. 1998; Goldberg, Gurwitz & Gore 1999; Ting et al. 2008; Ting et al. 2010), the proportions ranged from 2.9% (Ting et al. 2008) to 3.5% (Ting et al. 2010) of the total population of individual studies. Asian was the smallest group in four studies(Canto et al. 1998; Goldberg, Gurwitz & Gore 1999; Ting et al. 2008; Ting et al. 2010) ranging from 1.0% (Canto et al. 1998; Goldberg, Gurwitz & Gore 1999) to 1.4%(Ting et al. 2008) of the total population of individual studies. Two studies in the UK collected data from South Asian groups which ranged from 3.4% (Ben-Shlomo, Naqvi & Baker 2008) to 23.2% of the total population of individual studies (Kendall et al. 2013). A Canadian study (King, Khan & Quan 2009) included South Asian, Chinese and Southeast Asian groups with proportions of 24.9%, 22.7% and 14% respectively (Table 4.3).

Data source and study size

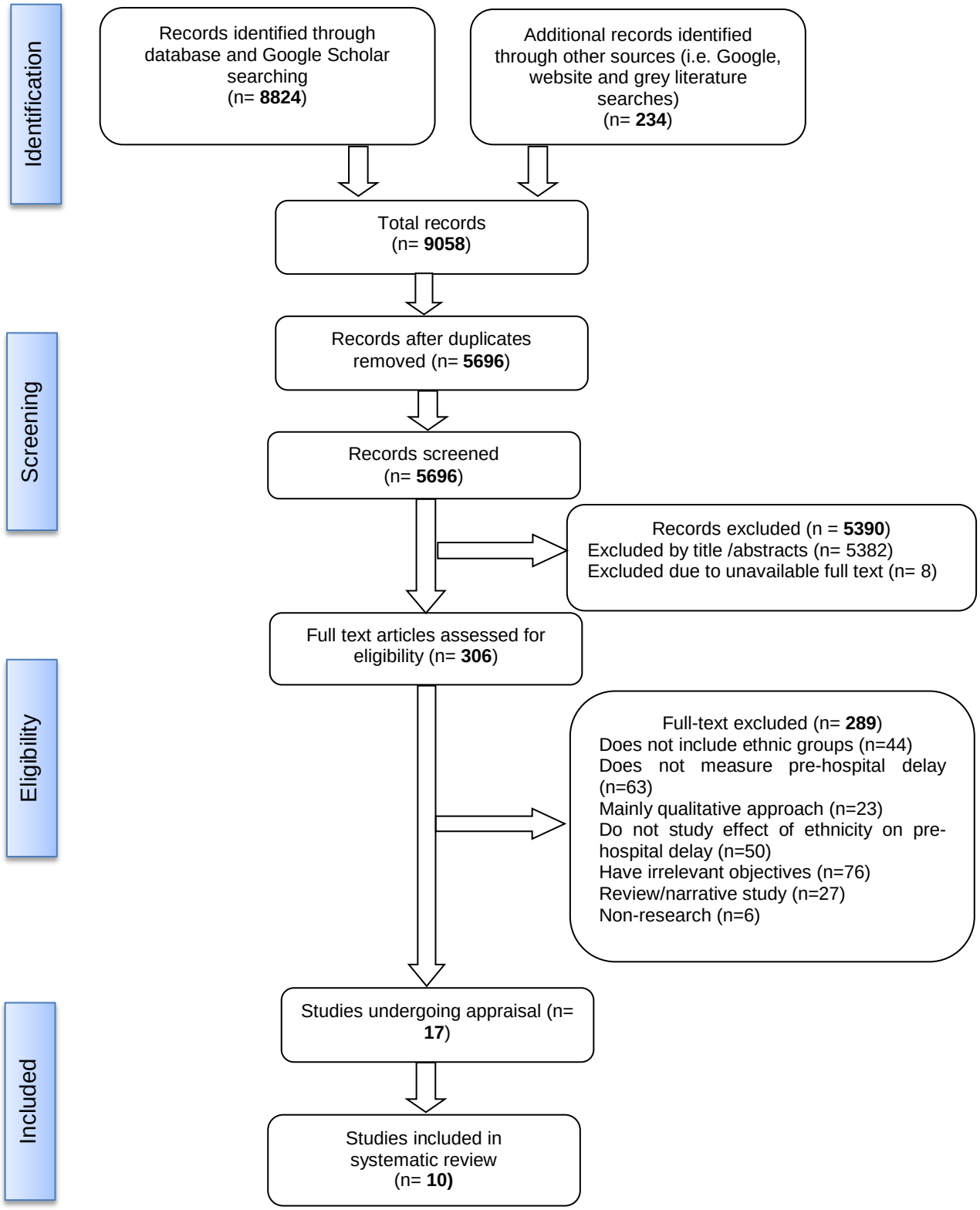
Data from the ten included studies were collected from large databases and large university hospitals. Eight studies included participants from databases at a national level, including the Myocardial Ischaemic National Audit Project (MINAP) (Ben-Shlomo, Naqvi & Baker 2008), National Registry of Myocardial Infarction (NRMI)(Canto et al. 1998; Goldberg, Gurwitz & Gore 1999; Ting et al. 2008), British Cardiovascular Intervention Society (BCIS)(Kendall et al. 2013), Atherosclerosis Risk in Community (ARIC)(McGinn et al. 2005), the Cooperative Cardiovascular Project and Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes with Early

Implementation (CRUSADE) (Ting et al. 2010). The remaining two studies (King, Khan & Quan 2009; Syed et al. 2000) included participants from the local hospitals. The selected studies had sample sizes varying from 395 (Syed et al. 2000) to 482, 327 (Ting et al. 2008) participants.

Methodological quality

All ten included studies were observational studies, including five prospective cohort studies (Ben-Shlomo, Naqvi & Baker 2008; Canto et al. 1998; Syed et al. 2000; Ting et al. 2008; Ting et al. 2010), and five retrospective cross-sectional studies (Goldberg, Gurwitz & Gore 1999; Kendall et al. 2013; King, Khan & Quan 2009; McGinn et al. 2005; Sheifer et al. 2000). The descriptive summary of all studies is presented in Table 4.3. All selected studies were classified as level 3 and 4 (level 3 c – level 4b) according to the JBI Levels of Evidence for Effectiveness (Appendix XIV). Methodologically, they were deemed satisfactory. According to JBI critical Appraisal checklist for comparable cohort/ case control, all studies included patients at a similar condition (Q 2) i.e. presenting to ED with chest pain. They also met criteria Q 5, Q 8 and Q9 where the outcomes were assessed, measured and statistically analysed appropriately. Furthermore 90% of all studies identified confounding factors and have strategies to deal with them (Q4). The total score of all reviewed studies ranged between 66.7% and 88.9 % on the quality assessment criteria using the JBI-MAStARI appraisal tool (Table 4.4). The outcomes were measured in two ways: quantitative time measured in hour units (Ben-Shlomo, Naqvi & Baker 2008; Canto et al. 1998; Goldberg, Gurwitz & Gore 1999; Kendall et al. 2013; Syed et al. 2000; Ting et al. 2008; Ting et al. 2010) (Table 4.5) and categories of time (King, Khan & Quan 2009; McGinn et al. 2005; Sheifer et al. 2000) (Table 4.6).

Appropriate statistical analyses were undertaken in the studies, t-test for continuous variables and Chi-square tests for categorical variables. Additionally, 70% of the included studies (Ben-Shlomo, Naqvi & Baker 2008; Canto et al. 1998; Goldberg, Gurwitz & Gore 1999; McGinn et al. 2005; Sheifer et al. 2000; Ting et al. 2008; Ting et al. 2010) had a large sample size at a national level, only three studies (Kendall et al. 2013; King, Khan & Quan 2009; Syed et al. 2000) enrolled less than 1000 participants.



Moher D, Liberati A, Tetzlaff J, Altman DG, The Prisma Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med. 2009;6(7):e1000097. Doi:10.1371/journal.pmed.1000097(Moher et al. 2009)

Figure 4.1: TED I study Selection flowchart

Table 4.3 Summary of included studies in JBI Systematic Review

Authors	Country/ year	Study design	Data source/ Sample size	Ethnic group (%)	Median PDT (hour)	Key findings	Ethnicity associated with delay time
(Ben-Shlomo, Naqvi & Baker)	UK 2008	Prospective cohort study	The MINAP n = 162 516	Caucasian= 72.8 South Asian = 3.4	3.10	There are ethnic differences in seeking care behaviour. Asian underuse of ambulance may reflect cultural differences.	Yes
(Canto et al.)	USA 1998	Prospective Cohort study	NRMI 2 n = 275 046	White = 86 Hispanic= 3 Asian= 1 Native = <1	2.03	Time from symptom onset to hospital among ethnic groups were longer than white Cultural and socioeconomic factors may influenced symptom perception	Yes
(Goldberg, Gurwitz & Gore)	USA 1999	Retrospective Cross-sectional study	NRMI 2 n = 364 131	White = 86 Black = 6 Hispanic = 3 Asian = 1.0	2.10	Ethnicity were significantly associated with longer delay	Yes
(Kendall et al.)	UK 2013	Retrospective analysis study	The BCIS n = 672	White= 76.8 South Asian =23.2	2.05	South Asians were more likely to had longer delay time and a longer post- hospital delay and entire delay (pre- and post-) than white	Yes
(King, Khan & Quan)	Canada 2009	Retrospective analysis study	Patients admitted with AMI to Calgary region hospital n = 406	Caucasian = 28.8 Chinese = 22.7 South Asian = 24.9 Southeast Asian = 14.0 First nation = 9.6	NA	Largest proportion ethnic patients waited > 12 hours Ethic group were less likely to recognised cardiac symptoms and were significantly delay > 3 hours even had classic symptoms Language barrier was a potential barrier to identify symptoms and to reach definitive care	Yes

PDT: prehospital delay time, AMI: acute myocardial infarction, ED: emergency department, ARIC: Atherosclerosis Risk in Community, NRMI: National Registry of Myocardial Infarction CRUSADE: Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes with Early Implementation, STEMI: ST-segment elevation myocardial infarction, NSSTEMI: Non- ST-segment elevation myocardial infarction

Table 4.3 Summary of included studies in JBI Systematic Review (continued)

Authors/ year	Country/ Year	Study design	Data Source/ sample size	Ethnic group (%)	Median PDT (hour)	Key findings in relation to association between ethnicity and delay	Ethnicity associated with delay time
(McGinn et al.)	USA 2005	Retrospective Cross-sectional study	ARIC Study (1987-2000) n = 18 928	White = 79.9 Black = 20.1	NA	Black ethnicity associated with longer delay (≥ 4 hours) Differences in delay times and ambulance use across ethnic groups is likely to involves cultural as well as environmental issues	Yes
(Sheifer et al.)	USA 2000	Retrospective Cross-sectional study	The Cooperative Cardiovascular Project n = 102 339	White = 90.9 Black = 9.1	NA	Black race was among associated factors of delay to present to ED and more likely to presented later than 6 hours	Yes
(Syed et al.)	USA 2000	Prospective Cohort Study	Patients admitted to urban teaching hospital n = 395	White = 67 Black = 33	2.65	Time from symptom onset to ED and time to receipt thrombolysis treatment were significant longer in Black compared with white	Yes
(Ting et al.)	USA 2008	Prospective Cohort Study	NRMI 1 n = 482 327	White = 86.2 Black = 5.1 Hispanic = 2.9 Asian = 1.4	1.90	Ethnicity were associated with longer delay time	Yes
(Ting et al.)	USA 2010	Prospective Cohort Study	CRUSADE n = 104 622	White = 80.5 Black = 11.4 Hispanic = 3.5 Asian = 1.1	2.60	Non-white ethnicity was associated with longer delay time	Yes

PDT: prehospital delay time, AMI: acute myocardial infarction, ED: emergency department, ARIC: Atherosclerosis Risk in Community, NRMI: National Registry of Myocardial Infarction CRUSADE: Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes with Early Implementation, STEMI: ST-segment elevation myocardial infarction, NSSTEMI: Non- ST-segment elevation myocardial infarction

The ten studies were performed over periods of time ranging from one year (Ben-Shlomo, Naqvi & Baker 2008) to ten years (Ting et al. 2008). The heterogeneity of the outcome measures of included studies prevented statistical pooling for meta-analysis. Therefore, as meta-analysis could not be performed (The Joanna Briggs Institute 2014) the data was presented as a narrative summary. The lack of meta-analysis means this review is unable to present the statistical significance of differences between studies.

Methods of ethnic classification varied between studies. There were four studies that stated their methods in classifying ethnicity. Two studies in the UK identified ethnicity by 'healthcare professional classifying' method (Ben-Shlomo, Naqvi & Baker 2008) and self-reported method (Kendall et al. 2013). One study in the USA classified ethnicity by country of origin (Canto et al. 1998) and another one study in Canada use surname method (King, Khan & Quan 2009). The differences in methods of ethnic classification may impact on the outcome and the ability to compare studies. For example, the Asian group in Ting et al. (2008) included all Asians, while King, Khan and Quan (2009) stratified Asian into three sub groups and as such these two studies cannot be compared.

Table 4.4 Summary of quality assessment using the JBI-MAStARI appraisal tool

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	%
Kendall et al. (2013)	Y	Y	Y	Y	Y	Y	N	Y	Y	88.9
King, Khan and Quan (2009)	Y	Y	Y	Y	Y	U	Y	Y	Y	88.9
Ting et al. (2008)	Y	Y	Y	Y	Y	N	Y	Y	Y	88.9
Ben-Shlomo, Naqvi and Baker (2008)	Y	Y	Y	Y	Y	N	U	Y	Y	77.8
Goldberg, Gurwitz and Gore (1999)	N	Y	Y	Y	Y	Y	U	Y	Y	77.8
Canto et al. (1998)	Y	Y	U	Y	Y	N	N	Y	Y	66.7
McGinn et al. (2005)	Y	Y	U	U	Y	N	N	Y	Y	66.7
Sheifer et al. (2000)	N	Y	Y	Y	Y	N	N	Y	Y	66.7
Syed et al. (2000)	N	Y	Y	Y	Y	N	N	Y	Y	66.7
Ting et al. (2010)	U	Y	Y	Y	Y	N	N	Y	Y	66.7
%	60	100	80	90	100	20	20	100	100	75.6

Q1-Q9 = JBI-MAStARI critical appraisal criteria (Appendix II), Y= Yes, N= No, U= unclear

Results of meta-synthesis of quantitative research findings

Delay in seeking care for chest pain

The association between ethnicity and time taken to seek care for chest pain was reported in all reviewed studies. All ten included studies defined delay as the interval between times from symptom onset to hospital arrival. Seven studies (Ben-Shlomo, Naqvi & Baker 2008; Canto et al. 1998; Goldberg, Gurwitz & Gore 1999; Kendall et al. 2013; Syed et al. 2000; Ting et al. 2008; Ting et al. 2010) reported delay as quantitative time in hour units ranged from 1.90 (Ting et al. 2008) to 3.10 hours(Ben-Shlomo, Naqvi & Baker 2008) (Table 4.5) whist the other three studies (King, Khan & Quan 2009; McGinn et al. 2005; Sheifer et al. 2000) reported delay in time different categories ranging from < 1 hour to within 24 hours (Table 4.6). Nine studies (Canto et al. 1998; Goldberg, Gurwitz & Gore 1999; Kendall et al. 2013; King, Khan & Quan 2009; McGinn et al. 2005; Sheifer et al. 2000; Syed et al. 2000; Ting et al. 2008; Ting et al. 2010) concluded that there was a statistically significant difference in delay between ethnic groups and the majority group. Only one study (Ben-Shlomo, Naqvi & Baker 2008) in the UK reported a similarity in delay between Caucasian and South Asian groups (Table 4.5 and Table 4.6). Six studies (Goldberg, Gurwitz & Gore 1999; McGinn et al. 2005; Sheifer et al. 2000; Syed et al. 2000; Ting et al. 2008; Ting et al. 2010) reported longer delays in Black compared to Caucasian/White. Hispanics arrived at hospital later than Caucasian/White in four studies (Canto et al. 1998; Goldberg, Gurwitz & Gore 1999; Ting et al. 2008; Ting et al. 2010) in the USA. Asians suffering from chest pain also presented to the ED later than Caucasian/White in four studies (Canto et al. 1998; Goldberg, Gurwitz & Gore 1999; Ting et al. 2008; Ting et al. 2010).

The other three studies (Ben-Shlomo, Naqvi & Baker 2008; Kendall et al. 2013; King, Khan & Quan 2009) compared delay between Caucasian/White and South Asian; only two studies (Ben-Shlomo, Naqvi & Baker 2008; King, Khan & Quan 2009)reported longer delay in South Asians than the majority group. The Canadian study (King, Khan & Quan 2009) noted slower ED presentations in Southeast Asian and Chinese groups compared to the majority groups. The proportions of delayed groups differed significantly ($p < 0.05$) between majority group (White) and ethnic groups (Table 4.6). Ethnic groups were more likely to wait longer than majority group to seek medical care for chest pain.

Table 4.5 TED I: Delay time in seeking care for chest pain (hours)

Authors Country/year	Median delay (hours)					*p*
	White	Black	Hispanic	Asian	South Asian	
Ben-Shlomo, Naqvi and Baker (2008) UK	3.1				3.1	NS
Canto et al. (1998) USA	2.0		2.3	2.1		≤0.001
Goldberg, Gurwitz and Gore (1999) USA	2.1	2.4	2.3	2.2		NA
Kendall et al. (2013) UK	2.1				2.6	0.15
Syed et al. (2000) USA	2.1	3.2				0 .003
Ting et al. (2008) USA	2.0	2.4	2.3	2.1[#]		<0.001
Ting et al. (2010) USA	2.6	2.9	2.8	3.0		<0.001

Significant at p < 0.05, significant analysis compared between majority group (White) and ethnic groups (Black, Hispanic, Asian, and South Asian). # Non-significant p = 0.10, ¶ reported delay as geometric mean, NS: non-significant, NA= statistical comparison was not performed

Table 4.6 TED I: Delay time in seeking care for chest pain presented in categories of time

Authors Country/ year	Category of time (hours)	Proportion of patients (%)						***p***
		White	Black	South Asian	Southeast Asian	Chinese	Other race	
King, Khan and Quan (2009) Canada	<1	20.2		8.7	20.0	11.4		0 .015
	1-2	24.8		13.0	18.0	14.3		
	3-6	26.6		24.0	16.0	15.7		
	7-12	1.8		7.6	8.0	5.7		
	13-24	26.6		46.7	38.0	52.9		
McGinn et al. (2005) USA	< 4	52.3	43.4					<0.001
	≥ 4	47.7	56.6					
Sheifer et al. (2000) USA	< 6	91.5	5.0				3.5	0.001
	6-12	90.3	5.5				4.1	
	> 12	88.9	6.7				4.4	

Significant = *p* < 0.05, Significant analysis (*p* value) compare between majority (white) and ethnic groups (Black, South Asian, Southeast Asian, Chinese and other race)

Table 4.7 TED I: Summary of factors associated with longer delay

Factor	Studies
Differences in seeking care behavior	Ben-Shlomo, Naqvi and Baker (2008)
Differences in symptoms presentation	Canto et al. (1998) King, Khan and Quan (2009)
Cultural and socioeconomic status	Ben-Shlomo, Naqvi and Baker (2008) Canto et al. (1998) Sheifer et al. (2000) Kendall et al. (2013)
Atypical symptoms	Canto et al. (1998)
Longer time to establish history of cardiac pain	Ben-Shlomo, Naqvi and Baker (2008)
Symptom perception and recognition	King, Khan and Quan (2009)
Culture and language barriers	Ben-Shlomo, Naqvi and Baker (2008) Canto et al. (1998) King, Khan and Quan (2009)
Underuse of ambulance	Ben-Shlomo, Naqvi and Baker (2008) Canto et al. (1998) King, Khan and Quan (2009) McGinn et al. (2005)
High risk of heart disease	Ben-Shlomo, Naqvi and Baker (2008) Canto et al. (1998) Kendall et al. (2013)

Factors associated with longer delay

The factors relating to a longer delay identified by the primary study authors are summarized in Table 4.7. Although factors associated with longer delay were not part of the inclusion criteria, they are reported in this systematic review to emphasize the association between ethnicity and delay.

Discussion

This systematic review aimed to synthesize the existing evidence on the association between ethnicity and delay in seeking medical care for chest pain among culturally and linguistically diverse (CALD) populations. It revealed longer delays among CALD populations and showed the association between ethnicity and delay. This raises concerns regarding both the inequity in, and accessibility to, cardiac care among CALD populations and leads to query whether the current clinical care standards and guidelines have implemented practice for these populations.

Ethnicity and longer delay

Zerwic et al. (2003) and Henderson et al. (2001) noted a significantly longer delay in ethnic groups compared to the majority group. The current review found a significantly longer delay in ethnic groups such as Blacks, Hispanic, South Asian, and Southeast Asian, Chinese compared to the majority population (Caucasian/White) in three different countries (the USA, the UK and Canada). This systematic review included studies of varying methodological designs. Despite the varying quality of evidence, the main outcome of this review demonstrated the consistent trend in longer time taken to present to hospital after experiencing chest pain among CALD groups than those of the dominant group. Also, delay times of all groups were greater than the recommended time of one hour (Acute Coronary Syndrome Guidelines Working Group 2006; Boersma et al. 1996a; National Clinical Guideline Center 2013). Based on our search results, only ten studies met our inclusion criteria and critical appraisal process. There was no study of level 1 and 2 evidence (systematic review and RCTs) (JBI levels of evidence Appendix XIV) included in this review. However, an RCT is not an appropriate research design for the research question which focused on an association. Furthermore, the review findings has exhibited the lack of studies undertaken in countries considered as multicultural nations such as Australia, Germany, New Zealand and many countries in the European continent.

Association between ethnicity and time taken to seek care for chest pain

The recent studies (DuBard, Garrett & Gizlice 2006; King-Shier et al. 2015; Omariba 2015) demonstrated that ethnicity was associated with poorer symptom recognition, and protective health-related behaviours that lead to delay in seeking care. The findings of this systematic review confirm the association between ethnicity and longer delay. Some of the significant influencing factors found in this review were related to sociocultural factors such as cultural and socioeconomic status, culture and language barriers, differences in seeking care behaviours and symptom perception. The review findings are consistent with previous studies (Dracup et al. 2003; Liao et al. 2004; McKinley et al. 2004) that showed that the differences in delay between countries related to their unique sociocultural and political context. The additional factors included lower utilization of ambulance and health insurance. Lozzi et al. (2005) found a large number of ACS patients hesitated to call an

ambulance and Brown et al. (2000) found the demographics such as age and gender, beliefs, situational factors and financial concern influenced on emergency utilization. Heterogeneity of health systems across nations might have an impact on how CALD populations seek medical care. Also, it is inevitable that migrants will encounter hardships with settlement in a new land including the different health care system from their home land (Wechkunanukul, Grantham & Clark 2014). Consequently, their health behaviours such as seeking emergency care and preventative care might differ from the local population.

For health care providers, not only does the system need to be developed and improved, but also an understanding of CALD populations is required by developing cultural competence (Lancellotti 2008; McFarland & Eipperle 2008). Cultural competence is a set of congruent behaviours, attitudes and policies that come together in a system, agency or among professionals and enable that system, agency or those professions to work effectively in cross-cultural situations. It is more than awareness of culture difference but includes the notion where reciprocity, action and accountability are emphasized to improve practice on the basis of cultural differences (National Health and Medical Rresearch Council 2006). Many organizations such as the Heart Foundation in Australia have promoted chest pain action plans to the public in order to minimize delays. Disappointingly, patient delay times are still longer than the recommendation response time of 10-60 minutes worldwide (Dracup et al. 2003; Goldberg et al. 2009), and are supported by the findings of this review.

Limitations of this review

Based on our search results, only ten studies met our inclusion criteria and critical appraisal process. There was no study of level 1 and 2 evidence (systematic review and RCTs) (JBI levels of evidence Appendix XIV) included in this review. However, an RCT is not an appropriate research design for the research question which focused on an association. Observational studies without controls may be considered lower level evidence. Nonetheless, the majority of the included studies were large observational studies conducted at a national level which is likely to reflect the whole population of the study area. Secondly, the included studies were conducted in only three countries, the USA, the UK and Canada, and as such the outcomes might not apply to other countries. The review findings

has exhibited the lack of studies undertaken in countries considered as multicultural nations such as Australia, Germany, New Zealand and many countries in the European continent. The third limitation of the review is the differences in outcome measures, which prevented statistical pooling. Although the measures were different, delay of ethnic groups in all reviewed studies were reported to be longer than those of the majority group. Finally, the methods of classifying ethnicity varied between studies and also seem subjective which may have impacted on the result of each individual study.

Conclusion

This systematic review showed that CALD groups had a significant longer delay time than the majority population. In many countries, there was a significant association between ethnicity and time taken to reach hospital after experiencing chest pain among CALD populations. Reducing delays in seeking care for chest pain is a critical issue for health agencies worldwide. Improving public awareness would bring many benefits to CALD populations suffering from a heart attack. Additionally, further quality research in multicultural countries is warranted to understand the patterns to seeking care among these non-majority populations

Implications for practice

There was evidence of association between ethnicity and delay in seeking help among CALD populations. Therefore, health providers, public health agencies and health policy makers should be aware of ethnicity and its impacts on CALD health. Cultural competence training could be one strategy to be normalized into practice in order to improve provision of care for these populations. Adequate of interpreting and translating services for CALD populations facing the language barrier would place a high value on quality practices. A future health policy or public health agenda should give priority to the accessibility issues such as location of healthcare setting and availability of emergency medical services. Evaluation of current campaigns are warranted to check their effectiveness, especially public awareness among CALD populations. Guidelines and clinical care standards for acute coronary syndromes should target CALD populations and integrate recommended practices for patients with different ethnic backgrounds.

Implications for research

There is a need for further research in ethnicity and delay in seeking medical care for chest pain, particularly well-designed, adequately powered, high quality randomized controlled trials (RCTs) that evaluate the efficacy of health promotion or interventions reducing the time delay among these populations. In addition to RCT research, large cohort studies should perform a sub-analysis of ethnicity to explore the differences in delays between majority and CALD populations, and also the distinction in seeking care patterns between CALD subgroups. High quality qualitative research is recommended to explore the reasons and responding patterns underlying the delay within CALD groups. An ethnic classification system/scale and outcome measures should be standardized for further studies worldwide. A further study of CALD populations in multicultural societies such as the USA, Australia, New Zealand, Spain, Germany and Russia is recommended (United Nations 2013b) Also, research focusing on sociocultural factors influencing delays should be performed for the sake of CALD populations in regards to accessibility and equality in health care services. To clarify the impact of ethnicity on delay, future studies should consider other confounding factor such as economic status, income and health insurance status of CALD populations.

The end of this publication

Time, Ethnicity and Delay Study II

This section presents results of TED II which has been published in the International Journal of Cardiology, vol. 220, pages 901-908,

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Presenting characteristics and processing times for culturally and linguistically diverse (CALD) patients with chest pain in an emergency department: Time, Ethnicity, and Delay (TED) Study II

Introduction

Acute Coronary Syndrome (ACS) is a leading cause of death worldwide (Mendis, Puska & Norrving 2011). In 2011, 190 heart attacks occurred daily in Australia (Australian Commission on Safety and Quality in Health Care 2014), and every one and a half minutes, one American dies from a coronary event (Mozaffarian et al. 2015). Chest pain is recognized as one of the most common symptoms of ACS and is also the most common chief complaint to emergency departments (ED) (Niska, Bhuiya & Xu 2010). The optimal benefits of treatment are achieved when a patient receives timely treatment within the first hour of the initial onset of symptoms (Boersma et al. 1996b). Every minute of delay time in seeking medical care when an individual has ACS increases mortality rates in both the short- and long-term (Giusppe et al. 2004). Delay time has been defined as the interval between the onset of the symptoms and the initiation of definitive medical care, including pre-hospital and in-hospital delay (Dracup et al. 1995). Researchers have found a number of potential factors which influence delay time in seeking care for chest pain, such as being of older age, female gender, not having knowledge and awareness of ACS symptoms, underuse of ambulance services, ethnicity and cultural backgrounds, and a lack of knowledge or misconceptions about ACS. (Moser et al. 2006; Wechkunanukul, Grantham & Clark 2016).

Ethnicity has been found to be associated with a longer time to seek medical help for chest pain and underutilisation of emergency services (Ting et al. 2010). There is research to support the notion that there are ethnic variations in prevalence, incidence, symptoms, and healthcare-seeking behaviours among patients from different ethnic backgrounds (Abdelnoor et al. 2012; Wechkunanukul, Grantham & Clark 2015). However, the causes of these variations are complex and difficult to fully explain, or to address, from a single perspective because socio-economic, cultural, lifestyle, and environmental factors have been found to influence these differences between ethnic groups (Henderson et al. 2001; King-Shier et al. 2015). It is important for health professionals and agencies to learn about and understand these differences, and the importance of cultural values in healthcare

delivery, in order to improve appropriate services for these ethnic populations (Engebretson, Mahoney & Carlson 2007; Sobralske & Katz 2005). However, there are very little existing data on ethnic variations in terms of characteristics of patients, presentations, care-seeking behaviours, and access to care in some countries (Chiu et al. 2010; King, Khan & Quan 2009).

Chew et al. (2013) stated that, regardless of improvements in the guidelines for the management of ACS, cultural differences are considered as one of the likely factors that influence the time-effectiveness and risk appropriateness of ACS care. Inequity and accessibility issues in healthcare among culturally and linguistically diverse (CALD) migrants has been highlighted on the public health agenda for decades (National Health and Medical Research Council 2006). Several public education campaigns have been implemented to reduce the time taken to reach treatment, but delay and hesitation in accessing to care is still occurring. (Anderson, Green & Payne 2009; Gushulak & Williams 2004). It is important to gain insight into the differences in the characteristics and presentations of CALD patients as compared to the predominant population and the concordance with current evidence-based practice guidelines.

This study use the term ‘guideline concordance’ rather than ‘guideline adherence’ to describe and compare behaviours of patients, clinicians or health care professionals in relation to the practice guidelines during suspected ACS episodes. Guideline concordance was referred to an agreement with follow the guidelines without explicit control or monitoring, but under naturalistic circumstance.

The Time, Ethnicity and Delay (TED) study was a triangulation of three distinct research approaches to investigate delays in seeking medical care for chest pain among CALD populations. The process of triangulation in TED study involves a systematic review (TED I) (Wechkunanukul et al. 2014), a cross-sectional analysis of an emergency department cohort of patients presenting with chest pain (TED II), and a retrospective medical record review (TED III). TED II focused on the differences in the characteristics of, processing times and clinical outcomes between, CALD and Australian-born patients presenting to an ED with chest pain. This study placed an emphasis on processing times in ED and guideline concordance with management of chest pain in the ED. The specific objectives of the study were:

1. to describe the characteristics of, and processing times in the ED for CALD patients presenting to the ED with chest pain;

2. to compare the differences in characteristics of, and processing times between CALD and Australian-born patients; and

3. to examine the effect of CALD status on the guideline concordance with the management of chest pain in the ED.

Methods

Study design and setting

This study was a cross-sectional analysis of an ED presentation dataset of a 593-bed specialist referral public metropolitan hospital. The ED in this setting provides emergency medical services 24 hours a day, 7 days a week. The Department of Cardiovascular Medicine provides all cardiology services except transplantation. There are approximately 75,000 ED visits annually with an admission rate of 40%. Of these, 5.5% of all visits present with chest pain (approximately 4500 visits per year), one-third of all patients were born overseas.

Participants

The dataset included 151,249 presentations to the ED between 1 July 2012 and 30 June 2014. This study reviewed a subset of 8,225 (5.5%) patients who presented to the ED with chest pain as their primary presenting complaint.

The inclusion criteria for this cross sectional analysis included:

1. chest pain presented as the chief complaint;

2. time of presentation (triage time) was recorded; and

3. country of birth was stated.

The exclusion criteria included country of birth being classified as one of the ‘main English-speaking countries’ based on the Australian Bureau of Statistics definition, including the United Kingdom,

Ireland, New Zealand, Canada, the United States of America, and South Africa (Australian Bureau of Statistics 2011d).

Definitions

1. Culturally And Linguistically Diverse (CALD) was defined as a person born overseas in a country other than countries classified by the Australian Bureau of Statistics as a 'main English-speaking countries', speak a language other than English and may speak English as a second language (Ethnic Communities' Council of Victoria 2012; Federation of Ethnic Communities' Councils of Australia 2015).

2. Distance from hospital was defined as the distance between the patient's residence and the hospital based on the postcode of the patient's residence.

3. First medical contact was defined as the point at which the patient was either initially assessed by a paramedic, physician, or other medical professional in the pre-hospital setting, or when the patient arrived at the hospital emergency department (Steg et al. 2012).

4. Presenting symptoms were defined as the patients' symptoms recorded at triage.

5. Time to treatment was defined as the interval between triage time and the time patients were seen by a doctor in the ED (Australasian college for Emergency Medicine 2013). Australasian Triage Scale (ATS) admission time was defined as the amount of time the patient spent in the ED before a decision to admit the patient was taken (Australian Institute of Health and Welfare 2014). ED stay was defined as the period between when the patient presented at the ED and when that person was recorded as having physically departed the ED (Australian Institute of Health and Welfare 2014).

6. Priority of care (priority) was defined as an ATS category (1 to 5) based on the guidelines on the implementation of the Australasian Triage Scale in emergency department (Australasian college for Emergency Medicine 2013).

7. Episode end status was defined as the status of patient at the end of the ED service episode

(Australian Institute of Health and Welfare 2014).

8. Length of hospital stay was defined as the amount of time a patient spent in the hospital after they arrived at ED until physically departed from hospital.

9. Guideline concordance was developed by compositing the three selected criteria of guidelines for management of chest pain made on the basis of available data. The three criteria comprise: 1) ambulance as the first medical contact; 2) Triage priority 1 or 2; and 3) Time to treatment ≤10 minutes. The two guidelines included the guidelines for management of acute coronary syndrome 2006 (Acute Coronary Syndrome Guidelines Working Group 2006) and the guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments (Australasian college for Emergency Medicine 2013).

10. Cultural competence is a set of congruent behaviours, attitudes and policies that come together in a system, agency or among professionals and enable that system, agency or those professions to work effectively in cross-cultural situations (National Health and Medical Research Council 2006).

Data source and data collection

Data from the clinical data system [Emergency Department Information System] EDIS were automatically captured in a Microsoft Access ® software database which contained information on every ED visit from June 1993 onwards. The basic demographic information of the patients included in this study as well as ED functional information such as triage time, time of initiation of medical treatment in ED, time of admission to hospital, and time of ED departure were extracted from the EDIS.

Ethical consideration

This study was approved by the Clinical Human Research Ethics Committee, and conformed to the provisions of the Declaration of Helsinki (as revised in Brazil 2013) (World Medical Association 2013). The ethic application approval number: 458.14-HREC/14/SAC/479 with Site Specific Assessment number: SSA/14/SAC/483.

Variables and data measurements

Demographic variables included age; gender; health insurance; distance from hospital; socio-economic status (Socio-Economic Indexes for Areas (SEIFA): Index of Relative Socio-economic Advantage and Disadvantage (IRSAD)); and CALD status. Country of birth was classified into Australia, the main English-speaking countries, and CALD countries, based on the Australian Bureau of Statistics classifications (Australian Bureau of Statistics 2011d).

The presentation and processing time variables included: presenting symptoms; first medical contact; day of presentation (i.e., weekday and weekend); time of presentation (i.e., business hours: 9.00-17.00 and after hours: 17.01 – 8.59); time to treatment; Australasian Triage Scale (ATS) admission time; and ED stay (Table 4.8). There were 21 symptom variables extracted from the dataset (i.e., central chest pain, right/left chest pain, tight/heavy chest, arm pain, back pain, throat pain, jaw pain, shoulder pain, neck pain, rib pain, calf/leg pain, shortness of breath, diaphoresis, palpitations, nausea/vomiting, abdominal pain, headache, lethargy/fatigue, collapse, and heart burn.

Time to treatment was classified into '≤ 10', '> 10' minutes based on the Guidelines on the Implementation of the Australasian Triage Scale in an Emergency Department (Australasian college for Emergency Medicine 2013). ATS admission time was classified into '≤ 4', '> 4' hours based on the National Health Reform Agreement (NHRA) National Partnership Agreement on Improving Public Hospital Services (NPA IPHS)(Australian Institute of Health and Welfare 2014). ED stay was classified into two categories, '≤ 4' and '> 4' hours based on the National Health Performance (NHP) indicator #21b(Australian Institute of Health and Welfare 2014).

The clinical outcome variables included: triage priority; episode end status (i.e., cardiac services, non-cardiac services, discharged, dead, other admission); length of hospital stay; and guidelines concordance. Measurement of the variable, 'guideline concordance' was created from the three variables available in this dataset related to guidelines for management of chest pain: ambulance as first medical contact (Guidelines for the management of acute coronary syndromes 2006) (Acute Coronary Syndrome Guidelines Working Group 2006), triage priority 1 or 2, and time to treatment within 10 minutes (Guidelines on the Implementation of the Australasian Triage Scale in Emergency

Departments) (Australasian college for Emergency Medicine 2013). The 'guideline concordance' variable was analysed by combining three variables together as detailed above. Each variable was weighted one point equally if all three variables were met, that Individual case was considered meeting the 'guideline concordance' (value 'Yes'). This variable was classified into two categories 'Yes' and 'No'.

Statistical analysis

The data were analysed using IBM SPSS Statistics Version 22.0 and the level of significance was set at $p < 0.05$ with 95% confidence interval. Patient presenting characteristics, clinical outcomes, processing times and guidelines concordance data were stratified by CALD status; CALD patients, and Australian-born patients. Categorical variables were described as frequencies and percentages and chi-square test was used to compare between CALD and Australian-born patients. Continuous variables with normal distribution were presented as mean and standard deviation (SD), and independent t-test was used for comparisons. For continuous variable with skewed distribution, data were presented as median (25^{th} percentile, 75^{th} percentile) and using Mann-Whitney U tests for comparisons. The relationship between processing times and CALD status, adjusted for age, was examined using the general linear model. Sub analysis comparing the differences in median processing times between CALD and Australian-born patients were performed for five subgroups, including 1) patients with central chest pain; 2) patients discharged home; 3) patients admitted to non-cardiac wards; 4) patients admitted to hospital; and 5) patients admitted to cardiac services. Man-Whitney U test was used to compare the median processing times.

The logistic regression model was used to model the predictors associated with the concordance with guidelines for the management of chest pain in the ED, and to establish whether CALD status was an independent predictor of guideline concordance after controlling for covariates. Eight demographic and presenting factors (age, gender, distance from hospital, low socio-economic status, chest pain, day and time of presentation, and CALD status) were included in the multivariate model.

Results

In total, 8,225 patients presented with chest pain to the ED between 1 July 2012 and 30 June 2014 were reviewed for eligibility; 213 patients were excluded due to the lack of country of birth information. The remaining 8,012 patients were allocated into two groups based on their country of origin, with 5,399 patients being allocated to the Australian-born group, and 2,613 patients being allocated to overseas-born group. Those overseas-born group patients whose countries of birth were classified as the main English-speaking countries (Australian Bureau of Statistics 2011d) (i.e. the United Kingdom, Ireland, New Zealand, Canada, the United States of America, and South Africa) were excluded at this stage, leaving 1,241 patients in CALD group. Finally, 6,440 patients were included in this study, including 5,399 Australian-born and 1,241 CALD patients (Figure 4.2).

Differences in characteristics and presentation

CALD patients who presented to the ED with chest pain were statistically significantly older than the Australian-born group (mean±SD; 62± 18.4 years vs 56 ± 19.6 years, $p < 0.001$). Slightly over half of both groups were males (51% vs 52%, $p=0.472$), and there was no significant difference between the two groups. All patients in the Australian-born group were eligible for Medicare compared to 95.0% of the CALD group ($p <0.001$). CALD patients were more likely to live closer to the hospital than Australian-born group, with a significant difference between the groups (median; 6.8 (4.6, 13.6) vs 6.4 (4.4, 9.8) Kms, $p < 0.001$). There was no difference in socio-economic status (SEIFA) between the two groups. There was also no statistically significant difference in the three specified types of first medical contact (ambulance, emergency department, and general practitioner) between the two groups. However, the percentage of patients referred from other hospitals was significantly lower in the CALD group than in the Australian-born group (5.6% vs 8.4%, $p < 0.001$). There was no association between CALD status and day or time of presentation (Table 4.8).

The top five presenting symptoms were similar for the two groups, including central chest pain, right/left chest pain, shortness of breath, tight/heavy chest and arm pain. Approximately two-thirds of both groups presented with central chest pain and there was no statistical difference between CALD and Australian-born patients on this measure (74.9% vs 75.7 %, $p <0.526$).

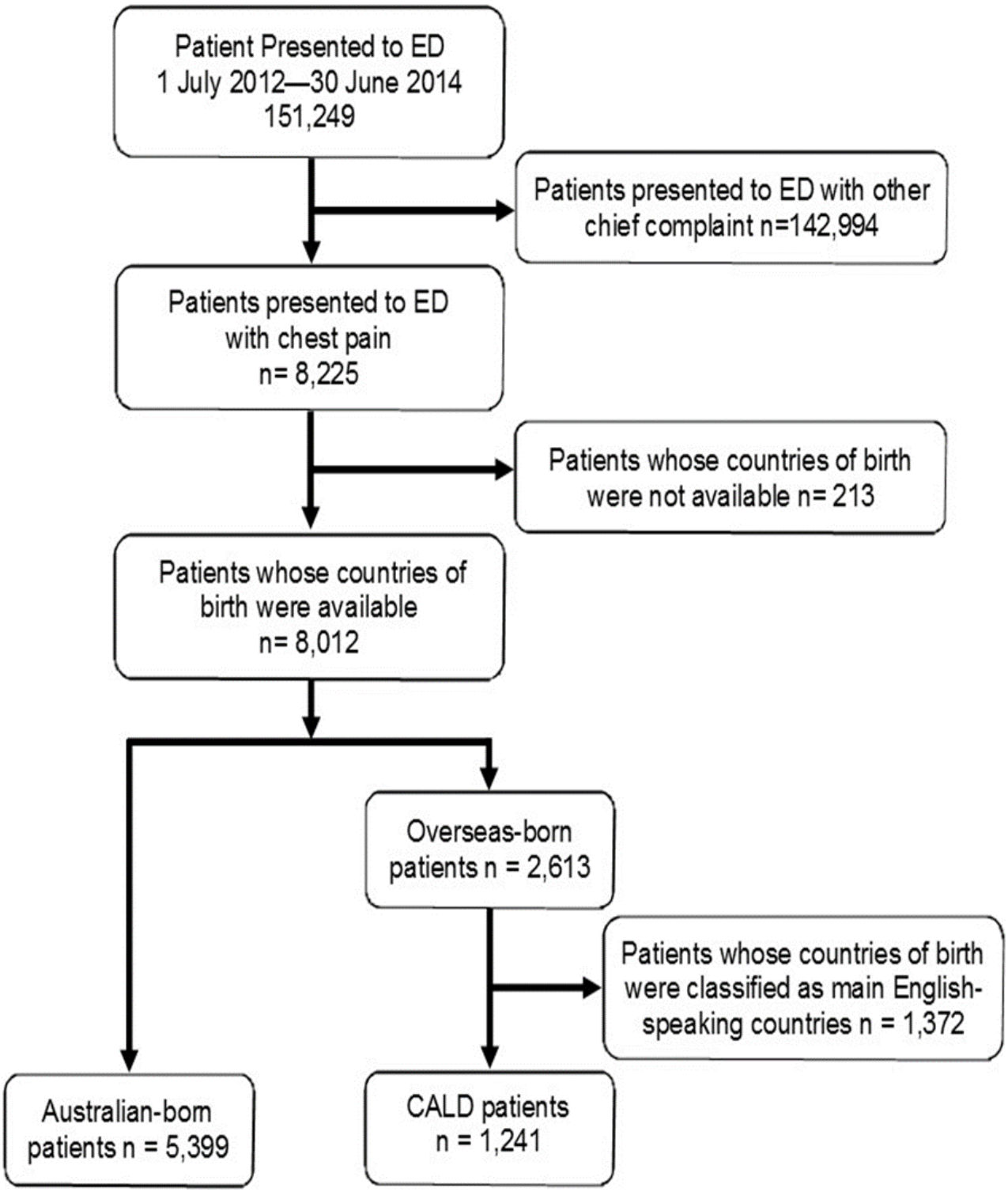


Figure 4.2 TED II study flow diagram

Table 4.8 TED II: Patient characteristics and clinical outcomes

Characteristics	Australian-born (n=5399)	CALD patients (n=1241)	*p*
Age (years), mean ± SD	56 ±19.6	62 ±18.4	< 0.001*
Age groups (n (%)			< 0.001**
< 45	1567 (29.0)	243 (19.6)	
45 – 55	1109 (20.5)	195 (15.7)	
56 – 65	1019 (18.9)	239 (19.3)	
66 – 75	711 (13.2)	202 (16.3)	
76 – 85	646 (12.0)	264 (21.3)	
>85	347 (6.4)	98 (7.9)	
Male, n (%)	2828 (52.4)	636 (51.2)	0.472
Medicare (Universal Health Coverage), n (%)	5399 (100.0)	1179 (95.0)	< 0.001**
Distance from hospital (Kms), median (25^{th},75^{th})	6.8 (4.6, 13.6)	6.4 (4.4, 9.8)	< 0.001***
SEIFA (1-5) status, n (%)	2951 (54.7)	714 (57.5)	0.066
First medical contact, n (%)			
Ambulance	2219 (41.1)	518 (41.7)	0.679
Emergency department	2197 (40.7)	521 (42.0)	0.405
General practitioner	528 (9.8)	133 (10.7)	0.320
Referral from other hospital	455 (8.4)	69 (5.6)	<0.001**
Priority at triage ≤ 2, n (%)	3120 (57.8)	805 (64.9)	< 0.001**
Episode end status, n (%)			
Cardiac service	2361 (43.7)	555 (44.7)	0.526
Non-cardiac services	1258 (23.3)	307 (24.7)	0.282
Discharge	1692 (31.3)	365 (29.4)	0.185
Dead	4 (0.1)	2 (0.2)	0.357
Other[a]	84 (1.6)	12 (1.0)	0.117
Length in hospital (days), median (25^{th}, 75^{th})	1 (0, 2)	1 (0, 2)	0.978

CALD: culturally and linguistically diverse, (25^{th}, 75^{th}): 25^{th} percentile, 75^{th} percentile, Kms: kilometres,
SEIFA (1-5): Socio-Economic Indexes for Areas ranked 1 to 5
Distance from hospital: distance from centre of residential postcode to hospital
[a] Other: includes discharge at own risk and unknown
*Significant $p < 0.05$ by Independent sample t-test test
**Significant $p < 0.05$ by Chi-square test
*** Significant $p < 0.05$ by Mann-Whitney U test

A greater proportion of CALD patients presented to the ED with tight/heavy chest (14.2% vs 11.7 %, p =0.014), back pain (6.8% vs 4.8 %, p =0.006), and dizziness (5.2% vs 3.0 %, p <0.001), than Australian-born patients. There was no association between CALD status and the remaining 17 presenting symptoms, yet interestingly, the percentage of rib pain cases were significantly fewer for CALD patients than for Australian-born patients (0% vs 0.4%, p = 0.036) (Table 4.9).

Difference in processing times

Patients in the CALD group had a longer 'time to treatment' than those in the Australian-born group; however, this did not differ significantly (median 22.0 (8.0, 66.3) vs 21.0 (7.0, 66.0) minutes, p = 0.375). There were also no differences in the proportions of patients received the initial assessment or treatment at the ED within the Australasian Triage Scale (ATS) timeframe , ≤ 10 minutes between the CALD and the Australian groups (31.5% vs 33.4%, p=0.198) (Table 4.10). CALD group had a longer median time waiting for admission compared to Australian-born patients, but this was on the borderline of statistical significance (median 2.8 (1.9, 3.8) vs 2.5 (1.3, 3.7) hours, p = 0.051). The proportion of CALD patients admitted to the hospital within the timeframe of four hours as specified in the guidelines was significantly greater than those of Australian-born patients (44.2% vs 38.4%, p < 0.001).

There was an association between ED stay and CALD status. Patients in the CALD group spent a significantly longer total time in the ED than the Australian-born group (median 5.4 (2.9, 7.7) vs 4.3 (0.5, 7.0) hours, p < 0.001). The proportion of patients leaving the ED within a four-hour timeframe recommended in the guidelines was significantly lower in the CALD group than those in the Australian-born group (35.9% vs 44.5% respectively, p < 0.001) (Table 4.10). The breakdown of time patients spent in ED into three components; 1) time to ED doctor after arrival; 2) time from assessment to doctor decision 3) time from doctor decision to discharge from ED, are presented and compared between the two groups in Figure 4.3. The findings revealed a significantly longer waiting time in the second and third components among CALD group. There was no difference in time to the initial treatment/assessment between two groups.

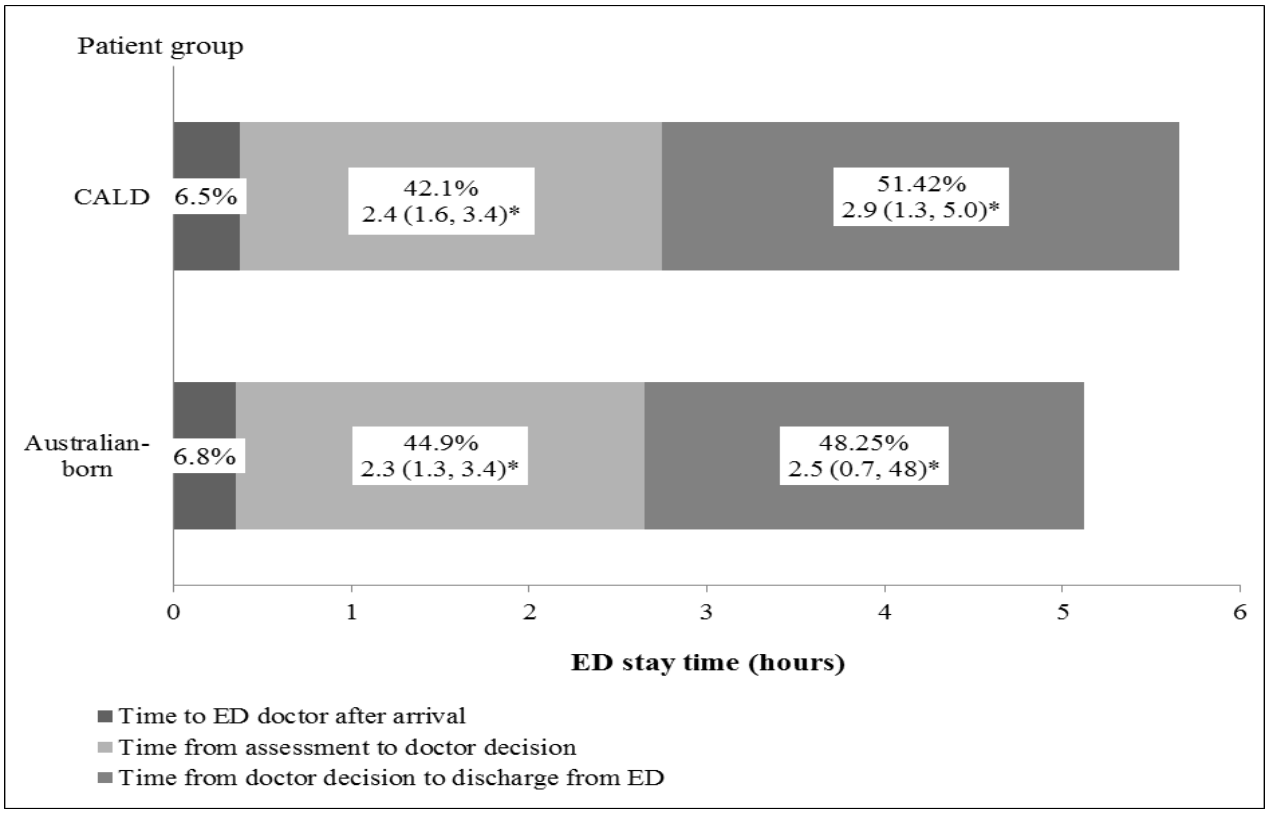
Table 4.9 TED II: Proportion of presenting symptoms of Australian-born and CALD patients

Rank	Australian-born (n = 5399)	%	Rank	CALD patient (n = 1241)	%
1	Central chest pain	75.7	1	Central chest pain	74.9
2	Right/left chest pain	19.6	2	Right/left chest pain	21.7
3	Shortness of breath	14.4	3	Shortness of breath	16.5
4	Tight/heavy chest	11.7*	4	Tight/heavy chest	14.2*
5	Arm pain	11.1	5	Arm pain	11.2
6	Back pain	4.8*	6	Back pain	6.8*
7	Nausea/vomiting	4.3	7	Dizziness	5.2*
8	Palpitation	4.0	8	Palpitation	4.8
9	Shoulder pain	3.8	9	Nausea/vomiting	4.1
10	Abdominal pain	3.5	10	Shoulder pain	3.9
11	Jaw pain	3.3	11	Abdominal pain	3.7
12	Dizziness	3.0*	12	Jaw pain	3.1
13	Diaphoresis	2.9	13	Neck	3.0
14	Neck	2.7	14	Diaphoresis	2.4
15	Headache	1.1	15	Headache	1.3
16	Fatigue	1.0	16	Fatigue	1.1
17	Throat pain	0.8	17	Heart burn	0.9
18	Heart burn	0.7	18	Throat pain	0.6
19	Rib pain	0.4*	19	Calf/leg pain	0.4
20	Calf/leg pain	0.4	20	Collapse	0.2
21	Collapse	0.2	21	Rib pain	0.0*

Table 4.10 TED II: Processing times in emergency department for patients presenting with chest pain

Processing time	Australian-born n = 5399	CALD n= 1241	*p*	*p* adjusted for age
Time to treatment (min), median (25^{th},75^{th})	21.0 (7.0, 66.0)	22.0 (8.0, 66.3)	0.375	0.127
≤ 10 minutes, n (%)	1804 (33.4)	391 (31.5)	0.198	0.004$^{\phi}$
ATS admission time (hrs), median(25^{th},75^{th})	2.5 (1.3, 3.7)	2.8 (1.9, 3.8)	0.051	0.625
≤ 4 hour, n (%)	2075 (38.4)	549 (44.2)	< 0.001**	0.107
ED stay (hours), median (25^{th},75^{th})	4.3 (0.5, 7.0)	5.4 (2.9, 7.7)	< 0.001*	0.006$^{\phi\phi}$
≤ 4 hour, n (%)	2382 (44.5)	442 (35.9)	< 0.001**	0.001$^{\phi}$

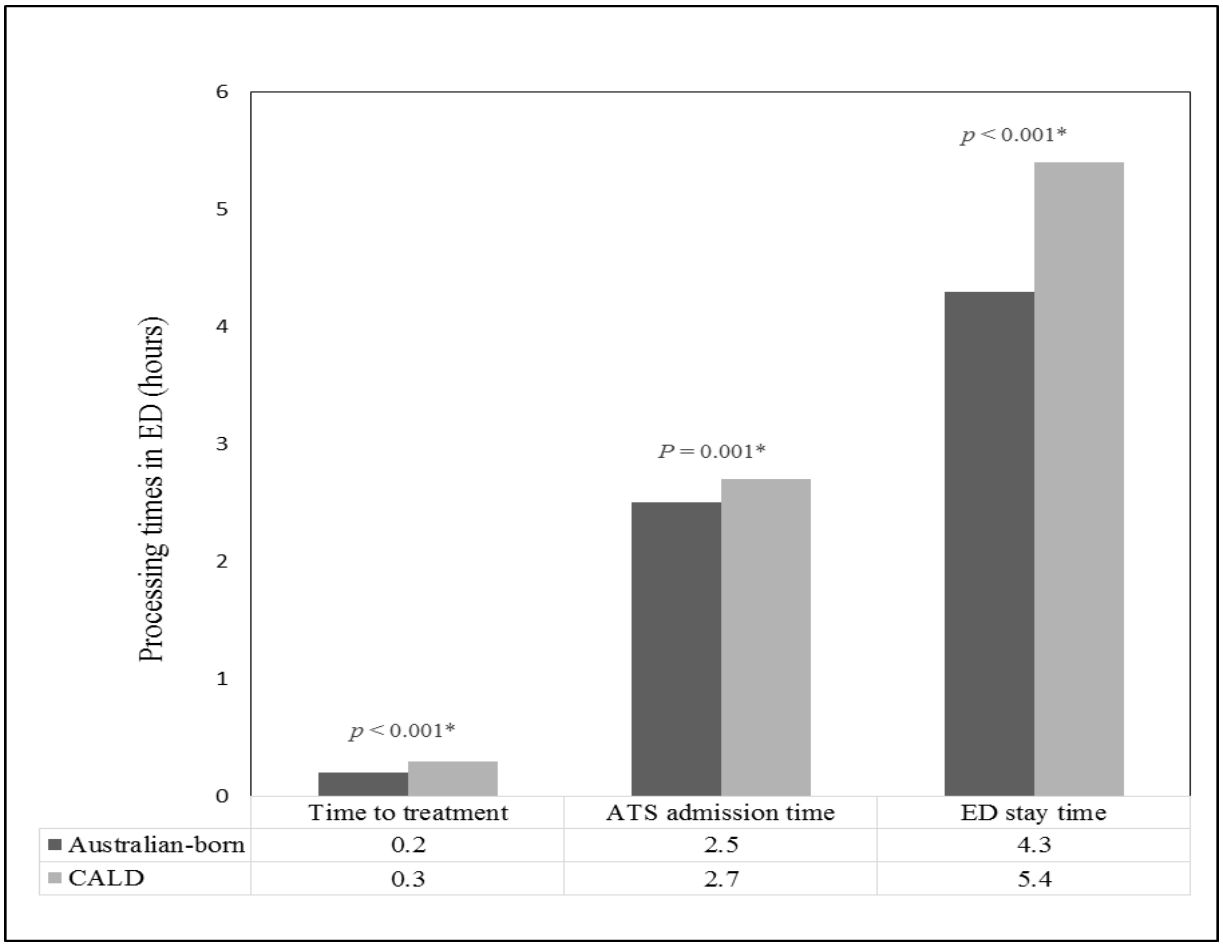
CALD: culturally and linguistically diverse, ATS: Australasian Triage Scale, ED: emergency department
Time to treatment: interval between triage time and time patient seen by emergency department doctor
ATS admission time: the amount of time the patient spent in the ED before the decision to admit was taken, ED stay: the period between when the patient presented at the ED and when that person was recorded as having physically departed the ED, min: minutes, hr: hours, (25^{th}, 75th): 25^{th} percentile, 75^{th} percentile
*Significant $p < 0.05$ by Man-Whitney U test, **Significant $p < 0.05$ by Chi-square test, $^{\phi}$ Significant $p < 0.05$ by logistic regression model adjusted for age, $^{\phi\phi}$ Significant $p < 0.05$ by general linear model adjusted for age



CALD: culturally and linguistically diverse, ED: Emergency department, Each component of processing times in ED presented in percentages of a total time patient spent in ED (from hospital arrival to discharge from ED), *Significant difference between two groups, $p < 0.050$ by Man-Whitney U test

Figure 4.3 TED II: Components of processing times in ED for all patients

In analysis of four subgroups, including 1) patient with central chest pain (n=5,017); 2) patient discharged home (n= 2,057); 3) patients admitted to non-cardiac wards (n=1,565); and 4) patients admitted to hospital (n =3,642) there was no significant difference in processing times in ED (i.e., time to treatment, ATS admission time and ED stay) between CALD and Australian-born patients within these subgroups. Conversely, sub analysis of patients admitted to cardiac services (n= 2,916) revealed a significantly longer processing times in CALD patients than Australian-born patients (Figure 4.4).



CALD: Culturally and Linguistically Diverse, ATS: Australasian Triage Scale, ED: Emergency Department
Time to treatment: interval between triage time and time patient seen by emergency department doctor
ATS admission time: the amount of time the patient spent in the ED before the decision to admit was taken l, ED stay: the period between when the patient presented at the ED and when that person was recorded as having physically departed the ED, *Significant p < 0.05 by Man-Whitney U test

Figure 4.4 TED II: Comparisons of processing times in ED for patients admitted to cardiac services

Differences in clinical outcomes

Clinicians nominated 'Triage priority 1 or 2' more frequent to CALD patients than to the Australian-born patients (64.9% vs 57.8%, $p < 0.001$). The percentage of CALD patients admitted to cardiac services was higher than those in the Australian-born group, but this was not statistically significant (44.7% vs 43.7%, $p = 0.526$). Similarly, there was no association between CALD status and the remaining episode end status. The median length in hospital was 1 (0, 2) day in both groups, and there was no association between length of time in hospital and CALD status (Table 4.8).

Guideline concordance and the independent predictors

The proportion of total patients who met guideline concordance (the three criteria: 1) ambulance as first medical contact; 2) triage priority 1 or 2; and 3) time to treatment within 10 minutes, of the two guidelines: 1) Guidelines for the management of acute coronary syndromes 2006 and 2) Guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments, was 13.0%. The percentage of the CALD group who met guidelines concordance was lower than those in the Australian group, but this was not statistically significant (12.5% vs 13.1%, $p = 0.556$) (Table 4.11).

Adjusting for the sociodemographic and presenting factors, CALD patients were 22% (95% CI, 0.65, 0.96, p=0.015) less likely to meet 'guideline concordance' than Australian-born patients. Age, gender, distance from hospital, low socio-economic status, central chest pain, presentation day and presentation time made a statistically significant contributions to predicting the concordance with guidelines, the model with $p < 0.050$ (Table 4.12). The strongest predictors of 'guideline concordance' were central chest pain symptoms and low socio-economic status which indicated that patients with central chest pain were 1.46 times (95% CI; 1.26, 1.77, p<0.001) more likely to meet the 'guideline concordance' than those with no chest pain.

Table 4.11 TED II: Guidelines concordance with three criteria of two guidelines for management of chest pain in emergency department

Criteria	All n = 6640	Australian-born n = 5399	CALD n= 1241	*p*
Ambulance as first medical contact, n (%)	2737 (41.2)	2219 (41.1)	518 (41.7)	0.679
Triage priority 1 or 2, n (%)	3925 (59.1)	3120 (57.8)	805 (64.9)	0.001*
Time to treatment ≤10 min, n(%)	2195 (33.1)	1804 (33.4)	391 (31.5)	0.198
Guidelines concordance, n (%)	863 (13.0)	708 (13.1)	155 (12.5)	0.556

CALD: culturally and linguistically diverse, Time to treatment: interval between triage time and time patient seen by emergency department doctor
[a] Guidelines for the management of acute coronary syndromes 2006 and Guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments
*Significant $p \leq 0.05$ by Chi-square test

Table 4.12 TED II: Independent predictors of Guidelines concordance with three criteria of two guideline the management of chest pain in the emergency department

Predictor	Odds ratio	95% CI	*p**
Socio-demographic factor			
Age	1.03	1.02, 1.04	< 0.001
Male gender	1.20	1.04, 1.40	0.015
Distance from hospital	1.00	0.99, 1.00	0.017
Low socio-economic status	1.47	1.26, 1.71	< 0.001
Presenting factor			
Central chest pain	1.46	1.21, 1.77	< 0.001
Presentation day (weekend)	1.20	1.01, 1.41	0.034
Presentation time (business hours)	0.86	0.74, 1.00	0.045
Cultural factor			
CALD status	0.78	0.65, 0.95	0.012

CALD: culturally and linguistically diverse, *significant $p < 0.05$, CI: Confidence Interval
a 1) ambulance as the first medical contact; 2) Triage priority 1 or 2; and 3) Time to treatment ≤10 minutes, b Guidelines for the management of acute coronary syndromes 2006 and Guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments

Similarly, patients with low socio-economic status were 1.47 times (95% CI; 1.26, 1.71, p<0.001) more likely to concordance with the guidelines for chest pain management than those with higher socio-economic status. Males were 1.20 times (95% CI; 1.04, 1.40, p=0.015) more likely to meet 'guideline concordance' than females, while patients who presented on the weekend were also 1.20 times (95% CI; 1.01, 1.41, p=0.034) more likely to meet concordance than those who presented on weekdays. The odds ratio of 1.03 (95% CI: 1.02, 1.04, p<0.001) for age indicated that, for every additional year of age, patients were 1.03 times more likely to meet 'guideline concordance'. Patients were less likely to concordance with guidelines 1 time (95% CI; 0.99, 1.00, p=0.017) for every additional kilometre away from hospital they lived. Presentation to the ED during business hours (9am to 5pm) decreased the chance of meeting the 'guideline concordance' by 14% (95% CI, 0.74, 1.00, p=0.045) than presenting after hours (5.01pm to 8.59am).

Discussion

TED II was a large, cross-sectional study of 2 years of data from an ED dataset comparing the differences in characteristics and processing times between CALD and Australian-born patients presenting to an ED with chest pain. This study focused on ED process times and the concordance with the first three criteria (ambulance as first medical contact, triage priority 1 or 2, and time to treatment within 10 minutes) of the guidelines for management of chest pain (Guidelines for the management of acute coronary syndromes 2006 and Guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments.

In total, 6,640 patients were included; 1,241 (18.7%) of who were classified into the CALD group and 5,399 (81.3%) into the Australian-born group. The study population reflected the national proportion of the CALD population (Australian bureau of Statistics 2015) and the national prevalence of specific self-reported cardiovascular condition (Nichols et al. 2014a).

Differences in characteristics and presentation

The current study found that CALD group were significantly older than the Australian-born group which is consistent with the previous studies in Australia (Hyun et al. 2014; Renzaho 2007). In this study, the Australian-born group had a statistically significantly higher proportion of younger patients

(< 45 years) presenting to the ED with chest pain; this might be due to the increased rate of cardiovascular risk in the Australian-born population as a result of the upward trend of obesity in Australian children under 17 years of age (Nichols et al. 2014a). The proportion of males was greater than females in relation to presentation of chest pain confirming recent national statistics and the findings of other studies worldwide. Although there were fewer females in both groups, the proportion of total females in this study increased by approximately 7% from a previous Australian study conducted around a decade ago (Taylor et al. 2005).

Any differences in Medicare (Universal Health Coverage) accessibility between the two groups are likely to depend upon the Australian social and health-related payments and services system. All Australian-born people are eligible for Medicare. By contrast, some CALD patients are not eligible to access this system, such as newly-arrived migrants who face waiting periods of 104 weeks before being eligible to access most social security payments(Australian Goverment Department of Human Services 2015b). Similarly to the USA, foreign-born populations are not eligible for federally funded health insurance during their first five years of arrival (Derose, Escarce & Lurie 2007). Some studies concluded that a lower rate of access to care among CALD was due to uninsured status (Derose et al. 2009; Lebrun 2012).

The two-thirds of patients in both groups presented with central chest pain was comparable to a recent study conducted in Perth, Australia (Coventry et al. 2015b). The main symptoms found in TED study II were consistent with those noted in a number of current Australian and international studies (Coventry et al. 2015a; Rawshani et al. 2014). The low percentage (41%) of ambulance use in both groups may indicate the lack of awareness or knowledge of the chest pain action plan. The Australian Heart Foundation launched the ‘Warning Sign of Heart Attack’ campaign in 2009 to improve ambulance call when people experience chest pain or heart attack symptom. Disappointedly, Bray et al. (2015) found no difference in ambulance use by campaign awareness. A further investigation should be performed to gain a deep understanding in the root cause of underutilisation of emergency services.

Differences in processing time

The time variables in this study were limited to information extracted from the emergency department information system (EDIS). Only three processing times in relation to delay time in seeking care for chest pain (i.e., time to treatment, ATS admission time, and ED stay) were available for comparisons. Despite being limited, these processing times helped to reveal a picture of the components of in-hospital delay in the ED (Figure 2). This study found no difference in 'time to treatment' and 'ATS admission time' between the two groups. It could imply equity in access to emergency care and no racial discrimination for all patients presenting to this centre. The finding was consistent with Karice et al.'s (Hyun et al. 2014) study which found a similar in-hospital processing time between English and non-English speaking patients.

Interestingly, within the patients admitted to cardiac services subgroup, CALD patients spent significantly longer than Australian patients in all stages of cares in ED (Figure 3). Also, all CALD patients were more likely than Australian-born group to spend a longer time in ED after triage (Figure 2). Whether communication barriers between CALD patients and the clinicians/doctors had an influence on their longer time during their assessment/treatment, is of vital interest for gaining an understanding of care processes in EDs for this population. CALD patients from different countries may interpret words from their native language to different words in English. For example, they may interpret 'chest' as breast, heart, or bust; and 'pain' as sore, or hurt. In addition to verbal communication, gestures and body language or silence in different cultures might play a key role in taking accurate information from patients to confirm the provisional diagnosis in ED. Due to limited data, the effect of communication and cultural barriers cannot be determined in this study. Qualitative study is recommended to perform to explain these longer processing times.

Guidelines concordance of the management of chest pain in the ED

The research team examined the holistic management of chest pain in relation to the guidelines for best practice. Due to the limited data extracted from the EDIS, only three variables (i.e., ambulance as first medical contact; triage priority 1 or 2; time to treatment within 10 minutes) were measured against the relevant guidelines (i.e., Guidelines for the management of acute coronary syndromes

2006, and Guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments). The findings showed a low rate of concordance with three of the chest pain related standards from two guidelines in ED in both groups. Since ambulance use and early treatment are acknowledged as vital for reaching optimal outcomes (Hutchings et al. 2004; Moser et al. 2006), a low rate of concordance to practice guidelines may impacts on patient's outcome, including survival and disability rate. The multivariate analysis demonstrated that demographics and presenting characteristics were significant predictors of guidelines concordance, including being CALD patients and having central chest pain.

This 'guidelines concordance' may not fully explain the entire complexity of cardiac care, and the delay in seeking medical care for chest pain. Further research on the complete components of delay time from symptom onset through to receiving definitive treatment is thus warranted. Under a low rate of guideline concordance, there is a significant room for practice improvement, and also a deeper understanding in conjunction with a better translation of evidence into clinical care is recommended.

Implications for research and practice

These findings could provide essential information for health providers and public health agencies in order to provide an appropriate emergency care provision. The lack of concordance with guidelines for management of chest pain could alert the health organisations to evaluate the existing public awareness campaigns and consider other possible effective strategies. The findings from TED II will form a crucial database for further study on delay in seeking medical care for chest pain among CALD populations. CALD group in this study consists of multiethnic subgroups; therefore further research on differences between ethnic groups is recommended.

Limitations

The TED II has a number of limitations. Firstly, the data from this study were collected from a single hospital. Nevertheless, this medical centre provides emergency care and full cardiac services for patients across South Australia, including patients from the rural and remote areas, thus yielding a large sample size of 6,640. In addition, the demographics of this population, and the proportion of

patients admitted to cardiac services were similar to those of the SNAPSHOT ACS study(Chew et al. 2013) which audited ACS care across Australia. The EDIS dataset provided only limited variables covering triage through to ED departure which led to some limitations in the analysis, more research is needed to review the outcomes of patients from the onset of symptoms (pre-hospital) through to hospital discharge.

This study also has a number of strengths. The data from the EDIS were collected over entire year covering incidents of chest pain which may vary according to the different seasons. The missing data was only a small percentage (2.5%) and was only due to the lack of country of birth data. CALD patients in this study made up approximately 18% of all patients, which is similar to the proportion of CALD migrants in the population nationwide (14%). Importantly, TED II study population involved CALD patients from all regions around the world demonstrated the genuine multiculturalism.

Conclusion

TED II established important information about the characteristics, processing times, and clinical outcomes in an ED of CALD patients presenting to the ED with chest pain. CALD patients were older and less likely to have been eligible for public insurance than Australian-born counterparts. The initial of treatment in ED was equally provided to all patient and yet CALD patients spent significantly longer time waiting in ED than Australian-born population. We found no evidence of inequality of access to emergency care in our study, however further qualitative study in this area is recommended. A low rate of concordance with three chest pain related standards from two guidelines in both groups is of interest for further investigation in order to improve health care practices.

The end of this publication

Time, Ethnicity and Delay Study III

This section presents results of TED III
which was produced as a manuscript,
but it has not been submitted entirely
or in part to any journals.

Prehospital delay, mode of transport and clinical outcomes of 607 patients with chest pain from 74 countries within nine ethnic groups (2012-2014): Time, Ethnicity, and Delay (TED) Study III

Introduction

The negative impact of delay in seeking medical care for suspected Acute Coronary Syndrome (ACS) has been supported by many studies over the last 20 years (Goldberg et al. 1998). Subsequently, various campaigns and public education programs have been implemented to promote a timely and appropriate response to chest pain in order to reduce mortality and morbidity rates from cardiac events (Dracup et al. 2009; Luepker et al. 2000; Moser et al. 2006). However, the response time has remained unchanged (Moser et al. 2006; Ting et al. 2010; Wechkunanukul, Grantham & Clark 2016).

Globally, pre-hospital delay times have varied from country to country, even between countries on the same continent (Wechkunanukul, Grantham & Clark 2016). McKee et al. (2013) concluded that behavioural factors and symptom presentation contributed to predictive pre-hospital delay. The cognitive and emotional response of the patient, and psychological and social factors were also found to be associated with longer delay times (McKinley, Moser & Dracup 2000; Pattenden et al. 2002a; Perkins-Porras et al. 2008), as were ethnicity and cultural factors (Ben-Shlomo, Naqvi & Baker 2008; Canto et al. 1998; King, Khan & Quan 2009). Variations in characteristics (e.g. age, education level, socioeconomic status), symptoms (e.g. symptom recognition, perception of pain, severity of pain), and outcomes (e.g. mortality rate, readmission rate) among ethnic groups have been reported in previous studies (Bhopal et al. 2012; Budoff et al. 2006; King, Khan & Quan 2009). A recent systematic review reported the association between ethnicity and delay time in seeking care for chest pain (Wechkunanukul et al. 2016a). King-Shier et al. (2015) concluded that ethnic or cultural differences had an impact on how people navigate the healthcare system.

It is important to determine the differences in care-seeking behaviours of specific ethnic groups. Therefore, in order to understand their unique problems and needs , further research on these ethnic groups is recommended (King-Shier 2015). Although sub-analyses of individual ethnic groups have been conducted in a number of multicultural countries, such as Canada (King, Khan & Quan 2009),

Sweden (Gadd et al. 2006), the UK (Ben-Shlomo, Naqvi & Baker 2008), and the USA (Henderson et al. 2001), only some ethnic groups were included, based on the limitations of each study such as a small percentage of ethnic groups and ethnic classification methods. The Time, Ethnicity, and Delay (TED) study was a triangulation of three distinct research approaches used to investigate delay in seeking medical care for chest pain among culturally and linguistically diverse (CALD) populations. The process of triangulation in the TED study involves a systematic review (TED I) (Wechkunanukul et al. 2014), a cross-sectional analysis of an emergency department cohort study (TED II) (Wechkunanukul et al. 2016b), and a retrospective medical record review (TED III).

The aim of TED III was to determine the differences in care-seeking behaviours and clinical outcomes between ethnic patients from 74 countries within 9 ethnic groups, compared to Australian patients. This study focuses on the differences in pre-hospital delay times, ambulance utilisation, and the association between delay and clinical outcomes.

The specific objectives of the study are:

1. to compare decision time and pre-hospital delay time between each ethnic group and the Australian group;

2. to compare ambulance utilisation and clinical outcomes between each ethnic group and the Australian group; and

3. to examine the effects of ethnicity on care-seeking behaviours.

Methods

Study design and setting

This retrospective medical record review extracted data from an Emergency Department Information System (EDIS) dataset and the medical records of patients in a metropolitan cardiac specialist public hospital. This setting provides emergency medical services 24 hours a day, 7 days a week. Specialist cardiac care services include a chest pain assessment unit, angiography, percutaneous interventions, and coronary artery bypass grafting (CABG) are provided throughout the year by the

Department of Cardiovascular Medicine. Annually, the ED serves approximately 75,000 presentations, with over 4,000 (5.5%) cases of chest pain. Ethnic patients presenting to the ED with chest pain accounted for one-third of all chest pain presentations.

Participants

Inclusion and exclusion criteria

The EDIS database were used to identify eligible patients who presented to the ED between 1 July 2012 and 30 June 2014. The inclusion criteria were: 1) chest pain reported as a chief complaint; 2) country of birth was recorded; and 3) time of arrival (triage time) was recorded.

The exclusion criteria were: 1) country of birth was unclassified; and 2) medical record was not available.

Sample selection and study size

Stratified random sampling was employed to obtain cases through the use of a computer program to generate random lists for medical records for reviews. A sample size of N1 = 276 for Ethnic group and N2 = 276 of Australian-born group (total n=552) will achieve 80% power to detect a 51.5% (OR=0.49) less likely to access the emergency medical system (EMS) within the first hour after the onset of symptoms for Ethnic group than Australian-born group. A stratified design, which divided the sample among nine strata, was analysed using the two-sided, Cochran-Mantel-Haenszel test.to reject the odds ratio (Table 4.13-4.14). A sample size was based on a previous study (Zerwic et al. 2003)that evaluated the effects of whether African-Americans delayed longer than non-Hispanic Whites during an acute myocardial infarction. The distribution of delays was skewed, so power analysis was based on binary divisions of patients' delay time which was dichotomized into one hour or less, or greater than one hour. The one hour interval is an important time period because in order to achieve treatment within the 2-hour window, an individual must access the EMS by approximately one hour. African American participants were less likely (OR=0.34) to access the EMS during the critical first hour after the onset of symptoms.

As the confidence interval was high (95% CI 0.140.85) in their study, we chose to be conservative in our estimates by choosing the middle of the CI (OR=0.495) to increase the likelihood of achieving

the highest statistical power possible. Assuming an alpha error of 0.05 and a beta error of 20%, power analysis indicated that n=552 participants would be required (N1=276 in migrant group and N2=276 in Australian-born group) to reach at least 80% power at 5% level of significance.

Data source, data collection and quality assurance

The data for this study was created by combining two datasets. The primary dataset was derived from a unique ED information system (EDIS) which contained basic demographic information and ED functional information of presenting patients. The secondary dataset was obtained from medical records which were randomly selected from the primary dataset. The additional variables collected from the medical record reviews included medical history, the onset of symptoms, first medical contact time, and clinical outcomes. The randomly selected medical records were reviewed by the first reviewer (KW) using a structured data extraction form. Any doubts that occurred during the data collection process resulted in a second opinion being sought from the second reviewer (HG or DT). The judgement of the third reviewer (RC) was sought if any conflicting opinions occurred between the first two reviewers.

Table 4.13 Summary of study size and sampling

power	Total sample size (N)	Sample size multiplier (M)	Sample size of group 1 (N1)	Sample size of group 2 (N2)	H0 Odds Ratio (OR0)	Actual Odds Ratio (OR1)	Signif* Level Alpha	Beta
0.800	552	30.617	276	276	1.000	2.020	0.0500	0.200

*Signif =significant
Source: (Lachin 2000; Nam 1992; Woolson, Bean & Rojas 1986)
Report Definitions
Power: the probability of rejecting a false null hypothesis. It should be close to one.
N: the total sample size summed across all groups and strata.
M: the factor by which the values of R1 and R2 are multiplied.
N1 and N2: the sample sizes from groups 1 and 2 summed across all strata.
OR0: the odds ratio [P1/(1-P1)] / [P2/(1-P2)] assuming the null hypothesis (H0).
OR1: the value of the odds ratio at which the power is computed.
Alpha: the probability of rejecting a true null hypothesis.
Beta: the probability of accepting a false null hypothesis.
In a treatment vs. control design, the treatment group is 1 and the control group is 2.

Table 4.14 Strata-Details report

Number of strata	Proportion of total sample in each strata	Proportion of this strata in Group 1	Proportion of this strata in group 2	Group 1 multiplier (R1)	Group 2 Multiplier (R2)	Strata probability of success
9	0.11111	0.5000	0.5000	1.000	1.000	0.1100

Ethical considerations

This study was approved by the Clinical Human Research Ethics Committee, and conformed to the provisions of the Declaration of Helsinki (as revised in Brazil 2013) (World Medical Association 2013). The ethics application approval number is: 461.14-HREC/14/SAC/484, while the Site Specific Assessment number is SSA/14/SAC/549.

Definitions

1. Australian in this study was referred patients whose country of birth classified as Australia, and Australian was allocated as the dominant group in this study.

2. First medical contact was defined as the point at which the patient was either initially assessed by a paramedic, physician, or other medical professional in the pre-hospital setting, or when the patient arrived at the hospital emergency department (Steg et al. 2012)

3. Time of symptom onset was defined as the time during which the patient reported becoming acutely or severely ill, prompting the patient to seek medical care (Goldberg et al. 2002).

4. Decision time was defined as the interval from the time of symptom onset to accessing the emergency response system or to initiating travel to the hospital (Dracup et al. 1995).

5. Pre-hospital delay time was defined as the interval between the time of symptom onset and hospital arrival (Dracup et al. 1995; King & McQuire 2007). This comprises two components: decision time and transportation time (Dracup et al. 1995).

Variables and data measurements

The presenting characteristic and medical history variables were collected from the EDIS and the medical records (Table 4.16). Language barriers, day and time of symptom onset, and location of events were extracted from the ambulance service patient report forms and medical records. Pain scores were ranked from 1 to 10 based on the document of first medical contact (i.e., ambulance service patient report form, ED patient record, or GP referral letter). The GRACE Score was calculated from the medical history variables, including age, heart rate, systolic blood pressure, Killip class, creatinine serum level, ST-segment, troponin level, and cardiac arrest history, by using the

GRACE 2.0 ACS Risk Calculator app, web version (The Global Registry of Acute Coronary Events).

Ethnic groups were classified into nine groups, in addition to the Australian group, including: 1) Oceanian; 2) North-West European; 3) Southern and Eastern European; 4) North African and Middle Eastern; 5) South-East Asian; 6) North-East Asian; 7) Southern and Central Asian; 8) People of the Americas; and 9) Sub-Saharan African, based on the Australian Standard Classification of Cultural and Ethnic Groups (Australian Bureau of Statistics 2000). The details of the ethnic group classification are available in Table 4.15.

Decision time was calculated from the documented times of symptom onset and of first medical contact. Pre-hospital delay time was calculated from the time of symptom onset and the documented triage time. The cut-off point of one hour for decision times was chosen to categorise those patients who made a timely decision during their cardiac event based on the guidelines for the management of acute coronary syndromes and from previous studies (Acute Coronary Syndrome Guidelines Working Group 2006; Bray et al. 2015; Goldberg et al. 2009; Perkins-Porras et al. 2009).

The clinical outcomes in this study included angiography, Percutaneous Coronary Intervention (PCI), hospital discharge diagnoses, and readmission. Hospital discharge diagnoses were classified according to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) (National Centre for Classification in Health 2008). Readmission time was calculated in the day unit from the separation date from hospital and the first following readmission date during the period between 1 July 2012 and 30 June 2014, and the first admission to the hospital after the first ED visit.

Table 4.15 Classification of 74 countries, 9 ethnic groups based on the Australian Standard Classification of Cultural and Ethnic groups

Group	Ethnic group	Narrow group	Country
1	Oceanian	Australian Peoples	Australia, Australian Antarctic territory
		New Zealand Peoples	New Zealand
		Melanesian and Papuan	Solomon, Papua New Guinea
		Micronesian	
		Polynesian	Fiji
2	North-West European	British	England, Scotland, The UK
		Irish	Ireland, Northern Ireland
		Western European	German, Netherlands
		Northern European	
3	Southern and East European	Southern European	Italy, Malta
		South Eastern European	Bulgaria, Croatia, Cyprus, Greece, Kosovo, Macedonia, Serbia
		Eastern European	Latvia, Poland, Russian, Ukraine
4	North African and Middle Eastern	Arab	Egypt, Iraq, Lebanon, Saudi Arabia, Syria
		Jewish	Israel
		Other North African and Middle Eastern	Iran, Sudan Turkish
5	South-East Asian	Mainland South-East Asian	Cambodia, Thailand, Vietnam
		Maritime South-East Asian	Indonesia, Malaysia, Philippines, Singapore
6	North-East Asian	Chinese Asian	China, Hong Kong,
		Other North-East Asian	Japan, South Korea, Mongolia
7	Southern and Central Asian	Southern Asian	Bangladesh, India, Pakistan, Sri Lanka
		Central Asian	
8	People of the Americas	North Americas	Canada, The USA
		South American	Argentina, Brazil, Chili, Columbia, Ecuador , Guyana, South America (NFD), Uruguay
		Central American	El Salvador
		Caribbean Islander	
9	Sub-Saharan African	Central and West Africa	Cameroon, Cote D'Ivoire, Nigeria, Senegal, Sierra Leone
		Southern and East Africa	Eritrea, Kenya, Mauritius, South Africa, Southern and east Africa, Zambia, Zimbabwe

Statistical analysis

The data were analysed using IBM SPSS Statistics Version 22.0. The *p* value for all the analyses were set at < 0.05 for statistical significance. This analysis involved the stratification of patient demographics, presentation, and medical history by nine ethnic groups in addition to the Australian group. Clinical outcomes were stratified by ethnic status (the Ethnic group and the Australian group). Categorical variables were described as frequencies and percentages which were compared through a Chi-square test.

Continuous variables with normal distribution were described as a mean with standard deviation, SD, and compared through an independent sample t-test. If the distribution was skewed, the median (25^{th}, 75^{th} percentile) was presented, and all medians were compared through the Man-Whitney U Test. The relationship between ethnic status and clinical outcomes, adjusted for age, was examined using the general linear model. Due to the small sample size of the individual ethnic groups, the sub-analyses of the clinical outcomes compared the differences between all the ethnic groups (as one group, known as the 'Ethnic group') and the Australian group, rather than a comparison of each individual ethnic group. Two logistic regression models were used to determine the independent predictors of decision time ≤ 1, and ambulance as the first medical contact, and to examine the effect of ethnic status on delay time. The 22 variables (presenting characteristics) were placed into the decision time ≤ 1, and ambulance as the first medical contact models.

Results

A total of 8,225 patients with chest pain presented to the ED over the two year period between 1 July 2012 and 30 June 2014 were assessed for eligibility. There were 213 patients excluded due to their country of birth being unclassified, leaving 8,012 patients included for the next stage. These were classified into 2,613 (32.6%) ethnic patients and 5,399 (67.4%) Australian-born patients, based on their countries of origin as classified by the Standard Australian Classification of Countries, Version 2.2 (Australian Bureau of Statistics 2011c). Ethnic patients from 74 countries were classified into nine ethnic groups (Table 4.15). Patients in each ethnic group were randomly selected, totaling 360 patients for the nine ethnic groups, and 376 patients for the Australian group. Due to a lack of

records, 54 patients were excluded from the Ethnic group and 65 from the Australian group. In total, 306 patients from the Ethnic group and 301 from the Australian-born group were included in the study population, resulting in 607 patients being eligible for medical record reviews (Figure 4.5).

Presenting characteristics

The mean age ± SD for all patients was 56± 19.1 years; males made up just over half of the population at 51.4%; and 44.5% were reported as being married. The mean age ± SD ranged between 46± 17.7 years (Southern and Central Asian) and 70± 16.1 years (Southern and Eastern European). Southern and Eastern Europeans and North-West Europeans were significantly older than the Australian group (means age ± SD: 70± 16.1 vs 55± 19.9, p <0.001; and 68± 17.5 vs 55± 19.9, p=0.00), whereas Sub-Saharan Africans and Southern and Central Asians were significantly younger than Australian patients (mean age ± SD: 48± 14.4 vs 55± 19.9 p=0.016; and 46± 17.7 vs 55± 19.9, p=0.010).

All Australian and European patients were covered by Medicare (Universal Health Coverage). By contrast, the proportions for eligibility were significantly lower among the remaining ethnic groups, ranging from 73.5% (North-East Asian) to 97.1% (Oceanian, South-East Asian, and the Americas). In general, there was no statistically significant difference in cardiovascular risk profiles and history of previous cardiovascular conditions/treatments between the ethnic groups and their Australian counterparts. Language barriers were reported in all ethnic groups, ranging from 2.9% (Oceanian) to 41.2% (North-East Asian), except for the North-West European group. The majority of events in all groups occurred at home (69.9%), ranging from 62.9% (Southern and Central Asian) to 90.9% (Southern and Eastern European).

There was no difference in the proportion of patients presenting with central chest pain between the ethnic groups and the Australian group. There was also no association between ethnicity and the processing times in the ED (time to initial treatment/assessment, time waiting for admission, and time staying in emergency department). The presenting characteristics of the patients are described in Table 4.16.

Ethnic differences in pre-hospital delay and its predictors

Comparisons of decision time between the ethnic groups and the Australian group

The median (25^{th}, 75^{th} percentile) decision time for the study samples was 2.0 (0.8, 7.9) hours. For individual ethnic groups, the decision time (hours) ranged from 1.5 (Australian) to 4.5 (Sub-Saharan African) hours. There was an association between ethnicity and decision time. Patients in five ethnic groups had significantly longer decision times compared to the Australian group, including the Sub-Saharan African (4.5 (1.8, 14.3) vs 1.5 (0.6, 4.5), p=0.001); the North African and Middle Eastern (4.1 vs 1.5 (0.6, 4.5), p =0.013); the South-East Asian (3.9 vs 1.5 (0.6, 4.5), p=0.001); the North-East Asian (3.0 vs 1.5, (0.6, 4.5), p =0.006); and the Oceanian (2.4 (1.0, 7.0) vs 1.5 (0.6, 4.5), p=0.035) groups (Figure 4.6).

Overall, 182 (31.9%) patients made the decision to seek care for chest pain within one hour. The breakdown of decision time into five categories (hours); ≤ 1, 1.01 – 2.00, 2.01 – 4.00, 4.01 – 8.00, and >8.00 are presented and compared between ethnic groups and the Australian group as seen in Table 4.17. The proportion of patients making a decision ≤ 1 hour ranged from 3.3% (South-East Asian) to 39.4% (Australian). Compared to the Australian group, two ethnic groups showed statistically significant differences in this category of time (≤ 1); the South-East Asian (3.3% vs 39.4%, p <0.001), and the Sub-Saharan African (12.5% vs 39.4%, p=0.003) groups. There were three ethnic groups that had a greater proportion than the Australian group in terms of delay times >8 hours; the North African and Middle Eastern (37.5% vs 19.4%, p=0.017); the Southern and Central Asian (36.4% vs 19.4%, p=0.024); and the Americas (35.3% vs 19.4%, p=0.024) groups.

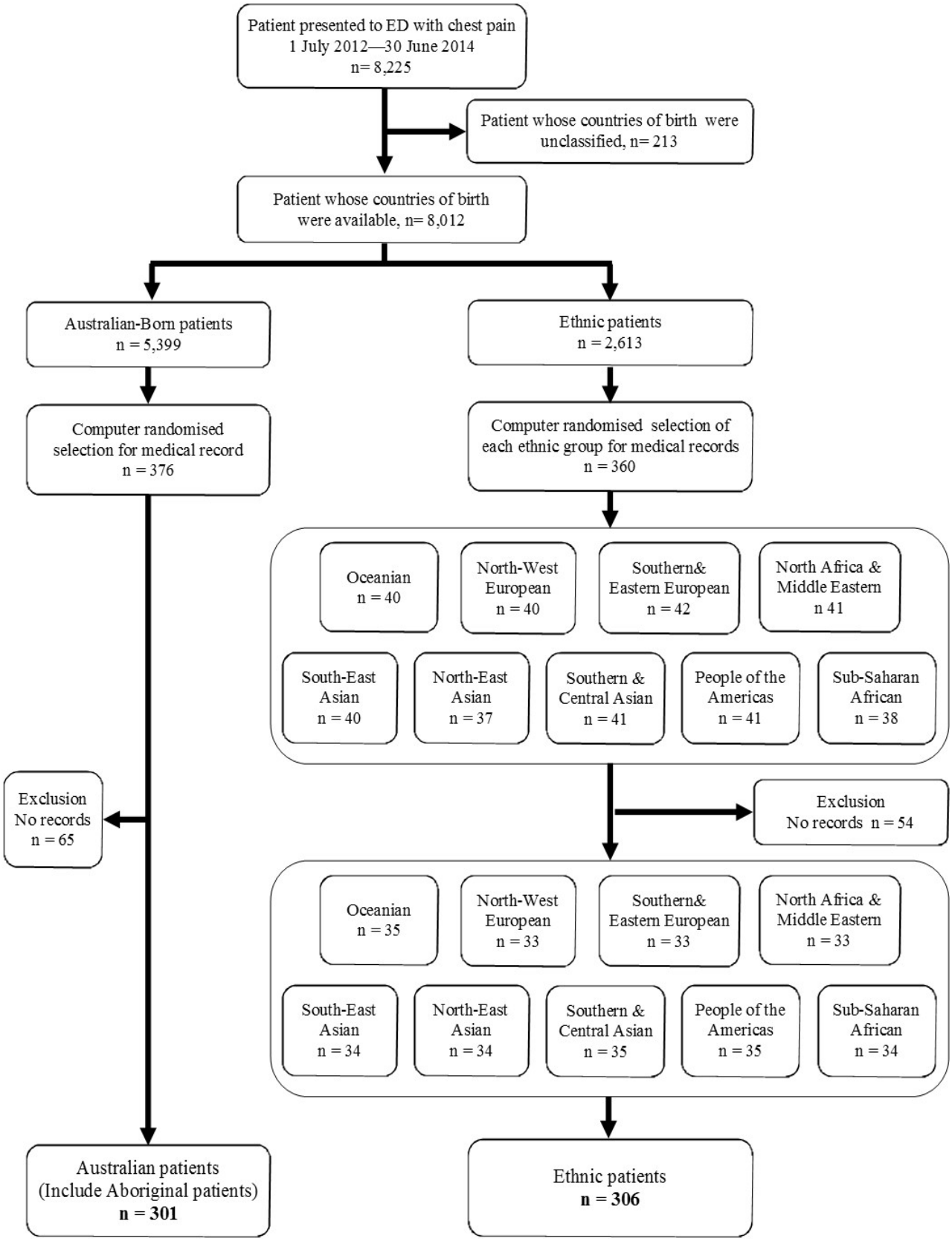


Figure 4.5 TED III: Study flow diagram

Table 4.16 TED III Presenting characteristics of patients presented to emergency department with chest pain by ethnic groups (continued)

Characteristics	Australian n=301	Nth W Euro n=33	Sth E Euro n=33	Nth E Asia n=34	Sth E Asia n=34	Sth Ct Asia n=35	Middle East n=33	Sth Africa n=34	Americas n=35	Oceanian n=35
Age (years), mean ± SD	55 ±19.9	68 ±17.5*↑	70 ±16.1*↑	52 ±18.3	58 ±18.4	46 ±17.7*↓	57 ±17.3	48 ±14.4*↓	50 ±17.2	58 ±12.8
Male, n (%)	163 (54.2)	20 (60.6)	19 (57.6)	13 (38.2)	11 (32.4)*↓	19 (54.3)	18 (54.5)	16 (47.1)	18 (51.4)	15 (42.9)
Married, n (%)	139 (46.2)	17 (51.5)	19 (57.6)	13 (38.2)	16 (47.1)	13 (37.1)	10 (30.3)	14 (41.2)	16 (45.7)	13 (37.1)
Medicare, n (%)	301 (100.0)	33 (100.0)	33 (100.0)	25(73.5)**↓	33(97.1)**↓	31(88.6)**↓	29(87.9)**↓	32(94.1)**↓	34(97.1)**↓	34(97.1)**↓
Distance from hospital, Kms	7.8	7.8	6.6	4.7	6.4	4.7	5.4	6.8	6.6	7.8
Median (25^{th}, 75^{th} quartile)	(4.7, 15.3)	(4.7, 14.6)	(4.7, 11.6)	(4.6, 8.3	(3.2, 9.7)	(4.4, 7.8)	(4.4, 7.5)	(4.5, 9.5)	(4.6, 8.3)	(5.4, 18.8)
Medical history, % (n)										
Family history of CHD	76 (25.2)	3 (9.1)	5 (15.2)	7 (20.6)	9 (26.5)	13 (37.1)	9 (27.3)	9 (26.5)	12 (34.3)	9 (25.7)
History of CHD	108 (35.9)	15 (45.5)	19 (57.6)	12 (35.3)	12 (35.3)	10 (28.6)	15 (45.5)	5 (14.7)	7 (20.0)	15 (42.9)
Hypertension	115 (38.2)	24 (72.7)	18 (54.5)	19 (55.9)	16 (47.1)	13 (37.1)	16 (48.5)	14 (41.2)	8 (22.9)	17 (48.6)
Diabetes Mellitus	46 (15.3)	5 (15.2)	12 (36.4)	8 (23.5)	6 (17.6)	10 (28.6)	8 (24.2)	6 (17.6)	6 (17.6)	8 (22.9)
Dyslipidaemia	96 (31.9)	20 (60.6)	12 (36.4)	14 (41.2)	14 (41.2)	12 (34.3)	15 (45.5)	11 (32.4)	7 (20.0)	14 (40.0)
Smoke (current or past)	133 (44.2)	16 (48.5)	15 (45.5)	6 (17.6)**↓	7 (20.6)**↓	8 (22.9)**↓	13 (39.4)	13 (38.2)	16 (45.7)	18 (51.4)
Alcohol (current or past)	83 (27.6)	13 (39.4)	3 (9.1)**↓	5 (14.7)	6 (17.6)	6 (17.1)	4 (12.1)	10 (29.4)	10 (28.6)	13 (37.1)
Prior myocardial infarction	64 (21.3)	9 (27.3)	9 (27.3)	5 (14.7)	8 (20.6)	5 (14.3)	8 (24.2)	2 (5.9)	3 (8.6)	8 (22.9)
Prior PCI	23 (7.6)	5 (15.2)	5 (15.2)	4 (11.8)	5 (14.7)	2 (5.7)	4 (12.1)	2 (5.9)	1 (2.9)	4 (11.4)
Prior CABG	21 (7.0)	4 (12.1)	2 (6.1)	1 (2.9)	3 (8.8)	0 (0.0)	5 (15.2)	0 (0.0)	1 (2.9)	2 (5.7)
Prior stroke/TIA	19 (6.3)	2 (6.1)	4 (12.1)	4 (11.8)	1 (2.9)	0 (0.0)	1 (3.0)	1 (2.9)	0 (0.0)	1 (2.9)

Table 4.16 TED III Presenting characteristics of patients presented to emergency department with chest pain by ethnic groups (continued)

Characteristics	Australian n=301	Nth W Euro n=33	Sth E Euro n=33	Nth E Asia n=34	Sth E Asia n=34	Sth Ct Asia n=35	Middle East n=33	Sth Africa n=34	Americas n=35	Oceania n=35
Language barrier, n (%)	0 (0.0)	0 (0.0)	5 (15.2)*↑	14(41.2)**↑	4(11.8)**↑	3(8.6)**↑	9(27.3)**↑	2(5.9)**↑	3(8.6)**↑	1(2.9)
Symptom onset: weekend, n (%)	83 (27.6)	8 (24.2)	9 (28.1)	10 (29.4)	7 (20.6)	7 (20.0)	6 (18.2)	10 (29.4)	4 (11.4)**↓	12 (34.3)
Symptom onset: daytime, n (%)	98 (32.2)	13 (44.8)	12 (42.9)	11 (34.4)	9 (29.0)	17 (51.5)**↑	12 (36.4)	11 (34.4)	14 (41.2)	11 (31.4)
Location at home, n (%)	194 (64.5)	27 (81.8)**↑	30 (90.9)**↑	22 (64.7)	24 (70.6)	22 (62.9)	28 (84.8)**↑	24 (70.6)	25 (71.4)	28 (80.0)
Central chest pain, n (%)	215 (71.4)	22 (66.7)	26 (78.8)	26 (76.5)	22 (64.7)	23 (65.7)	28 (84.5)	24 (70.6)	25 (71.4)	26 (74.3)
Pain score, mean ± SD	5.0 ±3.2	5.6 ±3.4	4.3 ±3.1	3.8 ±2.4*↓	6.2 ±2.7*↑	4.5 ±2.3	5.1 ±3.6	4.9 ±2.5	5.7 ±2.9	5.0 ±3.0
First Medical contact, n (%)										
Ambulance	116 (38.5)	18 (54.5)	17 (51.5)	8 (23.5)	10 (29.4)	8 (22.9)	9 (27.3)	8 (23.5)	11 (31.4)	12 (34.3)
Emergency department	153 (50.8)	9 (27.3)**↓	11 (33.3)	19 (55.9)	12 (35.3)	16 (45.7)	18 (54.5)	17 (50.0)	20 (57.1)	17 (48.6)
General practitioner	32 (10.6)	6 (18.2)	5 (15.2)	7 (20.6)	12(35.3)**↑	11(31.4)**↑	6 (18.2)	9(26.5)**↑	4 (11.4)	6 (17.1)
Hospital discharged diagnosis, n (%)										
Cardiac (include chest pain)	154 (51.2)	22 (66.7)	21 (63.6)	21 (61.8)	16 (47.1)	17 (48.6)	20 (60.6)	16 (47.1)	17 (48.6)	23 (65.7)
Non-cardiac	43 (14.3)	3 (9.1)	5 (15.2)	2 (5.9)	5 (14.7)	2 (5.7)	5 (15.2)	4 (11.8)	5 (14.3)	1 (2.9)
GRACE Score, Mean	74 ±36	95 ±35*↑	100 ±34*↑	70 ±32	76 ±32	58 ±26*↓	74 ±35	57 ±26*↓	65±30	75 ±22

Nth W Euro: North-West European, Sth E Euro: Southern and Eastern European, Nth E Asia: North-East Asian, Sth E Asia: South-East Asian, Sth Ct Asia: Southern and Central Asian, Middle East: North African and Middle Eastern, Sub Africa: Sub-Saharan African, CHD: coronary heart disease, PCI: percutaneous coronary intervention, CABG: coronary artery bypass graft, TIA: transient ischemic attack, GRACE: Global Registry of Acute Cardiac Event, ED: Emergency Department,
*Significant differences between Australian and ethnic groups, $p < 0.05$ by T- test, **Significant differences between Australian and ethnic groups, $p < 0.05$ by Chi-square test,
***Significant differences between Australian and ethnic groups, $p< 0.05$ by Man- Whitney U test, ↑ more than those of Australian group, ↓ less than those of Australian group

Table 4.17 TED III: Decision time and prehospital delay time in hours from symptom onset by ethnic groups

Delay time (hours)	Australian n=289	Nth W Euro n=28	Sth E Euro n=27	Nth E Asia n=31	Sth E Asia n=30	Sth Ct Asia n=33	Middle East n=32	Sth Africa n=32	Americas n=34	Oceania n=35
Decision time, Median (25^{th}, 75^{th})	1.5 (0.6, 4.6)	1.6 (0.8, 5.7)	2.1 (0.5, 8.5)	3.0* ↑ (1.6, 12.1)	3.9* ↑ (2.2, 21.3)	3.5 (0.7, 15.1)	4.1* ↑ (1.0, 22.0)	4.5* ↑ (1.8, 14.3)	2.2 (0.8, 15.4)	2.4 * ↑ (1.0, 7.0)
Decision time, n (%)										
≤ 1	114 (39.4)	10 (35.7)	10 (37.0)	7 (22.6)	1 (3.3)*↓	10 (30.3)	8 (25.0)	4 (12.5)*↓	9 (26.5)	9 (25.7)
1.01-2.00	59 (20.4)	5 (17.9)	3 (11.1)	4 (12.9)	6 (20.0)	4 (12.1)	3 (9.4)	6 (18.8)	7 (20.6)	6 (17.1)
2.01-4.00	39 (13.5)	3 (10.7)	5 (18.5)	5 (16.1)	8 (26.7)	3 (9.1)	5 (15.6)	4 (12.5)	3 (8.8)	5 (14.3)
4.01-8.00	23 (8.0)	5 (17.9)	2 (7.4)	6 (19.4)*↑	5 (16.7)	4 (12.1)	4 12.5)	8 (25.0)*↑	3 (8.8)	7 (20.0)
>8.00	56 (19.4)	5 (17.9	7 (25.9)	9 (29.0)	10 (33.3)	12 (36.4)*↑	12 (37.5)*↑	10 (31.3)	12 (35.3)*↑	8 (22.9)
Prehospital delay time, Median (25^{th}, 75^{th})	3.4 (1.4, 9.0)	3.6 (1.3, 9.9)	2.5 (1.0, 10.7)	4.7 (1.7, 12.3)	5.3*↑ (3.0, 22.3)	5.3 (1.6, 10.7)	5.3 (1.7, 25.0)	6.0*↑ (2.3, 20.6)	3.0 (1.2, 15.4)	5.3 (1.6, 14.9)

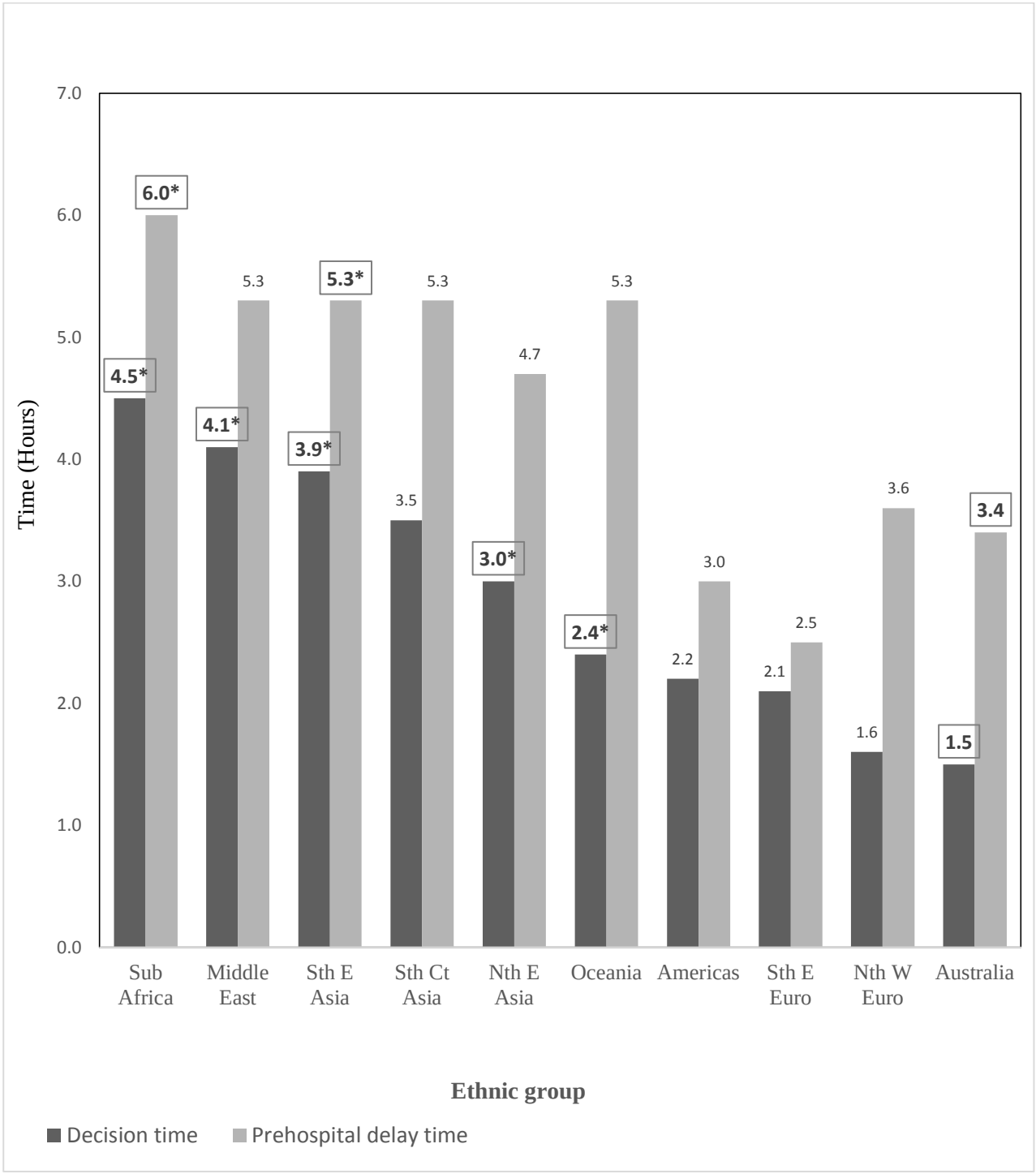
Nth W Euro: North-West European, Sth E Euro: Southern and Eastern European, Nth E Asia: North-East Asian, Sth E Asia: South-East Asian, Sth Ct Asia: Southern and Central Asian,Middle East: North African and Middle Eastern, Sub Africa: Sub-Saharan African
Missing data for decision time: 5.9%, Missing data for prehospital delay time: 5.1%
*Significant differences between Australian and ethnic groups, $p < 0.05$ by Chi-square test
↑ more than those of Australian group, ↓ less than those of Australian group

Comparisons of pre-hospital delay time between ethnic groups and the Australian group

In total, the median pre-hospital delay time (25^{th}, 75^{th} percentile) was 3.7 hours (1.5, 10.7), ranging between 2.5 (1.0, 10.7) (Southern and Eastern European) and 6.0 hours (2.3, 20.6) (Sub-Saharan African). The median pre-hospital delay times of individual ethnic groups did not significantly differ from the Australian group, except for the Sub-Saharan African (6.0 (2.3, 20.6) vs 3.2 (1.4, 8.8) hours, p=0.025) and the South-East Asian (5.3 (3.0, 22.3) vs 3.2 (1.4, 8.8) hours, p=0.012) groups (Figure 4.6). Overall, decision time contributed to 58.4% of the total pre-hospital delay time. The percentage of the decision time component for all ethnic groups ranged from 48.5% (Australian) to 83.2% (South-East Asian). The mean percentages of the decision time component were significantly greater in six ethnic groups compared to those of the Australian group: the South-East Asian (83.2% vs 48.5%), p<0.001); the Southern and Central Asian (75.8% vs 48.5%, p<0.001); the North-East Asian (74.3% vs 48.5%, p=0.001); the Sub-Saharan African (71.8% vs 48.5%, p=0.001); the North African and Middle Eastern (64.7% vs 48.5%, p=0.039); and the Oceanian (64.5% vs 48.5%, p=0.017) groups (Figure 4.7).

Independent predictors of decision time ≤ 1 hour

The results of the binary logistic regression analysis of decision time ≤ 1 hour are available in Table 4.18. Adjusting for socio-demographics, medical history, and presenting factors, the ethnic patients were 60% (95% CI, 0.23, 0.68, p=0.001) less likely than the Australian patients to seek medical care within one hour of experiencing chest pain. Three factors: being male, symptom onset during night time (18.00-5.59), and being active during the event significantly contributed to predicting a patient's decision time being within one hour (Table 4.18). Patients who experienced chest pain at night time (18.01-5.59) were 2.19 times (95% CI, 1.27, 3.77, p=0.005) more likely to initially seek care within one hour than those who experienced chest pain during the day (6.00-18.00). Symptom onset happening while taking part in activities increased the chance of seeking medical care within one hour by 1.88 times (95% CI, 1.02, 3.50, p=0.045) in comparison to onset taking place during resting. Male patients were 1.79 times (95% CI, 1.05, 3.07, p=0.034) more likely than females to make their decision within one hour of experiencing chest pain.



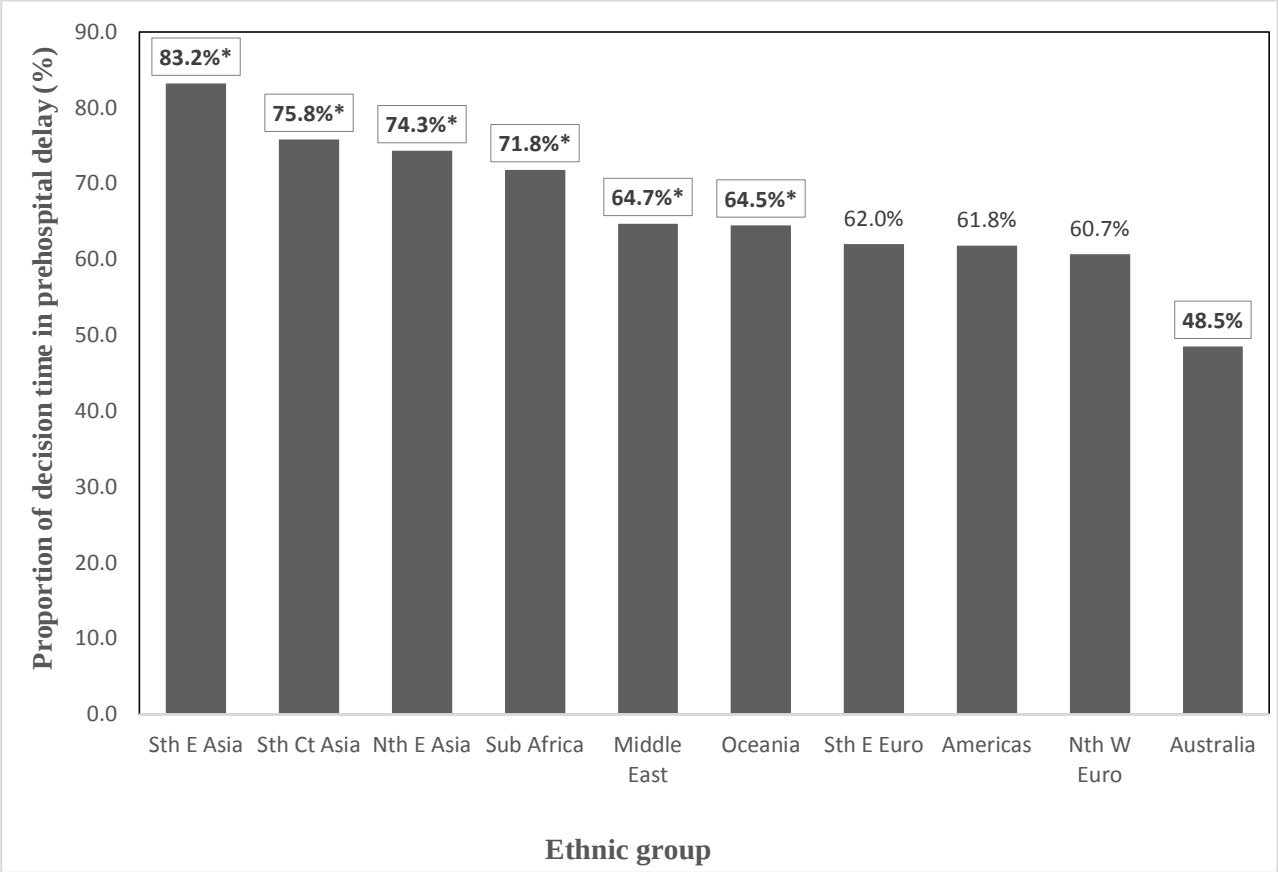
Nth W Euro: North-West European, Sth E Euro: Southern and Eastern European, Nth E Asia: North-East Asian, Sth E Asia: South-East Asian, Sth Ct Asia: Southern and Central Asian, Middle East: North African and Middle Eastern, Americas: People of the Americas, Sub Africa: Sub-Saharan African

[a]Decision time was defined as the interval from the time of symptom onset to accessing the emergency response system or to initiating travel to the hospital (Dracup et al. 1995).

[b]Prehospital delay time was defined as the interval between the time of symptom onset and hospital arrival (Dracup et al. 1995; King & McQuire 2007)

*Significant differences between Australian and each ethnic group, $p < 0.05$ by Man- Whitney U test

Figure 4.6: TED III: Comparison of decision time[a] (hours) and prehospital delay time[b] (hours) between ethnic and Australian groups



Nth W Euro: North-West European, Sth E Euro: Southern and Eastern European, Nth E Asia: North-East Asian, Sth E Asia: South-East Asian, Sth Ct Asia: Southern and Central Asian, Middle East: North African and Middle Eastern, Americas: People of the Americas, Sub Africa: Sub-Saharan African
Decision time component (%): percentage of decision time in prehospital delay time
*Significant differences between Australian and ethnic group, $p < 0.05$ by T- test

Figure 4.7: TED III: Comparison of decision time component (%) in prehospital delay time between ethnic and Australian groups

Table 4.18 TED III: Independent predictors of decision time ≤ 1 hour during the cardiac events

Predictor	Odds ratio	95% Confidence Interval	*p*
Socio-demographic factor			
Male	1.79	1.05, 3.07	0.034
Presenting factor			
Symptom onset: night time (18.01-5.59)	2.19	1.27, 3.77	0.005
Having active activity during event	1.88	1.02, 3.50	0.045
Cultural factor			
Ethnic status	0.40	0.23, 0.68	0.001

Significant at $p < 0.05$

Independent predictors of decision time ≤ 1 hour

The results of the binary logistic regression analysis of decision time ≤ 1 hour are available in Table 4.18. Adjusting for socio-demographics, medical history, and presenting factors, the ethnic patients were 60% (95% CI, 0.23, 0.68, *p*=0.001) less likely than the Australian patients to seek medical care within one hour of experiencing chest pain. Three factors: being male, symptom onset during night time (18.00-5.59), and being active during the event significantly contributed to predicting a patient's decision time being within one hour (Table 4.18). Patients who experienced chest pain at night time (18.01-5.59) were 2.19 times (95% CI, 1.27, 3.77, *p*=0.005) more likely to initially seek care within one hour than those who experienced chest pain during the day (6.00-18.00). Symptom onset happening while taking part in activities increased the chance of seeking medical care within one hour by 1.88 times (95% CI, 1.02, 3.50, *p*=0.045) in comparison to onset taking place during resting. Male patients were 1.79 times (95% CI, 1.05, 3.07, *p*=0.034) more likely than females to make their decision within one hour of experiencing chest pain.

Ambulance utilization and its independent predictors

Comparison of first medical contact between the ethnic and the Australian groups

The rate of ambulance utilization as the first medical contact when patients experienced chest pain for all samples was 35.7%. The proportion of patients calling an ambulance as the first medical contact varied across the ethnic groups, ranging from 22.9% (Southern and Central Asian) to 54.4% (North-West European), but this was not statistically significant (Table 4.16).

Independence predictors of ambulance utilisation

Adjusting for socio-demographic, medical history, and presenting factors, ethnic status was not associated with ambulance utilisation. Age, alcohol consumption history, prior stroke/TIA, symptom onset at night time, and pain score significantly contributed to the prediction of ambulance utilisation (Table 4.19). The strongest predictor was prior stroke/TIA, which indicated that patients with a prior history of stroke/TIA were 7.39 times (95% CI, 1.24, 40.3, *p*=0.021) more likely to call an ambulance upon experiencing chest pain. The cardiac event occurring at night time (18.01-5.59) increased the chance of calling an ambulance by 2.68 times (95% CI, 1.54, 4.66, *p*<0.001) more than the event occurring during the day time (6.00-18.00).

Table 4.19 TED III: Independent predictors of ambulance utilization during the cardiac events

Predictor	Odds ratio	95% Confidence Interval	*p*
Socio-demographic factor			
Age	1.04	1.02, 1.06	<0.001
Medical history factors			
Alcohol consumption history	0.49	0.27, 0.90	0.021
Prior stroke/transient ischemic attack	7.39	1.24, 40.3	0.021
Presenting factor			
Symptom onset during night time (18.01-5.59)	2.68	1.54, 4.66	<0.001
Pain score			
	1.13	1.04, 1.24	0.007

Significant at $p < 0.05$

The odds ratio of 1.13 (95% CI, 1.04, 1.24, *p*=0.007) for the pain score indicated that, for every additional scale of chest pain, patients were 1.13 time more likely to call an ambulance. The patients were more likely to arrive at the hospital by ambulance 1.04 times (95% CI, 1.02, 1.06, *p*<0.001) for every additional year of age. The history of alcohol consumption decreased the chance of calling an ambulance when experiencing chest pain by 51% (95% CI, 0.27, 0.90, *p*=0.021) compared to those with a non-alcohol history.

Clinical outcomes of patients with chest pain

Comparison of clinical outcomes between the Ethnic group and the Australian group

This study measured and compared clinical outcomes, including having angiography, having PCI, hospital discharge diagnosis, and rehospitalisation between the entire Ethnic group and the Australian group. Of the total sample (n=607), 327 (53.9%) were discharged from hospital with cardiac diagnoses based on ICD-10-AM (Table 4.20) (National Centre for Classification in Health 2008). There were no significant differences in the proportions of hospital discharge diagnosis as cardiac conditions, angiogram and PCI, between the Ethnic and the Australian groups (Table 4.21).

Table 4.20 Hospital discharge diagnosis: cardiac diagnoses identified in TED III base on ICD-10-AM 10th version

Code	Hospital discharge diagnosis
I10	Essential (primary) hypertension
I200	Unstable angina
I208	Other forms of angina pectoris
I209	Angina pectoris, unspecified
I210	Acute transmural myocardial infarction of anterior wall
I211	Acute transmural myocardial infarction of inferior wall
I213	Acute transmural myocardial infarction of unspecified site
I214	Acute subendocardial myocardial infarction
I2511	Atherosclerotic heart disease
I269	Pulmonary embolism without mention of acute cor pulmonale
I301	Infective pericarditis
I309	Acute pericarditis, unspecified
I319	Disease of pericardium, unspecified
I350	Aortic (valve) stenosis
I428	Other cardiomyopathies
I471	Supraventricular tachycardia
I48	Atrial fibrillation and flutter
I489	Atrial fibrillation and atrial flutter, unspecified
I490	Ventricular fibrillation and flutter
I495	Sick sinus syndrome
I500	Congestive heart failure
I501	Left ventricular failure
I639	Cerebral infarction, unspecified
I978	Other postprocedural disorders of circulatory system, not elsewhere classified
R073	Other chest pain
R074	Chest pain, unspecified

ICD-10—AM: the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (National Centre for Classification in Health 2008)

Table 4.21 TED III: Clinical outcomes of patients with chest pain: ethnic group compared with Australian group

Clinical outcomes	All patients n = 607	Australian n = 301	Ethnic n = 306	*p*	*p* adjusted for age
Angiogram, n (%)	79 (13.0)	39 (13.0)	40 (13.1)	0.966	0.995
PCI, n (%)	31 (5.1)	20 (6.6)	10 (3.6)	0.088	0.518
Discharge diagnosis: cardiac, n (%)	327 (53.9)	154 (51.2)	173 (56.5)	0.184	0.133
Readmission (days), median (25^{th}, 75^{th} percentile)	128 (35, 297)	257 (85, 367)	73 (11, 193)	0.001*	0.013$^{\phi}$
Readmission, n (%)	77 (12.7)	32 (10.6)	45 (14.7)	0.132	0.133
Cardiac	59 (78.7)	23 (74.2)	36 (81.8)	0.427	0.448
Readmitted 30 day	18 (23.4)	3 (9.4)	15 (33.3)	0.014**	0.021$^{\phi\phi}$
Readmission n (%)					
6 months	51 (8.4)	15 (5.0)	36 (11.8)	0.003**	0.003$^{\phi\phi}$
1 year	39 (6.4)	24 (8.0)	15 (4.9)	0.123	0.119

PCI: Percutaneous Coronary Intervention
*Significant differences between Australian and ethnic groups, $p < 0.05$ by Man- Whitney U test
**Significant differences between Australian and ethnic groups, $p < 0.05$ by Chi-square test,
$^{\phi}$Significant differences between Australian and ethnic groups, $p< 0.05$ by general linear model adjusted for age
$^{\phi\phi}$Significant differences between Australia and ethnic groups, $p< 0.05$ by logistic regression model adjusted for age

However, there was a statistical association between ethnicity and rehospitalisation. The readmission rate for all patients was 12.7%, and the median (25th, 75th percentile) readmission interval was 128 (35, 297) days. Ethnic patients had a significantly shorter interval of rehospitalisation (days) than the Australian group (median: 73 (11, 193) vs 257 (85, 367), p=0.001). The percentage of ethnic patients readmitted within 30 days was significantly higher than in the Australian group (33.3% vs 9.4%, *p*=0.014). Similarly, ethnic patients were more likely than those in the Australian group to be readmitted within six months after the previous discharge (11.8% vs 5.0%, *p*=0.003).

Association between care-seeking behaviours and clinical outcomes

There were no associations between angiogram, PCI, hospital discharge diagnosis, readmission interval (days), and 'ambulance as the first medical contact' (Table 4.22). Nonetheless, the hospital

readmission rate among patients arriving at the hospital by ambulance was significantly higher than those arriving by other mode of transport (18.0% vs 9.7%, *p*=0.004). Patients who made a decision within one hour were more likely than the delayer > 1 hour group to have an angiogram (17.0% vs 11.1%, *p*=0.047), and they were also more likely to be discharged from the hospital with cardiac conditions (ICD-10-AM, Code I00-I99), compared to patients who took > 1 hour to make decision (62.6% vs 52.2%, *p*=0.019). There was an association between decision time and hospital readmission rate. Patients who decided to seek care within 1 hour had a significantly greater readmission rate (17% vs 10.5%, *p*=0.029) and 1-year readmission rate (11.0% vs 4.6%, *p*=0.004) than the delayers. (Table 4.22).

Table 4.22 TED III: Association between care-seeking behaviours and clinical outcomes

Clinical outcome	Mode of transportation (n = 607)		Decision time (n = 571)	
	Ambulance n= 217	Others n = 390	≤1 hr n = 182	> 1 hr n = 389
Ethnicity, n (%)	101 (46.5)	205 (52.6)	68 (37.4)*	214 (55.0)
Angiogram, n (%)	27 (12.4)	52 (13.3)	31 (17.0)*	43 (11.1)
PCI, n (%)	10 (4.6)	21 (5.4)	12 (6.6)	18 (4.6)
Discharge diagnosis: cardiac, n (%)	122 (56.2)	205 (52.6)	114 (62.6)*	203 (52.2)
Readmission (days), median (25^{th}, 75^{th} percentile)	164 (53, 277)	86 (25, 375)	164 (53, 284)	128 (48, 362)
Readmission, n (%)	39 (18.0)*	38 (9.7)	31 (17.0)*	41 (10.5)
Cardiac, n (%)	31 (83.3)	28 (73.7)	24 (82.8)	32 (78.0)
30 day	8 (3.7)	10 (2.6)	7 (3.8)	7 (1.8)
6 months	25 (11.5)*	26 (6.7)	19 (10.4)	28 (7.2)
1 Year	23 (10.6)*	16 (4.1)	20 (11.0)*	18 (4.6)

PCI: Percutaneous Coronary Intervention
Missing data for decision time: 5.9%, Missing data for prehospital delay time: 5.1%
*Significant differences between Australian-born and ethnic groups, $p < 0.05$ by Chi-square test

Discussion

TED III was the third part of the Time, Ethnicity, and Delay (TED) study aimed to determine the differences in care-seeking behaviours and clinical outcomes between ethnic patients from 74 countries within nine ethnic groups, compared to Australian patients. This study focuses on the differences in decision time (patient's delay) and the association between ethnicity and decision time.

Presenting characteristics of samples

There were significant differences in access to health insurance. The significantly lower rate of Medicare (universal health coverage) accessibility among seven ethnic groups (except for the two European groups) compared to the Australian group might be related to the 104-week waiting period for newly-arrived migrants before being eligible to access Medicare (Australian Goverment Department of Human Services 2015b). On the other hand, many European countries, such as the United Kingdom, Sweden, Finland, Italy, Belgium, Malta, and Slovenia have Reciprocal Health Care Agreements with Australia, through which the residents from certain European countries are able to access essential medical treatment while visiting Australia (Australian Government Department of Human Services 2015). This could explain the equal access to Medicare for all European patients in this study compare to the Australian group.

The majority of cardiac events occurred at home for all groups, thus other family members may have been present and influenced the thoughts and actions during the chest pain events (Henriksson, Lindahl & Larsson 2007; Herlitz et al. 2010a).Therefore, It is important to educate family members and relatives to ensure adequate and correct knowledge and attitudes for responding to chest pain and other warning signs of heart attack. Due to language barriers among the various ethnic groups, encouraging family members who have fluent English to accompany patients to the hospital could be of benefit for ensuring smooth communication.

Ethnic differences in pre-hospital delay (decision time and pre-hospital delay time)

The median decision time of 2.0 hours indicates an unchanged level of patient delay time when compared to a previous Australian study (Taylor et al. 2005) and an international study (Perkins-Porras et al. 2009) conducted in the last decade. The variation in decision times among the different ethnic groups demonstrated differences based on ethnicity in responding to chest pain. Africans, Middle Easterners, and Asians were among the latest delayers, taking more than three hours before initiating attempts to seek help, which was far from the recommended timeframe. Although the Australian group, took the shortest time to make a decision when experiencing chest pain, they also delayed for longer than the evidence-based recommendation of responding within 10 minutes (Chew et al. 2016) and the best outcomes will be achieved If the definitive treatment were initiated within one hour (Boersma et al. 1996b).

A recent Australian study (Bray et al. 2015) reported that 47% of patients made a decision to seek care within one hour, while this study found that only 31.9% of all patients made a decision in a timely manner. The lowest percentage of patients who made an early decision were Africans, Middle Easterners, and Asians. Conversely, at least one-third of these ethnic groups delayed for more than eight hours. Zerwic et al. (2003) noted that ethnicity was a significant predictor of care-seeking within one hour after symptom onset. TED III found similar results through a multivariate analysis which showed that ethnicity significantly impacted on patient delays of more than one hour. This suggests that further investigation on a large scale for each ethnic group is warranted to explain their patterns of decision-making.

The median pre-hospital delay time of TED III was 3.7 hours which was comparable to the average median delay time of 3.4 hours reported in a recent integrative literature review (Wechkunanukul, Grantham & Clark 2016). Pre-hospital delay times in Australia have varied from study to study over the last two decades, but the evidence-based recommended timeframe of two hours is never met. Dracup, McKinley and Moser (1997) reported a pre-hospital delay time of 6.4 hours in 1997 and Taylor et al. (2005) noted 3.17 hours from their study in 2005. In two recent studies in different states, Bray et al. (2015) reported a median delay time of 3.5 hours, while 2.2 hours was reported by

Coventry et al. (2015a). These fluctuating results might be explained by the inconsistency of the methodology used, such as in the measurement of time (Mackay et al. 2014). The make-up of the participants, and the inclusion and exclusion criteria might be other explanations for the variability in pre-hospital delay times in Australia. Since one-third of the Australian population are culturally and linguistically diverse people (Australian bureau of Statistics 2015), a different composition of participants in each study may have led to such varied research outcomes. The exclusion of an ethnicity variable, or of non-English speaking patients, could also have had an impact on the results (Bradby 2003; Sheikh et al. 2009; Wendler et al. 2006).

Our findings showed variations in pre-hospital delay times across the individual ethnic groups. All groups, including the Australian group, had a median pre-hospital delay time greater than the recommended time of one hours. Similar to decision time, Africans, Middle Easterners, and Asians had the longest delays, taking more than five hours to reach the hospital. The Australian and Europeans had the shortest delays; however, all the groups did not reach the ED in a timely manner. These findings were consistent with previous multi-ethnic studies in the USA (Canto et al. 1998) and Canada (King, Khan & Quan 2009), where all ethnic and dominant populations had a median delay time of greater than one hours.

More than half (58.4%) of the total pre-hospital delay time can be attributed to decision time which is comparable to other Australian studies (Coventry et al. 2015a; McKinley et al. 2011) and international studies (Herlitz et al. 2010a; Perkins-Porras et al. 2009). Ethnic groups had longer patient delay times of between 60% and 83% compared to 48.5% for the Australian group. Symptom recognition, knowledge of heart attack symptoms, and the cognitive and emotional responses of the patient have been found to have an influence on decision times (Goff et al. 1998; Motalebi & Iranagh 2013; Pattenden et al. 2002a). Additionally, Richards, Reid and Watt (2002) concluded that perceptions of symptoms and illness behaviours were shaped by the patients' cultural and social contexts. One binational study conducted in USA and Canada concluded that health care insurance caused differences in access to primary care between immigrants and non-immigrants (Siddiqi, Zuberi & Nguyen 2009).

Interestingly, the two ethnic groups, South-East Asian and the Sub-Saharan African, who had a significant longer decision time and prehospital delay time compared to the Australian groups were more likely than Australian to visit their general practitioners as the first medical contact. Also, these two ethnic groups had a significant lower rate of Medicare accessibility than Australian groups and more likely to encounter language barriers. These findings consistent with the previous studies which suggested to patients should call ambulance as the first point during chest pain events rather than contacting their GP to help decrease time delay (Brown et al. 2000; Hitchcock et al. 2003; Johansson, Stromberg & Awahn 2004). Additionally, these results supported the notion that health insurance was found associated with a longer prehospital delay in seeking care for chest pain (Brown et al. 1998)

Many researchers suggested that improving decision times can help in reducing total pre-hospital delays (Herlitz et al. 2010a; Khraim & Carey 2009; Pattenden et al. 2002a; Perkins-Porras et al. 2009); therefore, a culturally sensitive investigation of ethnic groups which emphasizes the impact of culture/ethnicity on different responses to chest pain has been recommended (Cullen et al. 2016; Goldberg et al. 2009; King-Shier et al. 2015; Moser et al. 2006).

Ambulance utilisation and the predictors

In TED III, 50.6% of all patients arrived at the hospital by ambulance, which is comparable to the primary data analysis phase of this study (TED II) (Wechkunanukul et al. 2016b), and a recent Australian study (Bray et al. 2015). A global review of delay time reported the average rate of ambulance use at 36.5% with a wide range of usage rates across countries (Wechkunanukul, Grantham & Clark 2016). Similarly, there was ethnic variation in ambulance use as the first medical contact, but no significant differences between the groups. Only one-third or less of the individual ethnic groups called an ambulance during chest pain episodes (except for the European patients). Meischke et al. (1995) noted that one of the main reasons for not calling an ambulance was that the 'symptoms were not severe'. The multivariate analysis undertaken in TED III supports this notion. The results of TED III revealed that a higher degree of pain contributed to a higher chance of calling an ambulance.

In Australia, ambulance costs of approximately $600 to $900 are not covered by Medicare or private health insurance (SA Ambulance Services 2016). Individuals have to apply for the ambulance cover separately. Therefore, economic factors, such as being not covered by the Ambulance Cover being on a low income or unemployed, may possibly be taken into account when patient considering whether to call the ambulance. Future research into the potential factors influencing emergency medical service for a range of ethnic groups is thus warranted.

Two studies have found that media campaigns did not increase ambulance utilisation (Bray et al. 2015; Ho et al. 1989). Another study concluded that the post-public campaign rate of ambulance usage tapered off over time (Eppler et al. 1994). Strategies for encouraging people to use an ambulance when experiencing chest pain require future interventions and appropriate initiatives to increase and sustain access to emergency services. One study suggested that effective campaigns should focus on long-term and ongoing action rather than short-term fixes (Finn et al. 2007).

Association between care-seeking behaviours and clinical outcomes

Generally, the equity of the clinical outcomes between the Ethnic group and the Australian group were revealed as being the same as in previous studies (Abdelnoor et al. 2012; Hyun et al. 2014; Wechkunanukul et al. 2016b). The angiography access rate was 13.0% for both ethnic and Australian patients which is comparable to the 13.1% found in a recent Australian study (Coventry et al. 2015b). The Ethnic group had a higher rate of readmission in both the short- and the long-term compared to the Australian group. A large scale study addressing this issue for the individual ethnic groups is proposed by the author.

Thang et al. (2012) noted a similar association between ambulance use and frequent rehospitalisation to the findings of the current study. Decision time ≤ 1 hour was associated with clinical outcomes, including cardiac care and readmission rates. The future investigation in higher readmission rate among patients responding to chest pain within one hour is recommended. These findings confirm the importance of patient delays for holistic outcomes and emphasize that improving patient awareness, knowledge, and attitudes to responding appropriately to chest pain is the cornerstone of reducing pre-hospital delay and improving outcomes.

Implications for research and practice

The Australian government has provided national guidelines and programs to encourage equity in accessing healthcare, including Multicultural Language Services Guidelines for Australian Government Agencies (Australian Government Department of Immigration and Border Protection 2013) and Multicultural Service Officers (Australian Goverment Department of Human Services 2015a). These organisations work cooperatively to provide a range of services, such as a multilingual phone service, and free interpreting and translation services, which enable non-English speaking patients to access care. However, a longer prehospital delay and underutilisation of ambulance among ethnic groups, which might be related to cultural and language barriers, still exist in Australia. The evaluation of the effectiveness of these national programs and the implementation of guidelines should be considered to help reducing those delays, particularly measuring effectiveness and efficiency at the community level. Care-seeking, behavioural, social, and cultural factors should be incorporated into public campaigns and associated interventions. Targeting specific ethnic communities with appropriate strategies may also help in addressing the unique problems and needs of each ethnic group (King-Shier et al. 2015). The use of existing education resources translated into languages other than English at the individual and community levels, such as mobile phone applications, radio programs, community television programs, and community education, may enable culturally and linguistically diverse people to access healthcare information.

Limitations and Strengths

There are a number of limitations of the TED III. Firstly, obtaining a dataset from a single hospital may be inappropriate for generalising the findings to the entire population. However, the TED III samples were randomly selected from a large population of the TED II participants (n=8,012) which reflected national population proportions. This study included a small sample size from nine ethnic groups due to the time limit for conducting a PhD study, but the sample sizes were achieved over 80% of the power analysis. Due to the small sample sizes for the individual ethnic groups, the clinical outcomes sub-analyses comparing each ethnic group with the Australian group were not considered to be appropriate. To address this limitation, clinical outcomes sub-analyses comparing the entire ‘Ethnic group’ (comprising all the ethnic groups) with the Australian group were conducted. As well,

TED III is a retrospective study that may have inherent biases in data selection, collection, and analysis, such as missing data (Schneider et al. 2013; Ward & Brier 1999). TED III also has a number of strengths. Firstly, the population samples included patients from 74 countries and nine ethnic groups which reflects the multicultural nature of Australian society. Secondly, the data were collected over an entire year covering incidents of chest pain in all seasons. Thirdly, the missing data comprised only a small percentage (5.9%) of the total, due to a lack of symptom onset.

Conclusion

TED III has revealed essential information in relation to ethnic differences in pre-hospital delay times among patients with chest pain from 74 countries within nine ethnic groups. The median decision time of all the groups was greater than the recommended timeframe of one hour. Five ethnic groups had significantly longer decision times than the Australian group. Africans, Middle Easterners, and Asians were among the longest delayers. Only one-third of all patients initiated their response to chest pain within one hour. Apart from the Australian and European groups, all other ethnic groups had a low rate of 30% or less in making their decision in a timely manner. The median of pre-hospital delay times of all groups was over two hours. This study also found differences in pre-hospital delay times between the Australian group and two ethnic groups (Sub-Saharan Africans and South-East Asians). Decision time was the major component of total pre-hospital delay time in all groups.

There was no significant difference in ambulance utilisation between the ethnic groups and the Australian group. Only one-third or less of all the groups called an ambulance as the first contact during a cardiac event (except for slightly over half for the European groups). Ethnic patients had a higher rate of short –term (30 days) and long-term (6 months) readmission compared to Australian group. There was an association between decision time ≤ 1 hour and clinical outcomes. The findings of TED III support the notion that ethnic differences in care-seeking behaviours do exist, and that ethnicity is a predictor of patient delay. Delays in responding to chest pain play a key role in patient outcomes. Future interventions and education campaigns focusing on patients' decision phase, and targeting of such interventions and campaigns based on ethnic differences are recommended.

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CHAPTER 5
SUMMARY AND CONCLUSIONS

CHAPTER 5 SUMMMARY AND CONCLUSIONS

This chapter provides a summary of findings from the three studies (i.e., TED I, TED II and TED III) incorporated in the Time, Ethnicity and Delay (TED) study. The first section provides an overview of TED study, including aims, scope and research design. The next three sections summarise the findings and conclusions from each study, followed by the conclusions of TED study with the limitations of TED study and recommendations for practices and research from TED study.

Time, Ethnicity and Delay (TED) study

Time, Ethnicity, and Delay (TED) study aimed to investigate the delay in seeking medical care for chest pain among CALD populations. The context of TED study comprised three levels of studies i.e., world-level, nation-level and community-level. The methodological triangulation was used to address research questions in each level of study. The three distinct research approaches including 1) a systematic review (TED I); 2) a cross-sectional analysis (TED II); and 3) a retrospective medical record review (TED III). TED I focused on the existing evidence, and formed a basic information. TED II focused on information in national level, and TED III carried out further analysis in community level. Finally, findings from three studies were incorporated to establish a new knowledge and essential database of ethnic differences in seeking care for chest pain among culturally and linguistically populations.

TED I: Summary from the JBI systematic review

To address the first research question of TED study '*Is there association between ethnicity and delay time in seeking medical care for chest pain?*' JBI systematic review system was adopted to determine the association between ethnicity and delay in seeking medical care for chest pain among culturally and linguistically diverse (CALD) populations.

The inclusion criteria of the systematic review were;

1. patients with different ethnic backgrounds who presented with chest pain at an emergency department;

2. studies that evaluated the association between ethnicity and delay in seeking medical care for chest pain among CALD populations;

3. quantitative studies classified from level 1 to level 3 based on the JBI Levels of Evidence for Effectiveness (Appendix XIV); and

4. delay time (interval from time of symptom onset and hospital arrival) was measured either as a continuous variable (in hours) or as categories of times (e.g. >1 hour, >4 hours, >6 hours).

A comprehensive search for relevant published and unpublished studies in English language with no date restriction were conducted through databases and 'grey literature' sources. A total of 5,696 identified records were reviewed against the inclusion criteria, and ten studies were selected. All included studies were classified as level 3 and 4 (level 3 c – level 4b) based on the JBI Levels of Evidence for Effectiveness.

Association between ethnicity and delay in seeking care for chest pain

This systematic review included 1,511,382 participants from seven ethnic groups, involving Caucasian/White, Black, Hispanic, Asian, South-East Asian and Chinese. The association between ethnicity and delay in seeking medical care for chest pain were reported in all ten included studies. The review outcomes demonstrated a significantly longer delay in seeking medical care for chest pain in ethnic groups compared to the dominant population (Caucasian/White). Also, time taken to arrive at emergency department after experiencing chest pain was longer than the recommended time of one hour in all ethnic groups, including the dominant counterpart. The primary studies in TED I noted that sociocultural factors such as cultural and socioeconomic status, culture and language barriers, and symptom perception, influenced differences in seeking care behaviours among ethnic groups. Underutilisation of ambulance, lack of eligibility to access health insurance and financial difficulty among ethnic groups were also related to a longer delay time. Globally, there was an association between ethnicity and delay in seeking medical care for chest pain. The findings from this systematic review showed that CALD patients took a longer time than the majority population to seek care for chest pain.

TED II: Summary from the cross-sectional analysis

The second component of the triangulation was a cross-sectional analysis approach which address the following research question in the nation-level study *'Is there difference in presenting characteristics and processing times in ED between culturally and linguistically diverse (CALD) and Australian-born patients?*' TED II was a 2-year cross-sectional analysis of an ED presentation at a specialist referral public metropolitan hospital between 1 July 2012 and 30 June 2014. The total of 6,440 patients were included; 1,241 (18.7%) were CALD patients and 5,399 (81.3%) were Australian patients. This study determined the differences in presenting characteristics, processing times and clinical outcomes in an ED between CALD and Australian patients presenting to an ED with chest pain. Processing times in ED and guideline concordance with three chest pain related standards from the two guidelines were placed as the highlighted outcomes.

In general, there was no significant difference in presenting characteristics between the two groups. However, CALD patients were older than Australian patients (mean±SD; 62± 18.4 years vs 56 ± 19.6 years, $p < 0.001$). CALD were more likely to be nominated 'Triage priority 1 or 2' (64.9% vs 57.8%, $p < 0.001$), but less likely to have been eligible for Medicare (Universal Health Coverage) compared to Australian-born group.

Differences in processing times and guideline concordance

The three processing times in ED (i.e., time to treatment, ATS admission time, and ED stay) were available for comparisons. CALD patients spent equal time to Australian patients waiting for the initial assessment or treatment in ED (median 22.0 (8.0, 66.3) vs 21.0 (7.0, 66.0) minutes, $p = 0.375$). The amount of time waiting for the decision to admit were also statistically equal between the two groups (median 2.8 (1.9, 3.8) vs 2.5 (1.3, 3.7) hours, $p = 0.051$). The findings of TED II demonstrated equity in emergency care provisions for all patients which can imply that there was no sign of racial discrimination in this centre, which is a positive message for health professionals and patients. Regarding sub analyses in patients admitted to cardiac services, CALD patients spent a significantly longer time than Australian group in all stages of emergency care after triage (i.e., waiting to be seen by ED doctor after triage; waiting for doctor decision after the initial of assessment; and waiting for

discharge from ED after the doctor decision). Due to the limited data, the impact of communication/cultural barriers between CALD patients admitted to cardiac services and clinicians on longer processing times cannot be explained by this study. A further qualitative study is recommended to provide a clearer explanation of these longer times.

Guideline concordance was a variable created from the three selected criteria of guidelines for management of chest pain based on available data. The three criteria included: 1) ambulance as the first medical contact; 2) Triage priority 1 or 2; and 3) Time to treatment ≤10 minutes. The two guidelines included the guidelines for management of acute coronary syndrome 2006 (Acute Coronary Syndrome Guidelines Working Group 2006) and the guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments (Australasian college for Emergency Medicine 2013). There was no significant difference in guideline concordance with three chest pain related standards from two guidelines between the two groups (12.5% vs 13.1%, p = 0.556). There were eight variables significantly influenced the concordance with guidelines. The six predictors, including old age; male gender; living far away from hospital; having low socio-economic status; having central chest pain; and presentation at ED during weekend, increased chance of meeting the 'guideline concordance'. By contrast, being CALD patient and presentation at ED during business time deceased chance of concordance with the guidelines. CALD patients were 22% less likely to meet the guideline concordance (OR 0.78, 95% CI, 0.65, 0.96, p=0.015). Guideline concordance in this study involved only three criteria available from the EDIS dataset and this outcomes may not able to provide a fully picture of concordance with guidelines. Further study on entire component of delay in seeking medical care for chest pain is warranted.

TED III: Summary from the medical record review

A retrospective medical record review was the last approach of the triangulation addressing the research question in the community level of TED study *'Is there difference in seeking-care behaviours and clinical outcomes between nine ethnic groups and Australian group?*' The aim of TED III was to determine the differences in care-seeking behaviours between ethnic groups and Australian, and to examine the effect of ethnicity on the delay, particularly decision time.

The medical record reviews were conducted at the same study site as TED II. A total of 607 cases from 74 countries within nine ethnic groups were randomly selected for medical record reviews, including 306 ethnic patients and 301 Australian patients. The nine ethnic groups included; 1) Oceanian; 2) North-West European; 3) Southern and Eastern European; 4) North African and Middle Eastern; 5) South-East Asian; 6) North-East Asian; 7) Southern and Central Asian; 8) People of the Americas; and 9) Sub-Saharan African, based on the Australian Standard Classification of Cultural and Ethnic Groups (Australian Bureau of Statistics 2000). European patients were older while South Asian and Sub-Saharan African were younger than Australian patients, while the remaining ethnic groups showed no significant difference in age compared to the Australian group. There was no significant difference in presenting symptoms, cardiovascular risk profiles and history of previous cardiovascular conditions/treatments between ethnic groups and Australian group, except for health insurance. This study revealed that only European patients were equally access to the Medicare (Universal Health Coverage) compared to Australians, whereas there were proportions of uninsured patients among all remaining ethnic groups. Reciprocal Health Care Agreements between European countries and Australia allow Europeans patients to access health care service in Australia, by contrast the 104-week waiting period for newly migrants before fully access to social benefits policy might stop other ethnic groups to access healthcare.

Regarding the first medical contact, ambulance were equally used as the first medical contact among all ethnic groups with a low rate at less than half in all ethnic groups including Australians. South-East Asian (35.3% vs 10.6%, $p<0.001$) and Sub-Saharan African (26.5% vs 10.6%, $p=008$) were more likely than Australians to see GP as the first medical contact. The ambulance costs which is not covered by Medicare (Universal Health Coverage) could be one of the reasons underneath the ambulance underutilisation among all patients. The future investigation into a low rate of calling ambulance when they experience chest pain for all ethnic groups, including Australian is recommended.

Differences in decision time between ethnic groups and Australian

The median decision time in this study was 2.0 (0.8, 7.9) hours and the median prehospital delay time was 3.7 (1.5, 10.7) hours, which was longer than the recommendation time of one hour (Chew et al. 2016). TED III revealed the association between ethnicity and decision time. Africans, Middle Easterners, and Asians were among the longest delayers. Only one-third or less of all ethnic groups including Australian initiated their attempt to seek care for chest pain within one hour. There were five ethnic groups (the Sub-Saharan African, the North African and Middle Eastern, the South-East Asian, the North-East Asian, and the Oceanian) had a significantly longer decision time compared to Australian group, but only two groups, Sub-Saharan African and South–East Asian, had a significantly longer prehospital delay time than Australians. Sub-Saharan African had the longest median decision time of 4.5 hours, and they also had the longest median prehospital delay time of 6.0 hours. Overall, all ethnic groups including Australians had a longer prehospital delay than the recommendation time of one hour. Interestingly, among these ethnic groups, they were less likely to eligible for Medicare compared to Australians and Europeans, but they were more likely to have language barriers. Also, they had a high proportion of patients who made decision later than four hours. These findings can imply that there were multiple factors involved in the delay in seeking care among patients from different ethnic backgrounds.

The results from multivariate analysis showed that four independent predictors influenced the chance of making decision within one hour. Patients who were Male; or having symptom onset during night time (18.00-5.59); or being active during the event, were more likely to make decision within one hour, whereas, being ethnic patient were 60% less likely to make decision within one hour (95% CI, 0.23, 0.68, p=0.001). These finding supported that to improve the delay in seeking medical care for chest pain, the holistic picture and multiple factors should be addressed. The findings from sub analyses of differences in care seeking behaviours and clinical outcomes between entire ethnic group and Australian demonstrated that readmission rates were higher in entire ethnic group compared to the Australian group. Due to a small sample size of each ethnic group in TED III, sub analysis between individual ethnic groups was not appropriated, therefore a further large-scale study on individual ethnic groups is recommended.

The knowledge emerged from TED III demonstrated that the differences in seeking care for chest pain among CALD patients from difference ethnic background were existed in this study area. The findings supported that patient delay play a vital role in the outcomes; as a result, improving patient delay can contribute to reducing prehospital delay and improving patient's outcomes. Also, the outcomes of TED III confirmed that prehospital delay is a complex process and more than one factors had impact on how patients from different ethnic backgrounds respond differently to chest pain.

Conclusions of Time, Ethnicity and Delay (TED) Study

The Time, Ethnicity, and Delay (TED) study was the research triangulating three distinct approaches to determine the ethnic differences in seeking medical care for chest pain among culturally and linguistically diverse (CALD) populations, and examine relationship between ethnicity and that delay. The findings from TED study were found consistency across the three approaches: a systematic review (TED I); a cross-section analysis of a cohort of emergency department presentations (TED II); and a medical record review (TED III) (Figure 5.1).

The association between ethnicity and a longer delay in seeking medical care for chest pain were found globally and in Australia. According to TED study population, there was no significant difference in presenting characteristics between CALD and Australian patients such as gender, having central chest pain, day and time of presentation to ED, day and time of symptom onset, and cardiovascular risk profiles. However, CALD population were older and less likely to be eligible for the Medicare (Universal Health Coverage) except for the European ethnic groups who were equally insured by Medicare compared to Australian patients. There were ethnic differences in care-seeking behaviours among patients from different ethnic backgrounds. The times taken to initial care-seeking when experiencing chest pain varied across the ethnic groups and were longer than those of Australian patients.

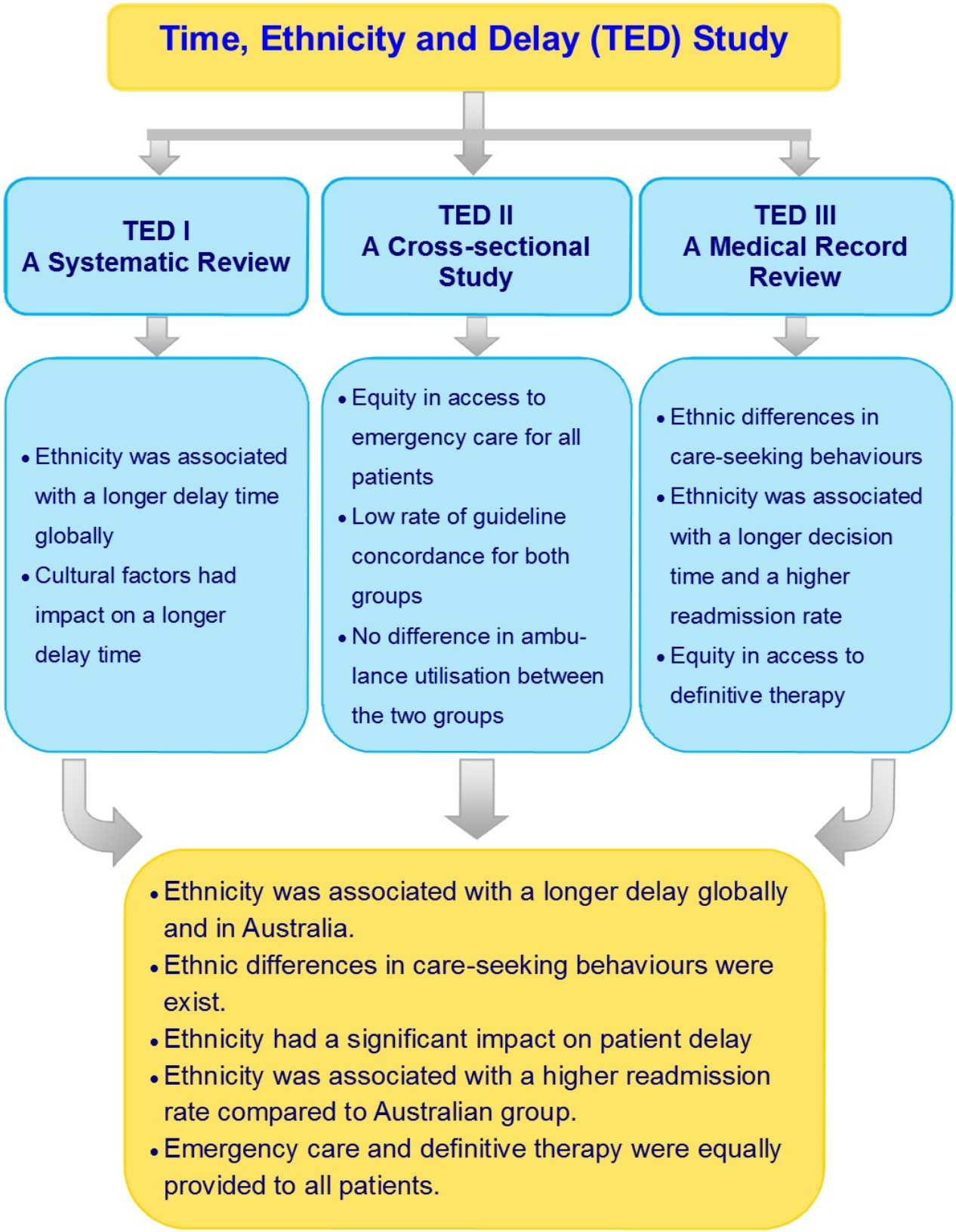


Figure 5.1: Summary of Time, Ethnicity and Delay (TED) study

For all ethnic groups including Australian, they all delayed longer than the recommendation time of one hour, and two-third of patients in all groups initialled their responses to chest pain later than one hour after the symptom onset. Decision time or patient's delay was the major component of prehospital delay time for all ethnic groups including Australian. Ethnicity was found to be a significant factor influencing a longer decision time. Accessing ambulance as the first medical contact was not significantly differ between ethnic groups and Australian, but visiting general practitioners as the first point when experiencing chest pain was significantly higher among ethnic groups compared to Australian patients.

The differences in prehospital delay among patients from different ethnic backgrounds found in TED study can be explained by the theoretical model (Figure 2.2) based on the Common-Sense Model of illness behaviour. The combination of contexts from homeland and Australia influence the responses to chest pain among CALD. The unique of personal context (e.g. age, history of ACS, family history, risk level of ACS, belief) and sociocultural context (e.g. language, culture, family, friends and health care system) of each ethnic group impact on their cognitive and emotional representations of illness which lead to differences in coping actions. Additionally, contexts from Consequently, seeking care behaviour between ethnic groups were presented differently upon their coping and appraisal process such as decision time to seek medical care, ambulance utilisation, contact other health providers (emergency department or family doctor).

By contrast, there was no significant difference in system delay in ED between CALD and Australian patients according to TED II outcomes. The initial treatment in emergency department was equally provided to all patients who presented to ED with chest pain, but CALD patients spent a longer time in ED than the Australian group where the further study for a clearer explanation is recommended. The definitive therapies for ACS (PCI, angiogram) were also equally provided to all patients. There was no difference in concordance with guidelines between CALD and Australian patients, but a low rate of guideline concordance was a matter of considerable concern for health care practice for both populations. These findings demonstrated the equality of access to emergency care and cardiac care and no evidence of racial discrimination in this setting.

Limitations of TED study

There were numbers of limitations of TED study. Firstly, the aim of systematic review was to determine an association; therefore, all included studies in systematic review were observational studies (level 3 evidence), and there was no study of level 1 or 2 of evidence. However, these ten selected studies were large-scale studies in national level. All ten selected studies were conducted in only three countries (Canada, the UK and the USA) of which the findings may not able to be generalised worldwide. Additionally, the inconsistencies in ethnic classifications and outcomes measures between the studies might impact on the findings of each study.

Secondly, data from TED II and TED III were collected from one study site, with which the findings may not appropriate for generalising to the nation population. Nevertheless, study population of TED II was large (6,640 cases), and the proportion of CALD patients reflected the national proportion of CALD population. Data from medical record reviews of TED III were randomly selected from the large population of TED II and involved all ethnic groups in Australia. In addition, data of TED II and TED III were collected over an entire year covering chest pain incidents which may vary between seasons. Due to limitation of PhD project, sample size for each ethnic group in TED III were small, but were achieved 80% of the power analysis. Although TED II and TED III were retrospective studies which may face biases in data selection and data collection such as missing data, the percentage of missing data were very small in both studies (2.5%-5.9%).

Recommendations for practices and research

The outcomes of TED study demonstrated a low rate of concordance with the guidelines for management of acute coronary syndrome and the guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments, and the underutilisation of ambulance among all patients, including Australian patients. The evaluation of effectiveness of health education programs and a thorough investigation into implementation of these standards and guidelines should be considered. The future health agenda in cardiovascular disease should target on culturally and linguistically diverse populations to address the ethnic differences in seeking care. Cultural, social and behavioural factors are recommended to be involved in health educations and public campaigns.

Also, specific strategies of those campaigns for each ethnic community should be considered to address the unique needs of individual ethnic groups. Multilanguage of education resource may enable patients who have limited English to access health information. Developing other forms of resource for education such as mobile phone application, radio program, and community television program and community education sessions, at individual and community levels in languages other than English is also recommended. Finally, integrating cultural competence into practice at all levels of health provisions, including primary care, secondary care, tertiary care and referral system could increase the effectiveness of work in cross-cultural context. Improving appropriate healthcare services and practices for CALD populations will lead to improving of accessibility and equity of cardiac services among these population.

TED study established an essential database for future study in cardiac care for CALD populations. A large-scale research in multiethnic groups focusing on patient's delay is recommended. Multiple centre study in Australia should be conducted in order to generalise the findings to the nationwide. The qualitative study focusing on ethnic differences in care-seeking behaviours which will provide a clearer explanation of their delay is also proposed by the author.

REFERENCE

REFERENCES

Abdelnoor, M, Eritsland, J, Brunborg, C & Halvorsen, S 2012, 'Ethnicity and acute myocardial infarction: risk profile at presentation, access to hospital management, and outcome in Norway', *Vascular health and risk management*, vol. 8, p. 505.

Acute Coronary Syndrome Guidelines Working Group 2006, 'Guidelines for the management of acute coronary syndromes 2006', *Medical Journal of Australia*, vol. 184, no. 8, p. S7.

Alonzo, AA 1984, 'An illness behavior paradigm: A conceptual exploration of a situational-adaptation perspective', *Social Science and Medicine*, vol. 19, no. 5, pp. 499-510.

Alonzo, AA 1986, 'The impact of family and lay others on care-seeking during life-threatening episodes of suspected coronary artery disease', *Social Science and Medicine*, vol. 22, no. 12, pp. 1297-311.

Alshahrani, H, McConkey, R, Wilson, J, Youssef, M & Fitzsimons, D 2013, 'Female gender doubles pre-hospital delay times for patients experiencing ST segment elevation myocardial infarction in Saudi Arabia', *European Journal of Cardiovascular Nursing*, p. 1474515113507159.

Alwan, A 2011, *Global status report on noncommunicable diseases 2010*, WHO, Geneva.

Amsterdam, EA, Wenger, NK, Brindis, RG, Casey, DE, Ganiats, TG, Holmes, DR, Jaffe, AS, Jneid, H, Kelly, RF, Kontos, MC, Levine, GN, Liebson, PR, Mukherjee, D, Peterson, ED, Sabatine, MS, Smalling, RW & Zieman, SJ 2014, '2014 AHA/ACC Guideline for the Management of Patients With Non–ST-Elevation Acute Coronary Syndromes: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines', *Circulation*, vol. 130, no. 25, pp. e344-e426.

Anderson, KO, Green, CR & Payne, R 2009, 'Racial and ethnic disparities in pain: causes and consequences of unequal care', *Journal of Pain*, vol. 10, no. 12, pp. 1187-204.

Antman, E, Bassand, J-P, Klein, W, Ohman, M, Sendon, JLL, Rydén, L, Simoons, M & Tendera, M 2000, 'Myocardial infarction redefined—a consensus document of the Joint European Society of Cardiology/American College of Cardiology committee for the redefinition of myocardial infarction: the Joint European Society of Cardiology/American College of Cardiology Committee', *Journal of the American College of Cardiology*, vol. 36, no. 3, pp. 959-69.

Anyfantakis, ZA, Baron, G, Aubry, P, Himbert, D, Feldman, LJ, Juliard, J-M, Ricard-Hibon, A, Burnod, A, Cokkinos, DV & Steg, PG 2009, 'Acute coronary angiographic findings in survivors of out-of-hospital cardiac arrest', *American Heart Journal*, vol. 157, no. 2, pp. 312-8.

Apple, FS 2009, 'A new season for cardiac troponinassay: it's time to keep a scorecard', *Clinical Chemistry*, vol. 55, no. 7, pp. 1303-6.

Appleby, P, Baigent, C, Collins, R, Flather, M, Parish, S & Peto, R 1994, 'Indications for fibrinolytic therapy in suspected acute myocardial infarction: collaborative overview of early mortality and major morbidity results from all randomised trials of more than 1000 patients', *The Lancet*, vol. 343, no. 8893, pp. 311-22.

Armstrong, PW, Fu, Y, Chang, W-C, Topol, EJ, Granger, CB, Betriu, A, Van de Werf, F, Lee, KL & Califf, RM 1998, 'Acute Coronary Syndromes in the GUSTO-IIb Trial Prognostic Insights and Impact of Recurrent Ischemia', *Circulation*, vol. 98, no. 18, pp. 1860-8.

Atzema, CL, Austin, PC, Huynh, T, Hassan, A, Chiu, M, Wang, JT & Tu, JV 2011, 'Effect of marriage on duration of chest pain associated with acute care myocardial infarction before seeking care', *Canadian Medical Association Journal*, vol. 183, no. 13, pp. 1482-91.

Australasian college for Emergency Medicine 2013, *Guidelines on the implementation of the Australasian triage scale in emergency department*, Australasian college for Emergency Medicine, Melbourne.

Australian Bureau of Statistics 1995, *Year Book Australia*, cat.no. 1301.0, Australian Bureau of Statistics.

Australian Bureau of Statistics 1999, *Standards for statistics on cultural and language diversity*, Australian Bereau of Statistics, Canberra, cat. no. 1289.0.

Australian Bureau of Statistics 2000, *Australian standard classification of cultural and ethnic groups*, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics 2006, *National Aboriginal and Torres Strait Islander Health Survey 2004-05*, cat. no. 4715.0, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics 2011a, *Causes of death* cat.no. 3303.0, ABS, Cannbera.

Australian bureau of Statistics 2011b, *Perspectives on education and traing: social inclusin, 2009*, CAt. 4250.0.55.001, Australian bureau of Statistics.

Australian Bureau of Statistics 2011c, *Standard Australian Classified of Countries (SACC),2011, version 2.2*, cat. no. 1269.0, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics 2011d, *Understanding Migrant Outcomes - Enhancing the Value of Census Data, Australia, 2011*, Australian Bureau of Statistics.

Australian Bureau of Statistics 2012, *Australian Health Survey 2011-2012*, cat. no. 4364.0.55.001, Australian Bureau of Statistics, Canberra.

Australian Bureau of Statistics 2013a, *Migration, Australia, 2011-12 and 2012-2013*, Cat. 3412.0, Australian Bureau of Statistics.

Australian Bureau of Statistics 2013b, *Socio-Economic Indexes for Area (SEIFA) 2011*, cat. no. 2033.0.55.001, Australian Bureau of Statistics.

Australian Bureau of Statistics 2014, *Australian demographic statistics 2014*, cat. no. 3101.0, Australian Bureau of Statistics, Canberra.

Australian bureau of Statistics 2015, *Migration Australia, 2013-2014*, Cat. 3412.0, Australian Bureau of Statistics.

Australian Commission on Safety and Quality in Health Care 2014, *Acute coronary syndromes clinical care standard*, Australian Commission on Safety and Quality in Health Care, Sydney.

Australian Goverment Department of Human Services 2015a, *Multicultural Service Officers*, viewed 29 June 2016, <https://www.humanservices.gov.au/customer/services/centrelink/multicultural-service-officers>.

Australian Goverment Department of Human Services 2015b, *Newly arrived resident's waitng period*, viewed 25 September 2015, <http://www.humanservices.gov.au/customer/enablers/newly-arrived-residents-waiting-period>.

Australian Government Department of Human Services 2015, *Reciprocal Health Care Agreements*, viewed 29 June 2016, <https://www.humanservices.gov.au/customer/services/medicare/reciprocal-health-care-agreements>.

Australian Government Department of Immigration and Border Protection 2013, *Multicultural Language Services Guidelines: for Australian government agencies*, DIBP, viewed May 2015, <https://www.dss.gov.au/sites/default/files/files/foi_disclosure_log/12-12-13/multicultural-lang-services-guidelines.pdf>.

Australian Institute of Health and Welfare 2000, *Australian's health 2000: biennial health report of the Australian Institute of Health and Welfare*, cat. no. 19, AIHW, Canberra.

Australian institute of Health and Welfare 2008, *Health care expenditure on cardiovascular disease 2004-2005*, cat. no. CVD 43, AIHW, Canberra.

Australian Institute of Health and Welfare 2011a, *Cardiovascular Disease: Australian facts 2011*, Cat. no. CVD 53, AIHW, Canberra.

Australian Institute of Health and Welfare 2011b, *Monitoring acute coronary syndrome using national*

hospital data: and information paper on trends and issues, Cat. no. CVD 57, Australian Institute of Health and Welfare, Canberra.

Australian Institute of Health and Welfare 2011c, *National Hospital Morbidity Database 2009/2010*.

Australian Institute of Health and Welfare 2012a, *Australia's Health 2012*, cat. no. 156, AIHW, Canberra.

Australian Institute of Health and Welfare 2012b, *National health data dictionary version 16*, Australian Institute of Health and Welfare, Canberra.

Australian Institute of Health and Welfare 2013, *Australian hospital statistics 2012-13: emergency department care*, Australian Institite of Health and Welfare, Canberra.

Australian Institute of Health and Welfare 2014, *Australian hospital statistics 2013-14: emergency department care*

Health services series no. 58. Cat. no. HSE 153, Australian Institute of Health and Welfare, Canberra.

Ayrik, C, Ergene, U, Kinay, O, Nazli, C, Unal, B & Ergene, O 2006, 'Factors influencing emergency department arrival time and in-hospital management of patients with acute myocardial infarction', *Advances in Therapy*, vol. 23, no. 2, pp. 244-55.

Badcock, D, Kelly, A-M, Kerr, D & Reade, T 2005, 'The Quality of Medical Record Review Studies in the International Emergency Medicine Literature', *Annals of Emergency Medicine*, vol. 45, no. 4, pp. 444-7.

Balarajan, R 1991, 'Ethnic differences in mortality from ischaemic heart disease and cerebrovascular disease in england and Wales', *British Medical Journal*, vol. 302, pp. 560-4.

Banks, AD & Dracup, K 2006, 'Factors associated with prolonged pregospital delay of African-Americans with acute myocardial infarction', *American Journal of Critical Care*, vol. 15, no. 2, pp. 149-57.

Banks, AD & Dracup, K 2007, 'Are there gender differences in the reasons why African Americans delay in seeking medical help for symptoms of an acute myocardial infarction?', *Ethnicity and Disease*, vol. 17, no. 2, p. 221.

Bassand, J-P, Danchin, N, Filippatos, G, Gitt, A, Hamm, C, Silber, S, Tubaro, M & Weidinger, F 2005, 'Implementation of reperfusion therapy in acute myocardial infarction. A policy statement from the European Society of Cardiology', *European Heart Journal*, vol. 26, no. 2733-2741.

Bates, MS 1987, 'Ethnicity and Pain: a biocultural model', *Social Science and Medicine*, vol. 24, no.

1, pp. 47-50.

Beattie, M, Atherton, I, McLennan, B & Lauder, W 2012, 'Compassion or speed, which is a more accurate indicator of healthcare quality in the emergency department from the patients' perspective?'.

Becares, L, Nazroo, J & Stafford, M 2009, 'The buffering effects of ethnic density on experienced rasism and health', *Health & Place*, vol. 15, pp. 700-8.

Begg, S, Vos, T, Barker, B, Stevenson, C, Stanley, L & Lopez, AD 2007, *The burden of disease and injury in Australia 2003*, cat. no. PHE82, AIHW, Canberra.

Beiser, M & Hou, F 2001, 'Language acquisition, unemployment and depressive disorder among Southeast Asian refugees: a 10-year study', *Social Science and Medicine*, vol. 53, pp. 1321-34.

Bekhet, AK & Zauszniewski, JA 2012, 'Methodological triangulation: an approach to understanding data', *Nurse Researcher*, vol. 20, no. 2, pp. 40-3.

Ben-Shlomo, Y, Naqvi, H & Baker, I 2008, 'Ethnic differences in healthcare-seeking behaviour and management for acute chest pain: secondary analysis of the MINAP dataset 2002–2003', *Heart*, vol. 94, no. 3, pp. 354-9.

Berdowski, J, Berg, RA, Tijssen, JGP & Koster, RW 2010, 'Global incidences of out-of-hospital cardiac arrest and survival rates: Systematic review of 67 prospective studies', *Resuscitation*, vol. 81, no. 11, pp. 1479-87.

Berglund, H, Luo, H, Nishioka, T, Fishbein, MC, Eigler, NL, Tabak, SW & Siegel, RJ 1997, 'Highly localized arterial remodeling in patients with coronary atherosclerosis: an intravascul;ar ultrasound study', *Circulation*, vol. 96, pp. 1470-6.

Berry, JW 1997, 'Immigration, acculturation, and adaptation', *Applied psychology*, vol. 46, no. 1, pp. 5-34.

Betancourt, JR, Green, AR & carrillo, JE 2002, *Cultural competence in health care: Emerging frameworks and practical approaches*, 576, The Commonwealth Fund, New York.

Bhatt, Dl & Topol, EJ 2005, 'Embolization as a pathological mechanism', in EJ Topol (ed.), *acute coronary syndromes*, 3rd edn, Marcel Dekker, New York.

Bhopal, RS, Bansal, N, Fischbacher, C, Brown, H, Capewell, S, Health, S & Study, EL 2012, 'Ethnic variations in chest pain and angina in men and women: Scottish Ethnicity and Health Linkage Study of 4.65 million people', *European journal of preventive cardiology*, vol. 19, no. 6, pp. 1250-7.

2010, *Emergency department visits for chest pain pain and abdominal pain: United States 1999-2008*, by Bhuiya, FA & McCaig, LF, National Center for Health Statistics.

Blendon, RJ, Schoen, C, DesRoches, C, Osborn, R & Zapert, K 2003, 'Common concerns amid diverse systems: health care experiences in five countries', *Health Affairs*, vol. 22, no. 3, pp. 106-21.

Boersma, E, Maas, ACP, Deckers, JW & Simoons, ML 1996a, 'Early thrombolytic treatment in acute myocardial infarction: reappraial of the golden hour', *Lancet*, vol. 348, pp. 771-75.

Boersma, E, Maas, ACP, Deckers, JW & Simoons, ML 1996b, 'Early thrombolytic treatment in acute myocardial infarction: reappraisal of the golden hour', *The Lancet*, vol. 348, no. 9030, pp. 771-5.

Bouma, J, Broer, J, Bleeker, J, van Sonderen, E, Meyboom-de Jong, B & DeJongste, M 1999, 'Longer pre-hospital delay in acute myocardial infarction in women because of longer doctor decision time', *Journal of Epidemiology and Community Health*, vol. 53, no. 8, pp. 459-64.

Brach, C & Fraserirector, I 2000, 'Can cultural competency reduce racial and ethnic health disparties? a review and conceptual model', *Medical Care Research and Review*, vol. 57, pp. 181-217.

Bradby, H 2003, 'Describing Ethnicity in Health Research', *Ethnicity and Health*, vol. 8, no. 1, pp. 5-13.

Bradley, EH, Herrin, J, Wang, Y & et al. 2004, 'RAcial and ethnic differences in time to acute reperfusion therapy for patients hospitalized with myocardial infarction', *JAMA*, vol. 292, no. 13, pp. 1563-72.

Braunwald, E, Jones, RH, Mark, DB, Brown, J, Brown, L, Cheitlin, MD, Concanon, CA, Cowan, M, Edwards, C & Fuster, V 1994, 'Diagnosing and Managing unstable angina', *Circulation*, vol. 90, pp. 613-22.

Bray, JE, Stub, D, Ngu, P, Cartledge, S, Straney, L, Stewart, M, Keech, W, Patsamanis, H, Shaw, J & Finn, J 2015, 'Mass Media Campaigns' Influence on Prehospital Behavior for Acute Coronary Syndromes: An Evaluation of the Australian Heart Foundation's Warning Signs Campaign', *Journal of the American Heart Association*, vol. 4, no. 7.

Brener, SJ 2005, 'Facilitated percutaneous coronary intervention for acute myocardial infarction', in EJ Topol (ed.), *Acute coronary syndrome*, 3 rd edn, Marcel Dekker, New York.

Brieger, D, Fox, KAA, FitzGerald, G, Eagle, KA, Buddaj, A, Avezum, A, Granger, C, Costa, B, Anderson, FA & Steg, G 2009, 'Prediting freedom from clinical events in non-ST-elevation acute coronary syndromes: the Global Registry of Acute Coronary Events', *Heart*, vol. 95, pp. 888-94.

Brieger, D, Kelly, A-M, Aroney, C, Tideman, P, Freedman, SB, Chew, D, Ilton, M, carroll, G, Jacobs,

I & Huang, NP 2009, 'Acute coronary syndromes: consensus recommendations for translating knowledge into action', *The Medical journal of Australia*, vol. 191, no. 6, pp. 334-8.

Broome, ME 2000, 'Integrative literature reviews for the development of concepts', *Concept development in nursing: foundations, techniques and applications. Philadelphia: WB Saunders Company*, pp. 231-50.

Brown, AL, Mann, C, Daya, M, Goldberg, RJ, Meischke, H, taylor, J, Smith, K, Osganian, S & Cooper, L 2000, 'Demographic, belief, and situational factors influencing the decosion to utilize emergency medical services among chest pain patients', *Circulation*, vol. 102, pp. 173-8.

Brown, DL, Schneider, DL, Colbert, R & Guss, D 1998, 'Influence of insurance coverage on delays in seeking emergency care in patients with acute chest pain', *The American journal of cardiology*, vol. 82, no. 3, pp. 395-8.

Budoff, MJ, Nasir, K, Mao, S, Tseng, PH, Chau, A, Liu, ST, Flores, F & Blumenthal, RS 2006, 'Ethnic differences of the presence and severity of coronary atherosclerosis', *Atherosclerosis*, vol. 187, no. 2, pp. 343-50.

Bunde, J & Martin, R 2006, 'Depression and prehospital delay in the context of myocardial infarction', *Psychosomatic Medicine*, vol. 68, no. 1, pp. 51-7.

Cameron, L, Leventhal, EA & Leventhal, H 1993, 'Symptom representations and affect as determinants of care seeking in a community-dwelling, adult sample population', *Health Psychology*, vol. 12, no. 3, p. 171.

Campbell, CM, Edwards, RR & Fillingim, RB 2005, 'Ethnic differences in responses to multiple experimental pain stimuli', *Pain*, vol. 113, no. 1, pp. 20-6.

Cannon, CP, Weintraub, WS, Demopoulos, LA, Vicari, R, Frev, MJ, Lakkis, N, Neumann, F-J, Robertson, DH, Delucca, PT, Dibattiste, PM, Gibson, M, Eugene, B & investigators, T-Timi 2001, 'Comparison of early invasive and conservative strategies in patients with unstable coronary syndromes treated with the glycoprotien IIb/IIa inhibitor tirofiban', *The New England Journaal of Medicine*, vol. 344, no. 25, pp. 1879-87.

Canto, JG, Shlipak, MG, Rogers, WJ, Malmgren, JA, Frederick, PD, Lambrew, CT, Ornato, JP, Barron, HV & Kiefe, CI 2000, 'Prevalence, clinical characteistics and mortality among patients with myocardial infarction presenting without chses pain', *The Journal of the American Medical Association*, vol. 283, no. 24, pp. 3223-9.

Canto, JG, Taylor Jr, HA, Rogers, WJ, Sanderson, B, Hilbe, J & Barron, HV 1998, 'Presenting characteristics, treatment patterns, and clinical outcomes of non-black minorities in the National Registry of Myocardial Infarction 2', *American Journal of Cardiology*, vol. 82, no. 9, pp. 1013-8.

Canto, JG, Zalenski, RJ, Omato, JP, Rogers, WJ, Kiefe, CI, Magid, D, Shlipak, MG, Frederick, PD,

Lambrew, CT, Littrell, KA & Barron, HV 2002, 'Use of emergency medical services in acute myocardial infarction and subsequent quality of care: observation from the National Registry of Myocardial Infarction 2', *Circulation*, vol. 106, pp. 3018-23.

Cappuccio, FP, Cook, DG, Atkinson, RW & Strazzullo, P 1997, 'Prevalence, detection, and management of cardiovascular risk factors in different ethnic groups in south London', *Heart*, vol. 78, no. 6, pp. 555-63.

Casey, D & Murphy, K 2009, 'Issues in using methodological triangulation in research: Dympna Casey and Kathy Murphy explore the advantages and disadvantages of using triangulation', *Nurse Researcher*, vol. 16, no. 4, pp. 40-55.

Cassidy, LD, Marsh, GM, Holleran, MK & Ruhl, LS 2002, 'Methodology to improve data quality from chart review in the managed care setting', *American Journal of Managed Care*, vol. 8, no. 9, pp. 787-93.

Centre for Multicultural Youth 2010, *Young people from refugee and migrant backgrounds: some definitions*, <http://cmy.net.au/sites/default/files/publication-documents/Culturally%20and%20linguistically%20diverse%20young%20people-info%20sheet%202010.pdf>.

Chew, DP, Aroney, C, Aylward, PE, Kelly, A-M, White, HD, Tideman, P, Waddell, J, Azadi, L, Wilson, AJ & Ruta, L-AM 2011, '2011 Addendum to the National Heart Foundation of Australia /Cardiac Society of Australia and New Zealand Guidelines for management of acute coronary syndromes (ACS) 2006', *Heart and Lung*, vol. 20, no. 487-502.

Chew, DP, French, J, Briffa, TG, Hammett, CJ, Ellis, CJ, Ranasignhe, I, Allprandi-Costa, BJ, Astley, CM, Turnbull, FM, Lefkovits, J, Redfern, J, Carr, B, Gambie, GD, Lintern, KJ, Howell, TEJ, Parker, H, Tavella, R, Bloomer, SG, Hyun, KK & Brieger, DB 2013, 'Acute coronary syndromes care across Australia and New Zealand: the snapshot ACS study', *Medical Journal of Australia*, vol. 199, pp. 1-7.

Chew, DP, Scott, IA, Cullen, L, French, JK, Briffa, TG, Tideman, PA, Woodruffe, S, Kerr, A, Branagan, M & Aylward, PEG 2016, 'National Heart Foundation of Australia & Cardiac Society of Australia and New Zealand: Australian Clinical Guidelines for the Management of Acute Coronary Syndromes 2016', *Heart, Lung and Circulation*, vol. 25, no. 9, pp. 895-951.

Chew, DPB, Allan, RM, Aroney, CN & Sheerin, NJ 2005, 'National data elements for the clinical management of acute coronary syndromes', *Medical Journal of Australia*, vol. 182, no. 9, pp. S1-S16.

Chin, H & Connolly, D 2008, 'Initial evaluation', in J Graham (ed.), *Acute coronary syndromes*, Oxford University Press, New York.

Chiu, M, Austin, PC, Manuel, DG & Tu, JV 2010, 'Comparison of cardiovascular risk profiles among ethnic groups using population health surveys between 1996-2007', *Canadian Medical Association*

Journal, vol. 182, no. 8, pp. E301-E10.

chiu, M, Austin, pc, Manuel, DG & Tu, JV 2011, 'Cardiovascular risk factor profiles of recent immigrations vs long-term residents od Ontario: a multi-ethnic study', *Canadian Medical Association Journal*, vol. 28, pp. 20-6.

Clark, L, Bellam, S, Shah, A & Feldman, J 1992, 'Analysis of prehospital delay among inner-city patients with symptoms of myocardial infarction: implications for therapeutic intervention', *Journal of the National Medical Association*, vol. 84, no. 11, p. 931.

Clark, RA, Coffee, N, Turner, D, Eckert, K, van Gaans, D, Wilkinson, D, Stewart, S, Tonkin, AM & group, TCAp 2012, 'Application of geographic modeling techniques to quantify spatial access to health services before and after an acute cardiac events', *Circulation*, vol. 125, pp. 2006-14.

Cooper, A, Calvert, N, Skinner, J, Sawyer, L, Sprrow, K, Timmis, A, Turnbull, N, Cotterell, M, Hill, D, Adams, P, Ashcroft, J, Clark, L, Coulden, R, Hemingway, H, James, C, Jarmac, H, Kendall, J, Lewis, P, Smeeth, L & Taylor, J 2010, *Chest pain of recent onset: assessment and diagnosis of recent onset chest pain or discomfort of suspected cardiac origin*, National Clinical Guideline Centre for Acute and Chronic Conditions, London.

Cooper, RS, Simmons, B, Castaner, A, Prasad, R, Franklin, C & Ferlinz, J 1986, 'Survival rates and prehospital delay during myocardial infarction among black persons', *American Journal of Cardiology*, vol. 57, no. 4, pp. 208-11.

Coventry, LL, Bremner, AP, Williams, TA & Celenza, A 2015a, 'The Effect of Presenting Symptoms and Patient Characteristics on Prehospital Delay in MI Patients Presenting to Emergency Department by Ambulance: A Cohort Study', *Heart, Lung and Circulation*, vol. 24, no. 10, pp. 943-50.

Coventry, LL, Bremner, AP, Williams, TA, Celenza, A, Jacobs, IG & Finn, J 2015b, 'Characteristics and Outcomes of MI Patients with and without Chest Pain: A Cohort Study', *Heart, Lung and Circulation*, vol. 24, no. 8, pp. 796-805.

Culic, V, Eterovic, D, Miric, D & Sillic, N 2002, 'Symptom presentation of acute myocardial infarction: influence of sex, age and risk factors', *American Heart Journal*, vol. 144, no. 6, pp. 1012-7.

Cullen, L, Greenslade, JH, Menzies, L, Leong, A, Than, M, Pemberton, C, Aldous, S, Pickering, J, Dalton, E & Crosling, B 2016, 'Time to presentation and 12-month health outcomes in patients presenting to the emergency department with symptoms of possible acute coronary syndrome', *Emergency Medicine Journal*, vol. 33, no. 6, pp. 390-5.

Dassanayake, J, Dharmage, SC, Gurrin, L, Sundararajan, V & Payne, WR 2009, 'Are immigrants at risk of heart disease in Australia: a systematic review', *Australian Health Review*, vol. 33, no. 3, pp. 479-91.

Davis, NE 2005, 'Atherosclerosis- an inflammatory process', *Journal of Insurance Medicine*, vol. 37, pp. 72-5.

de Vreede-Swagemakers, JJ, Gorgels, AP, Dubois-Arbouw, WI, Dalstra, J, Daemen, MJ, van Ree, JW, Stijns, RE & Wellens, HJ 1998, 'Circumstances and causes of out-of-hospital cardiac arrest in sudden death survivors', *Heart*, vol. 79, no. 4, pp. 356-61.

Denzin, NK 1989, *The Research Act: A Theoretical Introduction To Sociological Methods.* , Third edition edn, Prentice Hall, New York.

Department of Immigration and Multicultural Affairs 2001, *The guide: implemeting the standards for statistics on cultural and language diversity*, Department of Immigration and Multicultural Affairs, Canberra.

Derose, KP, Bahney, BW, Lurie, N & Escarce, JJ 2009, 'Immigrants and health care access, quality, and cost', *Medical Care Research and Review*.

Derose, KP, Escarce, JJ & Lurie, N 2007, 'Immigrants and health care: sources of vulnerability', *Health Affairs*, vol. 26, no. 5, pp. 1258-68.

Deshmukh, M, Joseph, MA, Verdecias, N, Malka, ES & LaRosa, JH 2011, 'Acute coronary syndrome: factors affecting time to arrival in diverse urban setting', *Journal of Community Health*, vol. 36, pp. 895-902.

DeVon, HA & Ryan, CJ 2005, 'Chest pain and associated symptoms of acute coronary syndromes', *Journal of Cardiovascular Nursing*, vol. 20, no. 4, pp. 232-8.

Diefenbach, MA & Lebventhal, H 1996, 'The common-sense Model of illness representation: theoretical and practical considerations', *Journal of Social Distress and the Homeless*, vol. 5, no. 1, pp. 11-38.

dos Santos Silva, I 1999, *Cancer epidemeology: principles and methods*, International Agency for Research on Cancer, Lyon.

Dracup, K, Alonzo, AA, Atkins, JM, Bennett, NM, Braslow, A, Clark, LT, Eisenberg, M, Ferdinand, KC, Frye, R & Green, L 1997, 'The physician's role in minimizing prehospital delay in patients at high risk for acute myocardial infarction: recommendations from the National Heart Attack Alert Program', *Annals of Internal Medicine*, vol. 126, no. 8, pp. 645-51.

Dracup, K, McKinley, S, Riegel, B, Moser, DK, Meischke, H, Doering, LV, Davidson, P, Paul, SM, Baker, H & Pelter, M 2009, 'A randomized clinical trial to reduce patient prehospital delay to treatment in acute coronary syndrome', *Circulation: Cardiovascular Quality and Outcomes*, vol. 2, no. 6, pp. 524-32.

Dracup, K, McKinley, SM & Moser, DK 1997, 'Australian patients' delay in response to heart attack symptoms', *Medical Journal of Australia*, vol. 166, pp. 233-6.

Dracup, K & Moser, DK 1991, 'Treatment seeking behavior among those with symptoms and signs of acute myocardial infarction', *Heart and Lung*, vol. 20, no. 5 Pt 2, pp. 570-5.

Dracup, K & Moser, DK 1997, 'Beyond sociodemographics: factors influencing the decision to seek treatment for symptoms of acute myocardial infarction', *Heart and Lung*, vol. 26, no. 4, pp. 253-62.

Dracup, K, Moser, DK, Eisenberg, M, Meischke, H, Alonzo, AA & Braslow, A 1995, 'Causes of delay in seeking treatment for heart attack symptoms', *Social Science and Medicine*, vol. 40, no. 3, pp. 379-92.

Dracup, K, Moser, DK, McKinley, S, Ball, C, Yamasaki, K, Kinm, CJ, Doering, LV & Caldwell, MA 2003, 'An international perspective on the time to treatment for acute myocardial infarction', *Journal of Nursing Scholarship*, vol. 35, no. 4, pp. 317-23.

DuBard, CA, Garrett, J & Gizlice, Z 2006, 'Effect of language on heart attack and stroke awareness among US Hispanics', *American Journal of Preventive Medicine*, vol. 30, no. 3, pp. 189-96.

Eder, C, Fullerton, J, Benroth, R & Lindsay, SP 2005, 'Pragmatic strategies that enhance the reliability of data abstracted from medical records', *Applied Nursing Research*, vol. 18, no. 1, pp. 50-4.

Edwards, CL, Fillingim, RB & Keefe, F 2001, 'Race, ethnicity and pain', *Pain*, vol. 94, no. 2, pp. 133-7.

Engdahl, J, Holmberg, M, Karlson, BW, Luepker, R & Herlitz, J 2002, 'The epidemiology of out-of-hospital ‘sudden’ cardiac arrest', *Resuscitation*, vol. 52, no. 3, pp. 235-45.

Engebretson, J, Mahoney, J & Carlson, ED 2007, 'Cultural competence in the era of evidence-based practice', *Journal of Professional Nursing*, vol. 24, no. 3, pp. 172-8.

Entwistle, VA, Watt, IS, Gilhooly, K, Bugge, C, Haites, N & Walker, AE 2004, 'Assessing patients’ participation and quality of decision-making: insights from a study of routine practice in diverse settings', *Patient Education and Counseling*, vol. 55, no. 1, pp. 105-13.

Eppler, E, Eisenberg, M, Schaeffer, S, Meischke, H & Larson, MP 1994, '911 and emergency department use for chest pain: results of a media campaign', *Annals of Emergency Medicine*, vol. 24, no. 2, pp. 202-8.

Eshah, NF 2013, 'Seeking medical attention among Jordanian patients with acute myocardial infarction', *European Scientific Journal*, vol. 9, no. 21.

Ethnic Communities' Council of Victoria 2012, *ECCV glossary of terms*, Ethnic Communities' Council of Victoria.

Evans, JDW 2012, *Cardiovascular System*, 4th edn, Mosby Elsevier, London.

Federation of Ethnic Communities' Councils of Australia 2015, *Review of Australian research on older people from culturally and linguistically diverse backgrounds*, Federation of Ethnic Communities' Councils of Australia.

Finn, JC, Bett, N, Shilton, TR, Cunningham, C & Thompson, PL 2007, 'Patient delay in responding to symptom of possible heart attack', *Medical Journal of Australia*, vol. 187, pp. 293-8.

Finnegan, JRJ, Meischke, H, Zapka, JG, Leviton, L, Meshack, A, Benjamin-Garner, R, Estabrook, B, Hall, NJ, Schaeffer, S, Smith, C, Weitzman, E, Raczynski, J & Stone, E 2000, 'Patient delay in seeking care for heart attack symptoms: findings from focus groups conducted in five US regions', *Preventive Medicine*, vol. 31, pp. 205-13.

Foody, JM & Nissen, SE 2006, 'The unstable plaque: implications and opportunities for prevention', in JM Foody (ed.), *Preventive cardiology: insight into the prevention and treatment of cardiovascular disease*, 2nd edn, Humana Press, New Jersey.

Foss, C & Ellefsen, B 2002, 'The value of combining qualitative and quantitative approaches in nursing research by means of method triangulation', *Journal of Advanced Nursing*, vol. 40, no. 2, pp. 242-8.

Foster, NE, Bishop, A, Thomas, E, Main, C, Horne, R, Weinman, J & Hay, E 2008, 'Illness perceptions of low back pain patients in primary care: What are they, do they change and are they associated with outcome?', *Pain*, vol. 136, no. 1–2, pp. 177-87.

Fowler, C, Kirschner, M, Van Kuiken, D & Baas, L 2007, 'Promoting self-care through symptom management: A theory-based approach for nurse practitioners', *Journal of the American Academy of Nurse Practitioners*, vol. 19, no. 5, pp. 221-7.

Fox, DM 2005, 'Evidence of evidence-based health policy: the politics of systematic reviews in coverage decisions', *Health Affairs*, vol. 24, no. 1, pp. 114-22.

Fox, KAA, Cokkinos, DV, Deckers, J, Keli, U, Maggioni, A & Steg, G 2000, 'The ENACT study: a pan European survey of acute coronary syndromes', *European Heart Journal*, vol. 21, pp. 1440-9.

Fox, KAA, Goodman, SG, Klein, W, Brieger, D, Steg, PG & Dabbous, O 2002, 'Management of acute coronary syndromes. Variations in practice and outcome: Finding from the Global Registry of Acute Coronary Events (GRACE)', *European Heart Journal*, vol. 23, no. 1177-1189.

Fox, KAA, Steg, PG, Eagle, KA, Goodman, SG, Anderson, FA, granger, C, Flather, MD, Buddaj, A, Quill, A, Gore, JM & the GRACE Investigators 2007, 'Decline in Rates of death and health failure in acute coronary syndromes, 1999-2006', *Journal of the American Medical Association*, vol. 297, pp. 1892-900.

Francis, S & Cornfoot, S 2007, *Multicultural youth in Australia: settlement and transition*, Australian Research Alliance for Children & Youth.

Franzosi, MG, Santoro, E, De Vita, C, Geraci, E, Lotto, A, Maggioni, AP, Mauri, F, Rovelli, F, Santoro, L & Tavazzi, L 1998, 'Ten-Year Follow-Up of the First Megatrial Testing Thrombolytic Therapy in Patients With Acute Myocardial Infarction Results of the Gruppo Italiano per lo Studio della Sopravvivenza nell'Infarto-1 Study', *Circulation*, vol. 98, no. 24, pp. 2659-65.

Frisbie, WP, Cho, Y & Hummer, RA 2001, 'Immigration and the health of Asian and Pacific Islander adults in the United States', *American Journal of Epidemiology*, vol. 153, no. 4, pp. 372-80.

Frobert, O, hansen, H-HT & Falk, E 2005, 'Plaque rupture: pathoanatomical and Bbiomechanical considerations', in Ε9 Τοπολ (ed.), *Acute coronary syndromes*, 3rd edn, Marcel dekker, New York.

Fukuoka, Y, Dracup, K, Rankin, SH, Froelicher, ES, Kobayashi, F, Hirayama, H, Ohno, M & Matsumoto, D 2005, 'Prehospital dealy and independent/independent construal of self among Japanese patients with acute myocardial infarction', *Social Science and Medicine*, vol. 60, pp. 2025-34.

Fung, K & Wong, Y-LR 2007, 'Factors influencing attitudes towards seeking professional help among East and Southeast Asian Imigrants and refugee women', *International Journal of Social Psychiatry*, vol. 53, no. 3, pp. 216-31.

Gadd, M, Johansson, S-E, Sundquist, J & Wändell, P 2006, 'Are there differences in all-cause and coronary heart disease mortality between immigrants in Sweden and in their country of birth? A follow-up study of total populations', *BMC Public Health*, vol. 6, no. 1, p. 102.

Gauld, R, Ikegami, N, Barr, MD, Chiang, T-L, Gould, D & Kwon, S 2006, 'Advanced Asia's health systems in comparison', *Health Policy*, vol. 79, no. 2–3, pp. 325-36.

Gearing, RE, Mian, IA, Barber, J & Ickowicz, A 2006, 'A methodology for conducting retrospective chart review research in child and adolescent psychiatry', *Journal of the Canadian Academy of Child and Adolescent Psychiatry*, vol. 15, no. 3, p. 126.

Gibson, M, Pride, YB, Frederick, PD, Pollack, CV, Canto, JG, Tiefenbrunn, AJ, Weaver, D, Lambrew, CT, French, WJ, Peterson, ED, Roger, WJ & the NRMI Inverstigators 2008, 'Trends in reperfusion strategies, door-to-needle and door-to-balloon times, and in-hospital mortality among infarction enrolled in the National Registry of Myocardial Infarction form 1990-2006', *American Heart Journal*, vol. 156, pp. 1035-44.

Gilbert, EH, Lowenstein, SR, Koziol-McLain, J, Barta, DC & Steiner, J 1996, 'Chart Reviews In Emergency Medicine Research: Where Are The Methods?', *Annals of Emergency Medicine*, vol. 27, no. 3, pp. 305-8.

Gilbert, PA & Khokhar, S 2008, 'Changing dietary habits of ethnic groups in Europe and implications for health', *Nutrition Reviews*, vol. 66, no. 4, pp. 203-15.

Gill, PS, Plumridge, G, Khunti, K & Greenfield, S 2013, 'Under-representation of minority ethnic groups in cardiovascular research: a semi-structured interview study', *Family Practice*, vol. 30, pp. 233-41.

Gilman, SC, Justice, J, Saepharn, K & Charles, G 1992, 'Cross-cultural Medicine: a decade later, use of traditional and modern health services by Laotian refugees', *Western Journal of Medicine*, vol. 157, pp. 310-5.

GISSI 1986, 'Effectiveness of intravenous thrombolytic treatment in acute myocardial infarction. Gruppo Italiano per lo Studio della Streptochinasi nell'Infarto Miocardico (GISSI)', *Lancet*, vol. 1, no. 8478, pp. 397-402.

Giusppe, DL, Suryapranata, H, Ottervanger, JP & Antman, EM 2004, 'Time delay to treatment and mortality in primary angioplasty for acute myocardial infarction: every minute of delay counts', *Circulation*, vol. 109, pp. 1223-5.

Go, AS, Mozaffarian, D, Roger, VL, Benjamin, EJ, Berry, JD, Blaha, MJ, Dai, S, Ford, ES, Fox, CS, Franco, S, Fullerton, HJ, Gillespie, C, Hailpern, SM, Heit, JA, Howard, VJ, Huffman, MD, Judd, SE, Kissela, BM, Kittner, SJ, Lackland, DT, Lichtman, JH, Lisabeth, LD, Mackey, RH, Magid, DJ, Marcus, GM, Marelli, A, Matchar, DB, McGuire, DK, Mohler, ER, Moy, CS, Mussolino, ME, Neumar, RW, Nichol, G, Pandey, DK, Paynter, NP, Reeves, MJ, Sorlie, PD, Stein, J, Towfighi, A, Turan, TN, Virani, SS, Wong, ND, Woo, D & Turner, MB 2014, 'Heart Disease and Stroke Statistics—2014 Update: A Report From the American Heart Association', *Circulation*, vol. 129, no. 3, pp. e28-e292.

Go, AS, Mozaffarian, D, Roger, VL, Benjamin, EJ, Berry, JD, Borden, WB, Bravata, DM, Dai, S, Ford, ES & Fox, CS 2013, 'Heart disease and stroke statistics-2013 update: a report from the American Heart Association', *Circulation*, vol. 127, no. 1, pp. e6-e245.

Goff, DC, Jr, Sellers, DE, McGovern, PG, Meischke, H, Goldberg, RJ, Bittner, V, Hedges, JR, Allender, S, Nichaman, MZ & group, tRs 1998, 'Knowledgeof a heart attack symptomps in a population survey in United states', *Archives of Internal Medicine*, vol. 158, pp. 2329-38.

Goff Jr, DC, Feldman, HA, McGovern, PG, Goldberg, RJ, Simons-Morton, DG, Cornell, CE, Osganian, SK, Cooper, LS & Hedges, JR 1999, 'Prehospital delay in patients hospitalized with heart attack symptoms in the United States: the REACT trial', *American Heart Journal*, vol. 138, no. 6, pp. 1046-57.

Goldberg, RJ, Gurwitz, JH & Gore, JM 1999, 'Duration of, and temporal trends (1994-1997) in, prehospital delay in patients with acute myocardial infarction: the second National Registry of

Myocardial Infarction', *Archives of Internal Medicine*, vol. 159, no. 18, pp. 2141-7.

Goldberg, RJ, Mooradd, M, Gurwitz, JH, Rogers, WJ, French, WJ, Barron, HV & Gore, JM 1998, 'Impact of time to treatment with tissue plasminogen activator on morbidity and mortality following acute myocardial infarction (The second National Registry of Myocardial Infarction)', *The American journal of cardiology*, vol. 82, no. 3, pp. 259-64.

Goldberg, RJ, Spencer, F, Fox, KAA, Brieger, D, Steg, G, Gurfinkel, E, Dedrick, R & Gore, JM 2009, 'Prehospital delay in patients with acute coronary syndromes (from the Global Registry of Acute Coronary Events [GRACE])', *American Journal of Cardiology*, vol. 103, pp. 596-603.

Goldberg, RJ, Steg, PG, Sadiq, I, Granger, C, Jackson, EA, Buddaj, A, Brieger, D, Avezum, A & Goodman, S 2002, 'Extent of, and factors associated with delay to hospital presentation in patients with acute coronary syndrome (The GRACE Registry)', *American Journal of Cardiology*, vol. 89, pp. 791-6.

Goodman, SG, Huang, W, Yan, AT, Buddaj, A, Kennelly, BM, Gore, JM, Fox, KAA, Goldberg, RJ & Anderson, FA 2009, 'The expanded Global Registry of Acute coronary Events: Baseline characteristics, management practices, and hospital outcomes of patients with acute coronary syndromes', *American Heart Journal*, vol. 158, pp. 193-201.e5.

Gough, D, Oliver, S & Thomas, J 2012, *An introduction to syatematic reviews*, SAGE, London.

Greenlund, KJ, Keenan, NL, Giles, WH, Zheng, ZJ, Neff, LJ, Croft, JB & Mensah, GA 2004, 'Public recognition of major signs and symptoms of heart attack: seven states and the US Vigin Islands, 2001', *American Heart Journal*, vol. 147, pp. 1010-6.

Gregory, KE & Radovinsky, L 2012, 'Research strategies that result in optimal data collection from the patient medical record', *Applied Nursing Research*, vol. 25, no. 2, pp. 108-16.

Gupta, M, Tabas, JA & Kohn, MA 2002, 'Presenting complaint among patients with myocardial infarction who present to an urban public hospital emergency department', *Annual of Emergency Medicine*, vol. 40, no. 2, pp. 180-6.

Gushulak, BD & Williams, LS 2004, 'National immigration health policy', *Canadian Journal of Public Health. Revue Canadienne de Santé Publique*, vol. 95, pp. 127-9.

Hagger, MS & Orbell, S 2003, 'A meta-analytic review of the common-sense model of illness representations', *Psychology and Health*, vol. 18, no. 2, pp. 141-84.

Halcomb, EJ & Andrew, S 2005, 'Triangulation as a method for contemporary nursing research', *Faculty of Science, Medicine and Health-Papers*, pp. 71-82.

Hamm, CW, Bassand, J-P, Agewall, S, Bax, J, Boersma, E, Bueno, H, Caso, P, Dudek, D, Gielen,

S, Huber, K, Ohman, M, Petrie, MC, Sonntag, F, Uva, MS, Storey, RF, Wijns, W & Zahger, D 2011, 'ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation The Task Force for the management of acute coronary syndromes (ACS) in patients presenting without persistent ST-segment elevation of the European Society of Cardiology (ESC)', *European heart journal*, vol. 32, no. 42, pp. 2999-3054.

Handoll, HHG & Smith, AF 2003, 'How to perform a systematic review', *Current Anaesthesia and Critical Care*, vol. 14, pp. 251-7.

Hanson, MA, Fareed, MT, Argenio, SL, Agunwamba, AO & Hanson, TR 2013, 'Coronary heart disease', *Primary Care: Clinic in Office Practice*, vol. 40, pp. 1-16.

Hedlund, E, Lange, A & Hammar, N 2007, 'Acute myocardial infarction incidence in immigrants to Sweden. Country of birth, time since immigration, and time trends over 20 years', *European Journal of Epidemiology*, vol. 22, no. 8, pp. 493-503.

Hemsey, JKZ & Drew, BJ 2012, 'Prehospital electrocardiography: a review of literature', *Journal of Emergency Nurses*, vol. 38, pp. 9-14.

Henderson, SO, Magana, R, Korn, CS, Genna, T & Bretsky, P 2001, 'Delayed presentation for care during acute myocardial infarction in a Hispanic population of Los Angeles County', *Ethnicity and Disease*, vol. 12, no. 1, pp. 38-44.

Henriksson, C, Larsson, M, Arnetz, J, Berglin-Jarlov, M, Herlitz, J, Karlsson, J-E, Svensson, L, Thuresson, M, Zedigh, C, Wernroth, L & Lindahl, B 2011, 'Knowledge and attitudes toward seeking medical care for AMI-symptoms', *International Journal of Cardiology*, vol. 147, pp. 224-7.

Henriksson, C, Lindahl, B & Larsson, M 2007, 'Patients' and relatives' thoughts and actions during and after symptom presentation for an acute myocardial infarction', *European Journal of Cardiovascular Nursing*, vol. 6, no. 4, pp. 280-6.

Herlitz, J, Thuresson, M, Svensson, L, Lindqvist, J, Lindahl, B, Zedigh, C & Jarlov, M 2010a, 'Factors of importance for patients's decision time in acute coronary syndrome', *International Journal of Cardiology*, vol. 141, pp. 236-42.

Herlitz, J, WireklintSundström, B, Bång, A, Berglund, A, Svensson, L & Blomstrand, C 2010b, 'Early identification and delay to treatment in myocardial infarction and stroke: differences and similarities', *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*, vol. 18, no. 1, p. 48.

Hess, DR 2004, 'Retrospective studies and chart reviews', *Respiratory Care*, vol. 49, no. 10, pp. 1171-4.

Hitchcock, T, Rossouw, F, McCoubrie, D & Meek, S 2003, 'Observational Study of prehospital delays in patients with chest pain', *Emergency Medicine Journal*, vol. 20, pp. 270-3.

Ho, MT, Eisenberg, M, Litwin, PE, Schaeffer, SM & Damon, SK 1989, 'Delay between onset of chest pain and seeking medical care: the effect of public education', *Annals of Emergency Medicine*, vol. 18, no. 7, pp. 727-31.

Hollander, J & Chase, M 2013, *Evaluation of chest pain in the emergency department*, viewed 5 December 2013, <http://www.uptodate.com/contents/evaluation-of-chest-pain-in-the-emergency-department#H1>.

Holly, C, Salmond, SW & Saimbert, MK 2012, *Comprehensive systematic review for advanced nursing practice*, Springer Publishing Company, New York.

Horne, R, James, D, Petrie, K, Weinman, J & Vincent, R 2000, 'Patient's interpretation of symptoms as a cause of delay in reaching hospital during acute myocardial infarction', *Heart*, vol. 83, pp. 388-93.

Hughes, D & Leethongdee, S 2007, 'Universal coverage in the land of smiles: lessons from Thailand's 30 Baht health reforms', *Health Affairs*, vol. 26, no. 4, pp. 999-1008.

Hugo, G, McDougall, K, Tan, G & Feist, H 2014, 'The CALD youth census report 2014'.

Hutchings, CB, Mann, C, Daya, M, Jui, J, Goldberg, RJ, Cooper, L, Goff, DC, Jr & Cornell, CE 2004, 'Patients with chest pain calling 9-1-1 or self- transportng to reach definitive care: which mode is quicker', *American Heart Journal*, vol. 147, pp. 35-41.

Hyun, K, Redfern, J, Aliprandi-Costa, B, French, J, Gamble, J, Lintern, K, Howell, T, Clark, R, Wechkunanukul, K & Brieger, D 2014, 'Variation in care between English speaking and culturally and linguistically diverse patients in SNAPSHOT ACS', *Global Heart*, vol. 9, no. 1, p. 127.

Jaffery, Z & Grant, AG 2010, 'The diagnostic approach to the cardiac patient with chest pain', in SM Webber (ed.), *Chest pain: causes, diagnosis and treatment*, Nova Science Publishers, New York.

Jansen, ACM, van Aalst-Cohen, ES, Hutten, BA, Büller, HR, Kastelein, JJP & Prins, MH 2005, 'Guidelines were developed for data collection from medical records for use in retrospective analyses', *Journal of Clinical Epidemiology*, vol. 58, no. 3, pp. 269-74.

Jneid, H, Anderson, JL, Wright, RS, Adams, CD, Bridges, CR, Casey, DE, Ettinger, SM, Fesmire, FM, Ganiats, TG & Lincoff, AM 2012, '2012 ACCF/AHA focused update of the guideline for the management of patients with unstable angina/non–ST-elevation myocardial infarction (updating the 2007 guideline and replacing the 2011 focused update): a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines', *Journal of the American College of Cardiology*, vol. 60, no. 7, pp. 645-81.

Johansson, I, Stromberg, A & Awahn, E 2004, 'Factors related to delay times in patients with

suspected acute myocardial infarction', *Heart and Lung*, vol. 33, no. 5, pp. 291-300.

Johnson, RL, Saha, S, Arbelaez, JJ, Beach, MC & Cooper, LA 2004, 'Racial and ethnic differences in patient perceptions of bias and cultural competence in health care', *Journal of General Interal Medicaine*, vol. 19, pp. 101-10.

Jones, A & Bugge, C 2006, 'Improving understanding and rigour through triangulation: an exemplar based on patient participation in interaction', *Journal of Advanced Nursing*, vol. 55, no. 5, pp. 612-21.

Jordan, JE, Buchbinder, R, Briggs, AM, Elsworth, GR, Busija, L, Batterham, R & Osborne, RH 2013, 'The health literacy management scale (HeLMS): a measure of an individual's capacity to seek, understand and use health information within healthcare setting', *Patient Education and Counseling*, vol. 91, pp. 28-235.

Keeley, EC, Boura, JA & Grines, CL 2003, 'Primary angioplasty versus intravenous thrombolytic therapy for acute myocardial infarction: a quantitative review of 23 randomised trials', *Lancet*, vol. 361, pp. 13-20.

Kelaher, M & Manderson, L 2000, 'Migration and mainstreaming: matching health services to immigrants's need in Australia', *Health Policy*, vol. 54, pp. 1-11.

Keller, ML, Leventhal, H, Prohaska, TR & Leventhal, EA 1989, 'Beliefs about aging and illness in a community sample', *Reseearch in Nursing and Health*, vol. 12, pp. 247-55.

Keller, T, Zeller, T, Peetz, D, Tzikas, S, Roth, A, Czyz, E, Bickel, C, Baldus, S, Warnholtz, A, Frohlich, M, Sinning, CR, Eleftheriadis, M, Wild, PS, Schnabel, RB, Lubos, E, Jachmann, N, Genth-Zotz, S, Post, F, Nicaud, V, Tiret, L, Lackner, KJ, Munzel, TF & Blankenberg, S 2009, 'Sensitive troponin I assay in early diagnosis of acute myocardial infarction', *New England Journal of Medicine*, vol. 361, pp. 868-77.

Kendall, H, Marley, A, Patel, JV, Khan, JM, Blann, AD, Lip, GY & Dwivedi, G 2013, 'Hospital delay in South Asian patients with acute ST-elevation myocardial infarction in the UK', *European journal of preventive cardiology*, vol. 20, no. 5, pp. 737-42.

Kentsch, M, Rodemerk, U, Müller-Esch, G, Schnoor, U, Münzel, T, Ittel, T-H & Mitusch, R 2002, 'Emotional attitudes toward symptoms and inadequate coping strategies are major determinants of patient delay in acute myocardial infarction', *Zeitschrift für Kardiologie*, vol. 91, no. 2, pp. 147-55.

Kenyon, LW, Ketterer, MW, Gheorghiade, M & Goldstein, S 1991, 'Psychological factors related to prehospital delay during acute myocardial infarction', *Circulation*, vol. 84, pp. 1969-76.

Khan, A, Kornberg, R & Coven, DL 2008, 'diagnosis and treatment of unstable angina', in MK Hong & E herzog (eds), *Coronary herat disease*, Springer, London.

Khan, KS, Kunz, R, Kleijnen, J & Antes, G 2003, 'Five steps to conducting a systematic review', *Journal of the Royal Society of Medicine*, vol. 96, pp. 118-21.

Khan, MS, Jafary, FH, Faruqui, AM, Rasool, SI, Hatcher, J, Chaturvedi, N & Jafar, TH 2007, 'High prevalence of lack of knowledge of symptoms of acute myocardial infarction inPakistan and its contribution to delayed presentationto the hospital', *BMC Public Health*, vol. 7, no. 1, p. 284.

Khattar, RS, Swales, JD, Senior, R & Lahiri, A 2000, 'Racial variation in cardiovascular morbidity and mortality in essencial hypertension', *Heart*, vol. 83, pp. 267-71.

Khraim, FM & Carey, MG 2009, 'Predictors of pre-hospital delay among patients with acute myocardial infarction', *Patient Education and Counseling*, vol. 75, pp. 155-61.

Khraim, FM, Scherer, YK, Dorn, JM & Carey, MG 2009, 'Predictors of decision delay to seeking health care among Jordanians with acute myocardial infarction', *Journal of Nursing Scholarship*, vol. 41, no. 3, pp. 260-7.

Kimchi, J, Polivka, B & Stevenson, JS 1991, 'Triangulation: operational definitions', *Nursing Research*, vol. 40, no. 6, pp. 364-6.

King-Shier, KM 2015, 'Cardiovascular care research for immigrant or ethnic groups', *European Journal of Cardiovascular Nursing*, p. 1474515115613889.

King-Shier, KM, Singh, S, LeBlanc, P, Mather, CM, Humphrey, R, Quan, H & Khan, NA 2015, 'The influence of ethnicity and gender on navigating an acute coronary syndrome event', *European Journal of Cardiovascular Nursing*, vol. 14, no. 3, pp. 240-7.

King, KB & McQuire, MA 2007, 'Symptom presentation amd time to seek care in women and men with acute myocardial infarction', *Heart and Lung*, vol. 36, pp. 235-43.

King, KM, Khan, NA & Quan, H 2009, 'Ethnic variation in acute myocardial infarction presentation and access to care', *American Journal of Cardiology*, vol. 103, no. 10, pp. 1368-73.

Kirchik, O, Gingras, Y & Larivière, V 2012, 'Changes in publication languages and citation practices and their effect on the scientific impact of Russian science (1993–2010)', *Journal of the American Society for Information Science and Technology*, vol. 63, no. 7, pp. 1411-9.

Kirkman-Liff, B & Mondragón, D 1991, 'Language of interview: relevance for research of southwest Hispanics', *American Journal of Public Health*, vol. 81, no. 11, pp. 1399-404.

Klingler, D, Green-Weir, R, Nerenz, D, Havstad, S, Rosman, HS, Cetner, L, Shah, S, Wimbush, F & Borzak, S 2002, 'Percecption of chest pain differ by race', *American Heart Journal*, vol. 144, pp. 51-

9.

Kopec, G, Sobien, B, Podolec, M, Dziedzic, H, Zarzecka, J, Loster, B, Pajak, A & Podolec, P 2010, 'Knowledge of a patient-dependent phase of acute myocardial infarction in Polish adults: The role of physician's advice', *European Journal of Public Health*, vol. 21, pp. 603-8.

Krairtchareon, N, Lekutai, S, Pongthavornkamol, K & Satayawiwat, W 2010, 'Factors influencing the decision making to seek treatment of pateint with acute myocardial infarction', *Journal of Nursing Science*, vol. 28, no. 2, pp. 49-57.

Kritharides, L & Lowe, HC 2011, 'Pathophysiology of atherosclerosis', in PL Thompson (ed.), *Coronary care manual*, Churchill Livingstone, NSW.

Kumar, A & Cannon, CP 2009, '

Acute coronary syndromes: diagnosis and management, part 1', *Mayo Clinic Proceedings*, vol. 84, no. 10, pp. 917-38.

Lachin, JM 2000, *Biostatistical Methods*, John Wiley & Sons, New York.

Lancellotti, K 2008, 'Culture care theory: a framework for expanding awareness of diversity and racism in nursing education', *Journal of Professional Nursing*, vol. 24, no. 3, pp. 179-83.

Lauer, MA 2006, 'Inflammation and infection in coronary artery disease', in JM Foody (ed.), *Preventive cardiology: insight into the prevention and treatment of cardiovascular disease*, Humana, New Jersey.

Lavis, J, Davies, H, Oxman, A, Denis, J-L, Golden-Biddle, K & Ferlie, E 2005, 'Towards systematic reviews that inform health care management and policy-making', *Journal of Health Services Research and Policy*, vol. 10, no. suppl 1, pp. 35-48.

Lebrun, LA 2012, 'Effects of length of stay and language proficiency on health care experiences among Immigrants in Canada and the United States', *Social Science and Medicine*, vol. 74, no. 7, pp. 1062-72.

Lee, H, Bahler, R, Chung, C, Alonzo, A & Zeller, RA 2000, 'Prehospital delay with myocardial infarction: The interactive effect of clinical symptoms and race', *Applied Nursing Research*, vol. 13, no. 3, pp. 125-33.

Leininger, MM 2006, 'Culture care diversity and universality theory and evolution of the ethnonursing method', in M Leininger & MM McFarland (eds), *Culture care diversity and universality: a worldwide nursing theory*, 2 nd edn, Jones and Bartlett Publishers, Sudbury.

Lesneski, L & Morton, P 2000, 'Delay in seeking treatment for acute myocardial infarction: why?',

Jornal of Emergency Nursing, vol. 26, pp. 125-9.

Lesser, ML 2012, 'Design and interpretation of observational studies: cohort, case control and cross-sectional designs', in PG Supino & JS Boere (eds), *Principle of research methodology: a guide for clinical investigators*, Springer, Dordrecht

Levental, H, Nerenz, DR & Steele, DJ 1984, 'Illness representations and coping with health threats', in A Baum, SE Taylor & JE Singer (eds), *Handbook of psychology and health*, Lawrence Erlbaum, Hillsdale, vol. IV.

Leventhal, H 1970, 'Finding and theory in the study of fear communications', *Advances in Experimantal Social Psychology*, vol. 5, pp. 119-86.

Leventhal, H & Cameron, L 1987, 'Behavioral theories and the problem of compliance', *Patient Education and Counseling*, vol. 10, pp. 117-38.

Leventhal, H, Leventhal, EA & Contrada, RJ 1998, 'Self-regulation, health, and behavior: A perceptual-cognitive approach', *Psychology and Health*, vol. 13, no. 4, pp. 717-33.

Leviton, LC, Finnegan, JRJ, Zapka, JG, Meischke, H, Estabrook, B, Gilliland, J, Linares, A, Weitzman, E, Raczynski, J & Stone, E 1999, 'Formative research methods to understand patient and provider responses to heart attack symptoms', *Evaluation and Program Planning*, vol. 22, pp. 385-97.

Liamputtong, P & Naksook, C 2003, 'Life as motherin a new land: the experience of motherhood among Thai women in Australia', *Health Care for Women International*, vol. 24, pp. 650-68.

Liao, L, Whellan, DJ, Tabuchi, K & Schulman, KA 2004, 'Differences in care-seeking behavior for acute chest pain in the United States and Japan', *American Heart Journal*, vol. 147, no. 4, pp. 630-5.

Lira, RPC, Vieira, RMC, Gonçalves, FA, Ferreira, MCA, Maziero, D, Passos, THM & Arieta, CEL 2013, 'Influence of English language in the number of citations of articles published in Brazilian journals of Ophthalmology', *Arquivos Brasileiros de Oftalmologia*, vol. 76, pp. 26-8.

Løvlien, M, Schei, B & Hole, T 2007, 'Prehospital delay, contributing aspects and responses to symptoms among Norwegian women and men with first time acute myocardial infarction', *European Journal of Cardiovascular Nursing*, vol. 6, no. 4, pp. 308-13.

Lozzi, L, Carstensen, S, Rasmussen, H & Nelson, G 2005, 'Why do acute myocardial infarction patients not call an ambulance? An interview with patients presenting to hospital with acute myocardial infarction symptoms', *Internal Medicine Journal*, vol. 35, pp. 668-71.

Lu, HT & Nordin, RB 2013, 'Ethnic differences in the occuence of acute coronary syndrome: results

of the Malasian National Cardiovascular Disease (NCVD) Database Registry (March 2006- February 2010)', *BMC Cardiovascular Disorders*, vol. 13, no. 97.

Luepker, RV, Raczynski, J, Osganian, S, Goldberg, RJ, Finnegan, JRJ, Hedges, JR, Goff, DC, Jr, Eisenberg, M, Zapka, JG, Feldman, HA, Labarthe, DR, McGovern, PG, Cornell, CE, Proschan, MA & Simons-Morton, D 2000, 'Effect of a community intervention on patient delay and emergency medical service use in acute coronary heart disease: the Rapid Early Action for Coronary Treatment (REACT) Trial', *Journal of the American Medical Association*, vol. 284, no. 1, pp. 60-7.

Mackay, MH, Ratner, PA, Nguyen, M, Percy, M, Galdas, P & Grunau, G 2014, 'Inconsistent measurement of acute coronary syndrome patients' pre-hospital delay in research: A review of the literature', *European Journal of Cardiovascular Nursing*, p. 1474515114524866.

Manheimer, E & Berman, B 2005, 'Exploring, Evaluating, and Applying the Results of Systematic Reviews of CAM Therapies', *Journal of Science and Healing*, vol. 1, no. 3, pp. 210-4.

Manuel, DG, Leung, M & Nguyen, Kea 2003, 'Burden of Cardiovascular disease in Canada', *Canada Journal Cardiology*, vol. 19, no. 9, pp. 997-1004.

Mason, S, Hussain-Gambles, M, Leese, B, Atkin, K & Brown, J 2003, 'Representation of South Asian people in randomised clinical trials: analysis of trials' data', *BMJ*, vol. 326, no. 7401, pp. 1244-5.

Mathers, C, Fat, DM & Boerma, JT 2008, *The global burden of disease: 2004 update*, WHO, Geneva.

Mathers, CD & Loncar, D 2006, 'Projections of global burned of disease from 2020 to 2030', *PLoS Medicine*, vol. 3, no. 11, pp. 2011-30.

McAndrew, LM, Musumeci-Szabó, TJ, Mora, PA, Vileikyte, L, Burns, E, Halm, EA, Leventhal, EA & Leventhal, H 2008, 'Using the common sense model to design interventions for the prevention and management of chronic illness threats: from description to process', *British Journal of Health Psychology*, vol. 13, no. 2, pp. 195-204.

McFarland, MM & Eipperle, MK 2008, 'Culture care theory: a proposed practice theory guide for nurse practioners in primary care setting', *Contemporary Nurse*, vol. 28, pp. 48-63.

McGinn, AP, Rosamond, WD, Goff, DC, Jr, Taylor, HA, Miles, JS & Chambless, L 2005, 'Trends in prehospital delay time and use of emergency medical services foe acute myocardial infarction: experience in 4 US communities from 1987-2000', *American Heart Journal*, vol. 150, pp. 392-400.

McKee, G, Mooney, M, O'Donnell, S, O'Brien, F, Biddle, MJ & Moser, DK 2013, 'Multivariate analysis of predictors of pre-hospital delay in acute coronary syndrome', *International Journal of Cardiology*, vol. 168, no. 3, pp. 2706-13.

Mckeever, LS & Enger, EL 2001, 'Pathophysiology of the acute coronary syndrome', in R Pifarre &

PJ Scanlon (eds), *Evidence-based management of the acute coronary syndrome*, Hanley & Belfus, Philadelphia.

McKinley, S, Aitken, LM, Marshall, AP, Buckley, T, Baker, H, Davidson, PM & Dracup, K 2011, 'Delays in presentation with acute coronary syndrome in people with coronary artery disease in Australia and New Zealand', *Emergency Medicine Australasia*, vol. 23, no. 2, pp. 153-61.

McKinley, S, Dracup, K, Moser, DK, Ball, C, Yamasaki, K, Kim, CJ & Barnett, M 2004, 'International comparison of factors associated with delay in presentation for AMI treatment', *European Journal of Cardiovascular Nursing*, vol. 3, no. 3, pp. 225-30.

McKinley, S, Fien, M, Riegel, B, Meischke, H, AbuRuz, ME, Lennie, TA & Moser, DK 2012, 'Complications after acute coronary syndrome are reduced by perceived control of cardiac illness', *Journal of Advanced Nursing*, vol. 68, no. 10, pp. 2320-30.

McKinley, SM, Moser, DK & Dracup, K 2000, 'Treatment-seeking behavior for acute myocardial infarction symptoms in North America and Australia', *Heart and Lung*, vol. 29, no. 4, pp. 237-47.

McLean, K & Moran, JF 2001, 'Clinical presentation and diagnosis (including triggering)', in R Pifarre & PJ Scanlon (eds), *Evidence-based management of the acute coronary syndrome*, Henley & Belfus, Philadelphia.

McManus, DD, Gore, JM, Yarzebski, J, Spencer, F, Lessard, D & Goldberg, RJ 2011, 'Recent trends in the incidence, treatment, and outcomes of patients with STEMI and NSTEMI', *American Journal of Medicine*, vol. 124, pp. 40-7.

McSweeney, JC, Lefler, LL, Fischer, EP, Naylor Jr, AJ & Evans, LK 2007, 'Women's prehospital delay associated with myocardial infarction: does race really matter?', *Journal of Cardiovascular Nursing*, vol. 22, no. 4, pp. 279-85.

Meischke, H, Eisenberg, MS & Larsen, MP 1993, 'Prehospital delay interval for patients who use emergency medical services: the effect of heart-related medical conditions and demographic variables', *Annals of Emergency Medicine*, vol. 22, no. 10, pp. 1597-601.

Meischke, H, Eisenberg, MS, Schaeffer, SM, Larsen, MP & Henwood, DK 1994, 'Impact of direct mail intervention on knowledge, attitudes, and behavioral intentions regarding use of emergency medical services for symptoms of acute myocardial infarction', *Evaluation and the Health Professions*, vol. 17, no. 4, pp. 402-17.

Meischke, H, Ho, MT, Eisenberg, M, Schaeffer, SM & Larson, MP 1995, 'Reasons patients with chest pain delay or do not call 911', *Annals of Emergency Medicine*, vol. 25, no. 2, pp. 193-7.

Mendis, S, Nordet, P, Fernandez-Britto, J & Sternby, N 2005, 'Atherosclerosis in children and young adults: an overview of the World Health Organisation and international society and federation of cardiology study on pathobiological determinants od atherosclerosis in youth study', *Prevention and*

Control, vol. 1, pp. 3-15.

Mendis, S, Puska, P & Norrving, B 2011, *Global atlas on cardiovascular disease prevention and control*, Worls Health Organisation, Geneva.

Meshack, AF, Goff, DC, Chan, W, Ramsey, D, Linares, A, Reyna, R & Pandey, D 1998, 'Comparison of reported symptoms of acute myocardial infarction in Mexican Americans versus non-Hispanic whites (the Corpus Christi Heart Project)', *American Journal of Cardiology*, vol. 82, no. 11, pp. 1329-32.

Mittal, S 2005, *Coronary heart disease in clinical pratice*, Springer, London.

Moher, D, Liberati, A, Tetzlaff, J, Altman, DG & The Prisma Group 2009, 'Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement', *PLoS Medicine*, vol. 6, no. 7, p. e1000097.

Moher, D, Shamseer, L, Clarke, M, Ghersi, D, Liberati, A, Petticrew, M, Shekelle, P, Stewart, LA & Group, P-P 2015, 'Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement', *Systematic Reviews*, vol. 4, no. 1, p. 1.

Montgomery, SL 2013, *Does science need a global language?: English and the future of research*, University of Chicago Press.

Mooney, M, McKee, G, Fealy, G, O' Brien, F, O'Donnell, S & Moser, D 2014, 'A Randomized Controlled Trial to Reduce Prehospital Delay Time in Patients With Acute Coronary Syndrome (ACS)', *Journal of Emergency Medicine*, vol. 46, no. 4, pp. 495-506.

Morabia, A 2004, *A history of epidemiologic methods and concepts*, Springer.

Morrow, DA, Antman, EM, Charlesworth, A, Cairns, R, Murphy, SA, Lemos, JA, de, Giugliano, RP, MaCabe, CH & Braunwald, E 2000, 'TIMI risk score for ST-elevation Myocardial infarction: a convenient, bedside, clinical score for assessment at presentation', *Circulation*, vol. 102, pp. 2031-7.

Moser, DK, Kimble, LP, Alberts, MJ, Alonzo, AA, Croft, JB, Dracup, K, Evenson, KR, Go, AS, Hand, MM, Kothari, RU, Mensah, GA, Morris, DL, Pancioli, AM, Riegel, B & Zerwic, JJ 2006, 'Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke: a scientific statement from thye American Heart Association Council on cardiovascular nursing and stroke council', *Circulation*, vol. 114, pp. 168-82.

Moser, DK, McKinley, SM, Dracup, K & Chung, ML 2005, 'Gender differntes in reasons patients delay in seeking treatment for acute myocardial infarction symptoms', *Patient Education and Counseling*, vol. 56, pp. 45-54.

Moss, AJ & Goldstein, S 1970, 'The pre-hospital phase of acute myocardial infarction', *Circulation*, vol. 41, no. 5, pp. 737-42.

Motalebi, SA & Iranagh, JA 2013, 'Patients delay in seeking medical care for acute myocardial infarction symptoms', *Rawal Medical Journal*, vol. 38, no. 2, pp. 109-12.

Mountain, D & Thompson, PL 2011, 'Acute coronary syndromes: emergency department care', in PL Thompson (ed.), *Coronary care manual*, 2 nd edn, Churchill Livingstone, Sydney.

Mozaffarian, D, Benjamin, EJ, Go, AS, Arnett, DK, Blaha, MJ, Cushman, M, de Ferranti, S, Despres, JP, Fullerton, HJ, Howard, VJ, Huffman, MD, Judd, SE, Kissela, BM, Lackland, DT, Lichtman, JH, Lisabeth, LD, Liu, S, Mackey, RH, Matchar, DB, McGuire, DK, Mohler, ER, 3rd, Moy, CS, Muntner, P, Mussolino, ME, Nasir, K, Neumar, RW, Nichol, G, Palaniappan, L, Pandey, DK, Reeves, MJ, Rodriguez, CJ, Sorlie, PD, Stein, J, Towfighi, A, Turan, TN, Virani, SS, Willey, JZ, Woo, D, Yeh, RW & Turner, MB 2015, 'Heart disease and stroke statistics--2015 update: a report from the American Heart Association', *Circulation*, vol. 131, no. 4, pp. e29-322.

Mullan, RJ, Flynn, DN, Carlberg, B, Tleyjeh, IM, Kamath, CC, LaBella, ML, Erwin, PJ, Guyatt, GH & Montori, VM 2009, 'Systematic reviewers commonly contact study authors but do so with limited rigor', *Journal of Clinical Epidemiology*, vol. 62, no. 2, pp. 138-42.

Mulrow, CD 1994, 'Rationale for systematic reviews', *British Medical Journal*, vol. 309, no. 6954, p. 597.

Multicultural SA 2013a, *South Australia's diversity*, Multicultural SA.

Multicultural SA 2013b, *Summary overview of SA population*, Multicultural SA.

Mumford, AD, Warr, KV, Owen, SJ & Fraser, AG 1999, 'Delay by patients in seeking treatment for acute chest pain: implication for achieving eariler thrombolysis', *Postgraduate Medical Journal*, vol. 75, pp. 90-5.

Murray, MD, Smith, FE, Fox, J, Teal, EY, Kesterson, JG, Stiffler, TA, Ambuehl, RJ, Wang, J, Dibble, M & Benge, DO 2003, 'Structure, functions, and activities of a research support informatics section', *Journal of the American Medical Informatics Association*, vol. 10, no. 4, pp. 389-98.

Mussi, FC, Mendes, AS, Queiroz, TLd, Costa, ALS, Pereira, Á & Caramelli, B 2014, 'Pre-hospital delay in acute myocardial infarction: judgement of symptoms and resistance to pain', *Revista da Associacao Medica Brasileira*, vol. 60, no. 1, pp. 63-9.

Nam, J-m 1992, 'Sample Size Determination for Case-Control Studies and the Comparison of Stratified and Unstratified Analyses', *Biometrics*, vol. 48, pp. 389-95.

National Centre for Classification in Health 2008, *The International Statistical Classification of*

Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM) 6th ed, National Centre for Classification in Health, Sydney, Australia.

National Clinical Guideline Center 2010, *Quick reference quide: unstable angina and NSTEMI*, Clinical Guideline 94, Royal College of Physicians, London.

National Clinical Guideline Center 2013, *Myocardial Infarction with ST-Segment Elevation: The acute management of myocardial infarction with ST-segment elevation*, Royal College of Physicians, London.

National Health and Medical Research Council 1999, *Guide to the Development, Implementation and Evaluation of Clinical Practice Guidelines*, vol. 88, National Health and Medical Research Council 88

Canberra.

National Health and Medical Research Council 2006, *Cultural Competency in health: a guide for policy, partnership and participation*, National Health and Medical Research Council, Canberra.

National Health and Medical Research Council, Australian Research Council & Committee, AV-Cs 2007, *National statement on ethical conduct in human research (updated March 2014)*, National Health and Medical Research Council, Canberra.

National Health and Medical Rresearch Council 2006, *Cultural competency in health: a guide for policy partnership and participation*, National Health and Medical Rresearch Council, Canberra.

National Health Performance Committee 2011, *National report on health sector performance indicators 2001- a report to the Australian Health Minister's Conference.*, New South Wales Health Department, Sydney.

National Heart Foundation of Australia 2008, *Summary report from the national acute coronary syndromes implematation forum*, National Heart Foundation, melbourne.

National Heart Foundation of Australia 2009a, *Heart Attack Action Plan*, viewed 10 October 2014, <http://heartfoundation.org.au/your-heart/heart-attack-warning-signs>.

National Heart Foundation of Australia 2009b, *Implementation of acute coronary syndromes guidelines in Australia*.

National Heart Foundation of Australia 2012, *A system of care for STEMI: reducing time to reperfusion for patients with ST-segment elevation myocardial infarction*, National Heart Foundation of Australia, Canberra.

National Vascular Disease Prevention Alliance 2012, *Guideline for the management of absolute*

cardiovascular disease risk, NHMRC, Canberra.

Newman, MAJ & Taggart, D 2011, 'Coronary artery bypass graft surgery', in PL Thompson (ed.), *Coronary manual care*, 2 nd edn, Churchill Livingstone, Sydney.

Nguyen, HL, Saczynski, JS, Gore, JM & Goldberg, RJ 2010, 'Age and sex differences in duration of prehospital delay in patients with acute myocardial infarction a systematic review', *Circulation: Cardiovascular Quality and Outcomes*, vol. 3, no. 1, pp. 82-92.

Nichol, G, Thomas, E, Callaway, CW & et al. 2008, 'Regional variation in out-of-hospital cardiac arrest incidence and outcome', *Journal of the American Medical Association*, vol. 300, no. 12, pp. 1423-31.

Nichols, M, Peterson, K, Alston, L & Allender, S 2014a, *Australian heart disease statistics 2014*, National Heart Foundation of Australia, Melbourne.

Nichols, M, Townsend, N, Scarborough, P & Rayner, M 2014b, 'Cardiovascular disease in Europe 2014: epidemiological update', *European Heart Journal*, vol. 35, no. 42, pp. 2950-9.

Niska, R, Bhuiya, F & Xu, J 2010, 'National hospital ambulatory medical care survey: 2007 emergency department summary', *Natl Health Stat Report*, vol. 26, no. 26, pp. 1-31.

Noureddine, S, Adra, M, Arevian, M, Dumit, NY, Puzantian, H, Shehab, D & Abchee, A 2006, 'Delay in seeking health care for acute coronary syndromes in a Lebanese sample', *Journal of Transcultural Nursing*, vol. 17, no. 4, pp. 341-8.

O'Brien, F, O'Donnell, S, Mckee, G, Mooney, M & Moser, DK 2012, 'Knowledge, attitudes, and beliefs about acute coronary syndrome in patients diagnosed with ACS: an Irish cross-sectional study', *European Journal of Cardiovascular Nursing*, vol. 12, no. 2, pp. 201-8.

O'Gara, PT, Kushner, FG, Ascheim, DD, Casey, DE, Chung, MK, De Lemos, JA, Ettinger, SM, Fang, JC, Fesmire, FM & Franklin, BA 2013a, '2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction: Executive Summary: A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines', *Circulation*, vol. 127, no. 4, pp. 529-55.

O'Gara, PT, Kushner, FG, Ascheim, DD, Casey, DE, Chung, MK, de Lemos, JA, Ettinger, SM, Fang, JC, Fesmire, FM, Franklin, BA, Granger, CB, Krumholz, HM, Linderbaum, JA, Morrow, DA, Newby, LK, Ornato, JP, Ou, N, Radford, MJ, Tamis-Holland, JE, Tommaso, CL, Tracy, CM, Woo, YJ & Zhao, DX 2013b, '2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction: Executive SummaryA Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines', *Journal of the American College of Cardiology*, vol. 61, no. 4, pp. 485-510.

Omariba, DWR 2015, 'Immigration, ethnicity, and avoidable mortality in Canada (vol 20, pg 409,

2015)', *Ethnicity and Health*, vol. 20, no. 4, pp. 409-36.

Ottesen, MM, Diaxen, U, Torp-Pederson, C & Kober, L 2004, 'Prehospital delay in acute coronary syndrome- an anlysis of the components of delay', *International Journal of Cardiology*, vol. 96, pp. 97-103.

Ottesen, MM, Kober, L, Jorgensen, S, Torp-Pedersen, C & group, tTs 1996, 'Determinants of delay between symptoms and hospital admission in 5978 patients with acute myocardial infarction', *European Heart Journal*, vol. 17, pp. 429-37.

Page, A, Lane, A, Taylor, R & Dobson, A 2012, 'Trends in socioeconomic inequalities in mortality from ischaemic heart disease and stroke in Australia 1979-2006', *European journal of preventive cardiology*, vol. 19, no. 6, pp. 1281-9.

Panacek, EA 2007, 'Performing chart review studies', *Air Medical Journal*, vol. 26, no. 5, pp. 206-10.

Panjrath, G, Josephson, EB & Herzog, E 2008, 'Evaluation in the emergency department and cardiac biomarkers', in MK Hong & E Herzog (eds), *Coronary heart disease*, springer, London.

Parsonage, WA, Cullen, L & Younger, JF 2013, 'The approach to patients with possible cardiac chest pain', *Medical Journal of Australia*, vol. 199, no. 1, pp. 1-5.

Patel, M, Dunford, JV, Aquilar, S, Castillo, E, Patel, E, Fisher, R, Ochs, G & Mahmud, E 2012, 'Pre-hospital electrocardiography by emergency medical personnel', *Journal of the American College of Cardiology*, vol. 60, no. 9, pp. 806-11.

Pattenden, J, Watt, I, Lewin, RJ & Stanford, N 2002a, 'Decision making processes in people with symptoms of acute myocardial infarction: qualitative study', *British Medical Journal*, vol. 324, no. 7344, p. 1006.

Pattenden, J, Watt, I, lewin, RJP & Stanford, N 2002b, 'Decision making process in people with symptoms of acute myocardial infarction: qualitative study', *British Medical Journal*, vol. 324, no. 7344, p. 1006.

Pearson, A 2004, 'Balancing the evidence: incorporating the systhesis of qualitative data into systematic reviews', *JBI reports*, vol. 2, pp. 45-64.

Pearson, A, Wiechula, R & Lockwood, C 2005, 'The JBI model of evidence-based healthcare', *International Journal of evidence based healthcare*, vol. 3, pp. 207-15.

Peng, YG, Feng, JJ, Guo, LF, Li, N, Liu, WH, Li, GJ, Hao, G & Zu, XL 2014, 'Factors associated with prehospital delay in patients with ST-segment elevation acute myocardial infarction in China', *American Journal of Emergency Medicine*, vol. 32, no. 4, pp. 349-55.

Perkins-Porras, L, Whitehead, DL, Strike, PC & Steptoe, A 2008, 'Causal Beliefs, cardiac denial and pre-hospital delays following the onset of acute coronary syndromes', *Journal of Behavioral Medicine*, vol. 31, pp. 498-505.

Perkins-Porras, L, Whitehead, DL, Strike, PC & Steptoe, A 2009, 'pre-hospital delay in patients with acute coronary syndrome: factors associated with patient decision time and home-to-hospital delay', *European Journal of Cardiovascular Nursing*, vol. 8, pp. 26-33.

Perry, K, Petrie, K, Jellis, C, Horne, R & Moss-Morris, R 2001, 'Symptom expectations and delay in acute myocardial infarction patients', *Heart*, vol. 86, pp. 91-3.

Pilote, L, Dasgupta, K, Guru, V & et.al 2007, 'A comprehensive view of sex-specific issues related to cardiovascular disease', *Canadian Medical Association Journal*, vol. 176, no. 6, pp. S1-44.

Pitsavos, C, Kourlaba, G, Panagiotakos, DB & Stefanadis, C 2006, 'Factors associated with delay in seeking health care for hospitalized patients with acute coronary syndromes: the GREECS study', *Hellenic Journal of Cardiology. Hellenike Kardiologike Epitheorese*, vol. 47, pp. 329-36.

Pryor, DB, Shaw, L, McCants, CB, Lee, KL, Mark, DB, Harrell, FE, Muhlbaier, LH & Califf, RM 1993, 'Value of the history an physical in identifying patients at increase risk for coronary artery disease', *Annals of Internal Medicine*, vol. 118, pp. 81-90.

Quinn, JR 2005, 'Delay in seeking care for symptoms of acute myocardial infarction: applying a theoretical model', *Research in Nursing and Health*, vol. 28, pp. 283-94.

Raczynski, JM, Finnegan Jr, JR, Zapka, JG, Meischke, H, Meshack, A, Stone, EJ, Bracht, N, Sellers, DE, Daya, M, Robbins, M, McAlister, A & Simons-Morton, D 1999, 'REACT theory-based intervention to reduce treatment-seeking delay for acute myocardial infarction', *American Journal of Preventive Medicine*, vol. 16, no. 4, pp. 325-34.

Ramirez, D, Engel, KG & Tang, TS 2008, 'Language interpreter utilization in the emergency department setting: a clinical review', *Journal of Health Care for the Poor and Underserved*, vol. 19, no. 2, pp. 352-62.

Ranganathan, M & Bhopal, R 2006, 'Exclusion and inclusion of nonwhite ethnic minority groups in 72 north American and European cardiovascular cohort studies', *PLoS Medicine*, vol. 3, no. 3, pp. 0329-36.

Rawles, J 1992, 'Feasibility, safety and efficacy of domiciliary thrombolysis by general practitioners: Grampian Region Early Anistreplase Trial. GREAT Group', *British Medical Journal*, vol. 305, pp. 548-53.

Rawshani, A, Larsson, A, Gelang, C, Lindqvist, J, Gellerstedt, M, Bång, A & Herlitz, J 2014,

'Characteristics and outcome among patients who dial for the EMS due to chest pain', *International Journal of Cardiology*, vol. 176, no. 3, pp. 859-65.

Razum, O & Gerhardus, A 1999, 'Editorial: Methodological triangulation in public health research – advancement or mirage?', *Tropical Medicine and International Health*, vol. 4, no. 4, pp. 243-4.

Reilly, A, Dracup, K & Dattolo, J 1994, 'Factors influencing prehospital delay in patients experiencing chest pain', *American Journal of Critical Care*, vol. 3, no. 4, pp. 300-6.

Renzaho, A 2007, 'Ischaemic heart disease and Australian immigrants: the influence of birthplace and language skills on treatment and use of health services', *Health Information Management Journal*, vol. 36, no. 2, pp. 26-36.

Richards, HM, Reid, ME & Watt, GCM 2002, 'Socioeconomic Variations in responses to chest pain: qualitative study', *British Medical Journal*, vol. 324, pp. 1308-11.

Richards, SB, Funk, M & Milner, KA 2000, 'Differences between blacks and whites with coronary heart disease in initial symptoms and in delay in seeking care', *American Journal of Critical Care*, vol. 9, no. 4, pp. 237-44.

Roger, WJ, Frederick, PD, Stoehr, E, Canto, JG, Ornato, JP, Gibson, M, Pollack, CV, Gore, JM, Chandra-Stobos, N, Peterson, ED, French, WJ & The National Registry of Myocardial Infarction Investigators 2008, 'Trends in presenting characteristics and hospital mortality among patients with ST elevation and non-ST elevation myocardial infarction in the National Registry of Myocardial Infarction from 1990-2006', *American Heart Journal*, vol. 156, pp. 1026-34.

Ross, R 1999, 'Atherosclerosis-an inflammatory disease', *New England Journal of Medicine*, vol. 340, no. 2, pp. 115-26.

Rothman, KJ, Greenland, S & Lash, TL 2008, *Modern epidemiology*, Lippincott Williams & Wilkins.

Rucker, DW, Brennan, TA & Burstin, HR 2001, 'Delay in seeking emergency care', *Academic Emergency Medicine*, vol. 8, no. 2, pp. 163-9.

Ruston, A, Clayton, J & Calnan, M 1998, 'patients' action during their cardiac event: qualitive study exploring differents and modifiable factors', *British Medical Journal*, vol. 316, pp. 1060-5.

Ryan, C & Shaw, RE 2010, 'Perspectives on the crisis and challenge of cardiovascular disease in the diverse Asian populations of California', *Hawai'i Medical Journal*, vol. 69, no. 2, pp. 25-7.

Ryan, CJ & Zerwic, JJ 2003, 'Perception of symptoms of myocardial infarction related to health care seeking behaviors in the elderly', *Journal of Cardiovascular Nursing*, vol. 18, no. 3, pp. 184-96.

Ryan, TJ, Antman, EM, Brooks, NH, Califf, RM, Hillis, D, Hiratzka, LF, Rapaport, E, Riegel, B, Russell, RO, Smith, EE & Weaver, D 1999, 'ACC/AHA Guidelines for the management of patients with acute myocardial infarction:excecutive summary and recommendations: a report of the American College of Cardiology/American Heart Association task force on practice guidelines (committee on management of acute myocardial infarction)', *Circulation*, vol. 100, pp. 1016-30.

SA Ambulance Services 2010, *SA Ambulance Service annual report 2009-10*, SA Ambulance Service, Adelaide.

SA Ambulance Services 2016, *Ambulance Cover*, viewed 29 June 2016, <http://www.saambulance.com.au/ProductsServices/AmbulanceCover.aspx>.

Saczynski, JS, Yarzebski, J, Lessard, D, Spencer, FA, Gurwitz, JH, Gore, JM & Goldberg, RJ 2008, 'Trends in prehospital delay in patients with acute myocardial infarction (from the Worcester Heart Attack Study)', *American Journal of Cardiology*, vol. 102, pp. 1589-94.

Saw, J & Moliterno, DJ 2005, 'Differences between unstable angina and acute myocardial infartion: pathological and clinical spectrum', in EJ Topol (ed.), *Acute coronary syndromes*, Maecel Dekker, New York.

Schmidt, SB & Borsch, MA 1990, 'The prehospital phase of acute myocardial infarction in the era of throbilysis', *American Journal of Cardiology*, vol. 65, pp. 1411-5.

Schneider, Z, Whitehead, D, Elliott, D, Lobiondo-Wood, G & Haber, J 2007, *Nursing and Midwifery research: metjods and appraisal for evidence-based practice*, 3 rd edn, Elsevier, Marrickville.

Schneider, Z, Whitehead, D, Lobiondo-Wood, G & Haber, J 2013, *Nursing and Midwifery research: methods and appraisal for evidence-based practice*, 4 th edn, Elsevier, Chatswood.

Schoen, C & Doty, MM 2004, 'Inequities in access to medical care in five countries: findings from the 2001 Commonwealth Fund International Health Policy Survey', *Health Policy*, vol. 67, no. 3, pp. 309-22.

Sheifer, SE, Rathore, SS, Gersh, BJ, Weinfurt, KP, Oetgen, WJ, Breall, JA & Schulman, KA 2000, 'Time to presentation with acute myocardial infarction in the elderly associations with race, sex, and socioeconomic characteristics', *Circulation*, vol. 102, no. 14, pp. 1651-6.

Sheikh, A, Halani, L, Bhopal, R, Netuveli, G, Patridge, MR, Car, J, Griffiths, C & Levy, M 2009, 'Facilitating the recruitment of minority ethnic people into research: qualitative case study of South Asians and Asthma', *PLoS Medicine*, vol. 6, no. 10, pp. 1-11.

Sheikh, A, Netuveli, G, Kai, J & Panesar, SS 2004, 'Comparison of reporting of ethnicity in US and European randomised controlled trials', *BMJ*, vol. 329, no. 7457, pp. 87-8.

Shih, FJ 1998, 'Triangulation in nursing research: issues of conceptual clarity and purpose', *Journal of Advanced Nursing*, vol. 28, no. 3, pp. 631-41.

Siddiqi, A, Zuberi, D & Nguyen, QC 2009, 'The role of health insurance in explaining immigrant versus non-immigrant disparities in access to health care: Comparing the United States to Canada', *Social Science and Medicine*, vol. 69, no. 10, pp. 1452-9.

Sihavong, A, Lundborg, CS, Syhakhang, L, Kounnavong, S, Wahlstrom, R & Freudenthal, S 2011, 'Comminity perceptions and treatment-seeking behaviour regarding reproductive tract infections including sexually transmitted infections in Lao PDR: a qualitative study', *Journal of Biosocial Science*, vol. 43, no. 03, pp. 285-303.

Sim, J & Sharp, K 1998, 'A critical appraisal of the role of triangulation in nursing research', *International Journal of Nursing Studies*, vol. 35, no. 1–2, pp. 23-31.

Sobralske, M & Katz, J 2005, 'Culturally competent care of patients with acute chest pain', *Journal of the American Academy of Nurse Practitioners*, vol. 17, no. 9, pp. 342-9.

Srimahachota, S, Boonyaratavej, S, Kanjanavanit, R, Sritara, P, Krittiyaphong, R, Kunjara-Na-Ayudhya, R & Tatsanavivat, P 2012, 'Thai Registry in Acute Coronary Syndrome (TRACS)- an extension of Thai Acute Coronary Syndrome Registry (TACS) Gropus: lower in-hospital but still high mortality at one-year', *Journal of the Medical Association of Thailand*, vol. 95, no. 4, pp. 508-18.

Srimahachota, S, Kanjanavanit, R, Boonyaratavej, S, Boonsom, W, Veerakul, G & Tresukosol, D 2007, 'Demograghic, management practices and in-hospital outcomes of Thai Acute Coronary Syndrome Registry (TACSR): the difference from the western world', *Journal of the Medical Association of Thailand*, vol. 90, no. 1, pp. 1-11.

Steg, PG, James, SK, Atar, D, Badano, LP, Lundqvist, CB, Borger, MA, Di Mario, C, Dickstein, K, Ducrocq, G, Fernandez-Aviles, F, Gershlick, AH, Giannuzzi, P, Halvorsen, S, Huber, K, Juni, P, Kastrati, A, Knuuti, J, Lenzen, MJ, Mahaffey, KW, Valgimigli, M, Hof, Avt, Widimsky, P & Zahger, D 2012, 'ESC guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation', *European Heart Journal*, vol. 33, no. 20, pp. 2569-619.

Syed, M, Khaja, F, Wulbrecht, N, Alam, M, Sabbah, HN, Goldstein, S, Borzak, S & Rybicki, BA 2000, 'Effect of delay on racial differences in thrombolysis for acute myocardial infarction', *American Heart Journal*, vol. 140, no. 4, pp. 643-50.

Tabriz, AA, Sohrabi, M-R, Kiapour, N & Yazdani, S 2012, 'Factors associated with delay in thrombolytic therapy in patients with ST-elevation myocardial infarction', *Journal of Tehran Heart Center*, vol. 7, no. 2, p. 65.

Taghaddosi, M, Dianati, M, Bidgoli, JFG & Bahonaran, J 2010, 'Delay and its factors in seeking treatment in patients with acute myocardial infarction', *ARYA Atherosclerosis Journal*, vol. 6, no. 1, pp. 35-41.

Talwar, kk, Sharma, YP, Thakur, JS, Mahajan, R & Bagga, S 2009, *Clinical Management guildelines for coronary artery disease for national programme for prevention and control of diabeyes, cardiovascular disease and stroke*, Chandigarh.

Tamis-Holland, Je, Joshi, S, Palazzo, A & Bangalore, A 2008, 'Diagnosis and treatment of Non-ST-segment elevation myocardial infarction', in MK Hong & E Herzog (eds), *Coronary heart disease*, Springer, London.

Taylor, DM, Garewal, D, Carter, M, Bailey, M & Aggarwal, A 2005, 'Factors that impact upon the time to hospital presentation following the onset of chest pain', *Emergency Medicine Australasia*, vol. 17, no. 3, pp. 204-11.

Taylor, HA, Canto, JG, Sanderson, B, Rogers, WJ & Hilbe, J 1998, 'Management and outcomes for black patients with acute myocardial infarction in the reperfusion era', *The American journal of cardiology*, vol. 82, no. 9, pp. 1019-23.

Taylor, R, Chey, T, Bayman, A & Webster, I 1999, 'Soio-economic, migrant and geogranphic differentials in coronary heart disease occurence in New South Wales', *Australia and New Zealand Journal of Public Health*, vol. 23, no. 1, pp. 20-6.

Thang, ND, Karlson, BW, Bergman, B, Santos, M, Karlsson, T, Bengtson, A, Johanson, P, Rawshani, A & Herlitz, J 2012, 'Characteristics of and outcome for patients with chest pain in relation to transport by the emergency medical services in a 20-year perspective', *American Journal of Emergency Medicine*, vol. 30, no. 9, pp. 1788-95.

The Global Registry of Acute Coronary Events *The GRACE 2.0 ACS Risk Calculator app Web Version*, <http://gracescore.org/WebSite/WebVersion.aspx>.

The GRACE Investigators 2001, 'Rationale and design of the GRACE (Global Registry of Acute Coronary events) project: A multinational registry of patients hospitalized with acute coronary syndromes', *American Heart Journal*, vol. 141, no. 2, pp. 190-9.

The Joanna Briggs Institute 2014, *Joanna Briggs Institute reviewers' manual: 2014 edition*, The Joanna Briggs Institute, Adelaide.

The Joanna Briggs Institution 2011, *Joanna Briggs Institution Reviewers' manual: 2011 edition*, The Joanna Briggs Institution, Adelaide.

Then, KL, Rankin, JA, Fofonoff, DA & Alberta, C 2001, 'Atypical presentation of acute myocardial infarction in 3 age groups', *Heart and Lung*, vol. 30, no. 4, pp. 285-93.

Thom, T, Haase, N, Rosamond, W, Howard, VJ, Rumsfeld, J, Manolio, T, Zheng, Z-J, Flegal, K, O'donnell, C & Kittner, S 2006, 'Heatr disease and stroke statistics- 2006 update: a report from the

American Heart Association Statistics Committee and Stroke Statistics Subcommittee', *Circulation*, vol. 113, no. 6, pp. e85-e151.

Ting, HH, Bradley, EH, Wang, Y, Lichtman, JH, Nallamothu, BK, Sullivan, MD, Gersh, BJ, Roger, VL, Curtis, JP & Krumholz, HM 2008, 'Factors associated with longer time from symptom onset to hospital presentation for patients with st-elevation myocardial infarction', *Archives of Internal Medicine*, vol. 168, no. 9, pp. 959-68.

Ting, HH, Chen, AY, Roe, MT, Chan, PS, Spertus, JA, Nallamothu, BK, Sullivan, MD, DeLong, ER, Bradley, EH & Krumholz, HM 2010, 'Delay from symptom onset to hospital presentation for patients with non–st-segment elevation myocardial infarction', *Archives of Internal Medicine*, vol. 170, no. 20, pp. 1834-41.

Torraco, RJ 2005, 'Writing integrative literature reviews: Guidelines and examples', *Human Resource Development Review*, vol. 4, no. 3, pp. 356-67.

Tran, TT 2009, 'Undersytanding cultural barriers in hepatitis B virus infection', *Cleveland Clinic Journal of Medicine*, vol. 76, no. 3, pp. S10-S3.

Trent, R, Rose, E, Adams, J, Jennings, K & Rawles, J 1995, 'Delay between the onset of symptoms of acute myocardial infarction and seeking medical assistance is influenced by left ventricular function at presentation', *British Heart Journal*, vol. 73, no. 2, pp. 125-8.

United Kingdom Heart Attack Study (UKHAS) Collaborative Group 1998, 'Effect of time from onset to coming under care on fatality of patients with acute myocardial infarction: effect of resuscitation and thrombolytic treatment. The United Kingdom Heart Attack Study (UKHAS) Collaborative Group', *Heart*, vol. 80, no. 2, pp. 114-20.

United Nation Population Fund 2014, *Migration: aworld on the move*, viewed 07 May 2014, <http://www.unfpa.org/pds/migration.html>.

United Nations 1998, *Recommendations on statistica of international migration Revision 1*, United Nations, New York.

United Nations 2012, 'Classification of countries by major area and region of the world'.

United Nations 2013a, *232 million international migrants living abroad worldwide new UN global migration statistics reveal*, United Nations, New York.

United Nations 2013b, *International migration 2013: migration by origin and destination*, No. 2013/3 Rev.1, United Nations.

United Nations 2013c, *The number of international migrants worldwide reaches 232 million*, No. 2013/2, United Nations, New York.

United Nations 2013d, *World migration in figures*, United Nations, New york.

Vaccarino, V, Krumholz, HM, Yarzebski, J, Gore, JM & Goldberg, RJ 2001, 'Sex differences in 2-year mortality after hospital discharge for myocardial infarction', *Annual of Internal Medicaine*, vol. 134, no. 3, pp. 173-81.

Van Weijen, D 2012, 'The language of (future) scientific communication', *Research Trend*s, vol. 31, pp. 7-9.

Walker, N & Lorimer, AR 2004, 'Coronary heart disease: epidemiology, pathology and diagnosis', in G Lindsay & A Gaw (eds), *Coronary heart disease prevention*, Chruchill Livingstone, London.

Ward, RA & Brier, ME 1999, 'Retrospective Analyses of Large Medical Databases What Do They Tell Us?', *Journal of the American Society of Nephrology*, vol. 10, no. 2, pp. 429-32.

Waters, A-M, Trinh, L, Theresa, C, Bourchier, M & Moon, L 2013, 'Lastest statistics on cardiovascular disease in Australia', *Clinical and Experimental Pharmacology and Physiology*, vol. 40, pp. 347-56.

Weaver, W, Cerqueira, M, Hallstrom, AP & et al. 1993, 'Prehospital-initiated vs hospital-initiated thrombolytic therapy: The myocardial infarction triage and intervention trial', *Journal of the American Medical Association*, vol. 270, no. 10, pp. 1211-6.

Weaver, WD 1995, 'Time to thrombolytic treatment: factors affecting delay and their influence on outcome', *Journal of the American College of Cardiology*, vol. 25, no. 7 Suppl, pp. 3S-9S.

Weaver, WD, Cerqueira, M, Hallstrom, AP, Litwin, PE, Martin, JS, Kudenchuk, PJ & Eisenberg, M 1993, 'Prehospital-initiated vs hospital-initiated thrombolytic therapy: The myocardial infarction triage and intervention trial', *Journal of the American Medical Association*, vol. 270, no. 10, pp. 1211-6.

Weber, SM (ed.) 2010, *Chest pain: causes, diagnosis, and treatment*, Nova Science Publishers, New York.

Wechkunanukul, K, Grantham, H & Clark, R 2015, 'Presenting characteristics and management of chest pain among culturally and linguistically diverse populations: a comprehensive review', *Heart, Lung and Circulation*, vol. 24, Supplement 3, p. S162.

Wechkunanukul, K, Grantham, H & Clark, RA 2014, 'Cultural competence in emergency department', *Australian Nursing and Midwifery Journal*, vol. 22, no. 4, p. 35.

Wechkunanukul, K, Grantham, H & Clark, RA 2016, 'Global review of delay time in seeking medical care for chest pain: An integrative literature review', *Australian Critical Care*.

Wechkunanukul, K, Grantham, H, Damarell, R & Clark, RA 2014, 'The association between ethnicity (culturally and linguistically diverse migrants) and the time taken in seeking medical care for chest pain: a systematic review protocol', *The JBI Database of Systematic Reviews and Implementation Reports*, vol. 12, no. 9, pp. 21-35.

Wechkunanukul, K, Grantham, H, Damarell, R & Clark, RA 2016a, 'The association between ethnicity and the delay time in seeking medical care for chest pain: a systematic review', *The JBI Database of Systematic Reviews and Implementation Reports*, vol. 14, no. 7, pp. 208-35.

Wechkunanukul, K, Grantham, H, Teubner, D, Hyun, KK & Clark, RA 2016b, 'Presenting characteristics and processing times for culturally and linguistically diverse (CALD) patients with chest pain in an emergency department: Time, Ethnicity, and Delay (TED) Study II', *International Journal of Cardiology*, vol. 220, pp. 901-8.

Wendler, D, Kington, R, Madans, J, Wye, GV, Christ-Schmidt, H, Pratt, LA, Brawley, OW, Gross, CP & Emanuel, E 2006, 'Are racial and ethnic minorities less willing to participate in health research', *PLoS Medicine*, vol. 3, no. 2, pp. 0201-10.

Whittemore, R & Knafl, K 2005, 'The integrative review: updated methodology', *Journal of Advanced Nursing*, vol. 52, no. 5, pp. 546-53.

Widimsky, P, Wijns, W, Fajadet, J, de Belder, M, Knot, J, Aaberge, L, Andrilkopoulos, G, Baz, JA, Betriu, A, Claeys, M, Danchin, N, Djambazov, S, Erne, P, Hartikainen, J, Huber, K, Kala, P, Kilinceva, M, Kristensen, SD, Ludman, P, Ferre, JM, Milicic, D, Morais, J, Noc, M, Opolski, G, Ostojit, M, Radovanovic, D, De Servi, S, stenestrand, U, Stendencan, M, Tubaro, M, Vasiljevic, Z, Weidinger, F, Witkowski, A & Zeymer, U 2010, 'Reperfusion therapy for ST elevation acute myocardial infarction in Europe: description of the current situation in 30 countries', *European Heart Journal*, vol. 31, pp. 943-57.

Wilson, RF 2012, 'Acute coronary syndromes', in Z Vlodaver, RF Wilson & DJ Garry (eds), *Coronary heart disease: Clinical , pathological, imaging and molecular profiles*, Springer, New York.

Windecker, S, Kolh, P, Alfonso, F, Collet, J-P, Cremer, J, Falk, V, Filippatos, G, Hamm, C, Head, SJ, Jüni, P, Kappetien, AP, Kastrati, A, Knuuti, J, Landmesser, U, Laufer, G, Neumann, F-J, Richter, D, Schauerte, P, Uva, MS, Stefanini, GG, Taggart, D, Torracca, L, Valgimigli, M, Wijns, W & Witkowski, A 2014, '2014 ESC/EACTS Guidelines on myocardial revascularization The Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS) Developed with the special contribution of the European Association of Percutaneous Cardiovascular Interventions (EAPCI)', *European Heart Journal*, vol. 35, pp. 2541-619.

Wish Garrett, P, Roberto, F, Grant Dickson, H & Klinken Whelan, A 2008, 'Communication and healthcare complexity in people with little or no English: the Communication Complexity Score', *Ethnicity and Health*, vol. 13, no. 3, pp. 203-17.

Woolson, RF, Bean, JA & Rojas, PB 1986, "Sample Size for Case-Control Studies Using Cochran's

Statistic', *Biometrics*, vol. 42, pp. 927-32.

World Health Organisation 2004, *A race against time: the challenge of cardiovascular disease in deveolping economies*, Trustees of Columbia University in the City of New York, New York.

World Health Organisation 2006, *World health statistics 2006*, WHO, Geneva.

World Health Organisation 2009, *Global health risks: mortality and burden of disease attributable to selected major risks*, WHO, Geneva.

World Health Organisation 2013, *Cardiovascular disease*, viewed 29 August 2013, <http://www.who.int/mediacentre/factsheets/fs317/en/index.html>.

World Health Organisation 2015, *Cardiovascular diseases (CVDs)*, viewed 24 December 2015, <http://www.who.int/mediacentre/factsheets/fs317/en/>.

World Heart Federation 2012, *Cardiovascular disease: Risk factors*, viewed 9 September 2013, <http://www.world-heart-federation.org/fileadmin/user_upload/documents/Fact_sheets/2012/PressBackgrounderApril2012RiskFactors.pdf>.

World Heart Federation 2013a, *Different heart diseases*, WHF, viewed 9 September 2013, <http://www.world-heart-federation.org/cardiovascular-health/heart-disease/different-heart-diseases/>.

World Heart Federation 2013b, *Warning Sign*, viewed 15 September 2013, <http://www.world-heart-federation.org/cardiovascular-health/heart-disease/warning-signs/>.

World Medical Association 2013, 'World medical association declaration of helsinki: Ethical principles for medical research involving human subjects', *JAMA*, vol. 310, no. 20, pp. 2191-4.

Worster, A, Bledsoe, RD, Cleve, P, Fernandes, CM, Upadhye, S & Eva, K 2005, 'Reassessing the Methods of Medical Record Review Studies in Emergency Medicine Research', *Annals of Emergency Medicine*, vol. 45, no. 4, pp. 448-51.

Worster, A & Haines, T 2004, 'Advanced statistics: understanding medical record review (MRR) studies', *Academic Emergency Medicine*, vol. 11, no. 2, pp. 187-92.

Yan, AT, Tan, M, Fitchett, D, Chow, C-M, Fowlis, R, McAvinue, TG, Roe, MT, Perterson, ED, Tu, JV, Langer, A & Goodman, SG 2004, 'One-year outcome of patients after acute coronary syndromes (from the canadian acute coronary syndrome registry)', *American Heart Journal*, vol. 94, pp. 25-9.

Yan, H, Song, L, Yong, J, Son, Y & Hu, D 2009, 'The association between pre-infarction angina and

care seeking behaviours and its effects on early reperfusion rates for acute myocardial infarction', *International Journal of Cardiology*, vol. 135, pp. 86-92.

Young, CM & Coles, A 1992, *Immigrants in Australia: a health profile*, cat.no AIHW 319, AIHW, Canberra.

Younker, J 2007, 'Clinical examination skills for assessing the patient with chest pain', in JW Albarran & J Tagney (eds), *Chest pain: acvanced assessment and management skills*, Blackwell Publishing, Oxford.

Yusuf, S, Reddy, KS, Ounpuu, S & Anand, s 2001a, 'Global Burden of Cardiovascular Disease Part I: General considerations, the epidemiology transition, risk factors, and impact of urbanization', *Circulation*, vol. 104, pp. 2746-53.

Yusuf, S, Reddy, KS, Ounpuu, S & Anand, s 2001b, 'Global burden of cardiovascular diseases, part II: Variations in cardiovacular disease by specific ethnic groups and geographic regions and prevention strategies', *Circulation*, vol. 104, pp. 2855-64.

Zerwic, JJ 1998, 'Symptoms of acute myocardial infarction: Expectations of a community sample', *Heart and Lung*, vol. 27, no. 2, pp. 75-81.

Zerwic, JJ, Ryan, CJ, DeVon, HA & Drell, MJ 2003, 'Treatment seeking for acute myocardial infarction Symptoms: differences in delay across sex and race', *Nursing Research*, vol. 52, no. 3, pp. 159-67.

Zhang, S, Hu, D, Wang, X & Yang, J 2009, 'Use of emergency medical services in patients with acute myocardial infarction in China', *Clinical Cardiology*, vol. 32, no. 3, pp. 137-41.

APPENDIX

APPENDIX

Appendix I: Awards and Certificates

THE JOANNA BRIGGS INSTITUTE | THE UNIVERSITY of ADELAIDE

I hereby certify that

Kannikar Wechkunanukul

attended

Comprehensive Systematic Review Training Programme

CSR_0001: Introduction to Evidence-Based Healthcare

CSR_0002: The Systematic Review of Evidence Generated through Quantitative Research

CSR_0003: The Systematic Review of Evidence Generated by Qualitative Research, Narrative and Text

Adelaide, Australia
2nd - 11th October 2013

Professor Alan Pearson
Executive Director
The Joanna Briggs Institute

Flinders
UNIVERSITY
inspiring achievement

Flinders University
Office of the Vice-Chancellor

Certificate of Completion

THIS IS TO CERTIFY THAT

Kannikar Wechkunanukul

COMPLETED THE

Academic Internship Program for Doctoral Students 2014

CONDUCTED BY

Centre for University Teaching

November 2014

Professor Andrew Parkin
Deputy Vice-Chancellor (Academic)
Flinders University

CRICOS No 00114A

Flinders
UNIVERSITY
inspiring achievement

UniSA THE UNIVERSITY of ADELAIDE Flinders UNIVERSITY

This is to certify that

Mrs Kannikar Wechkunanukul

attended the workshop titled

Ethics and Integrity in Research with Humans

at

Flinders in the City

on 25 & 26 June, 2014

Dr Peter Wigley
Manager, Research Ethics & Integrity

Appendix II: GRACE Score and risk factors calculation

GRACE Score

Grace Score (In hospital mortality with NSTEMI and STEMI)

Risk Category	In hospital mortality with NSTEMI		In hospital mortality with STEMI	
	Grace Score	Probability of mortality in (%)	Grace Score	Probability of mortality in (%)
Low	1-108	<1	49-125	<2
Intermediate	109-140	1-3	126-154	2-5
High	414-372	>3	155-319	>5

NSTEMI: Non-ST Segment Elevation Myocardial Infarction; **STEMI:** Segment Elevation Myocardial Infarction

GRACE Score (6 month post discharge mortality with NSTEMI and STEMI)

Risk Category	6 month post discharge mortality with NSTEMI		6 month post discharge mortality with STEMI	
	Grace Score	Probability of mortality in (%)	Grace Score	Probability of mortality in (%)
Low	1-88	<3	27-99	<4.4
Intermediate	89-118	3-8	100-127	4.5-11
High	119-263	>8	128-263	>11

NSTEMI: Non-ST Segment Elevation Myocardial Infarction; **STEMI:** Segment Elevation Myocardial Infarction

Grace Score risk factors calculation

Medical History

① Age in Years	Points
≤29	0
30-39	0
40-49	18
50-59	36
60-69	55
70-79	73
80-89	91
≥90	100

② History of Congestive Heart Failure	24
③ History of Myocardial Infarction	12

Findings at Initial Hospital Presentation

④ Resting Heart Rate, beats/min	Points
≤49.9	0
50-69.9	3
70-89.9	9
90-109.9	14
110-149.9	23
150-199.9	35
≥200	43

⑤ Systolic Blood Pressure, mm HG	
≤79.9	24
80-99.9	22
100-119.9	18
120-139.9	14
140-159.9	10
160-199.9	4
≥200	0

⑥ ST-Segment Depression	11

Findings During Hospitalization

⑦ Initial Serum Creatinine, mg/dL	Points
0-0.39	1
0.4-0.79	3
0.8-1.19	5
1.2-1.59	7
1.6-1.99	9
2-3.99	15
≥4	20

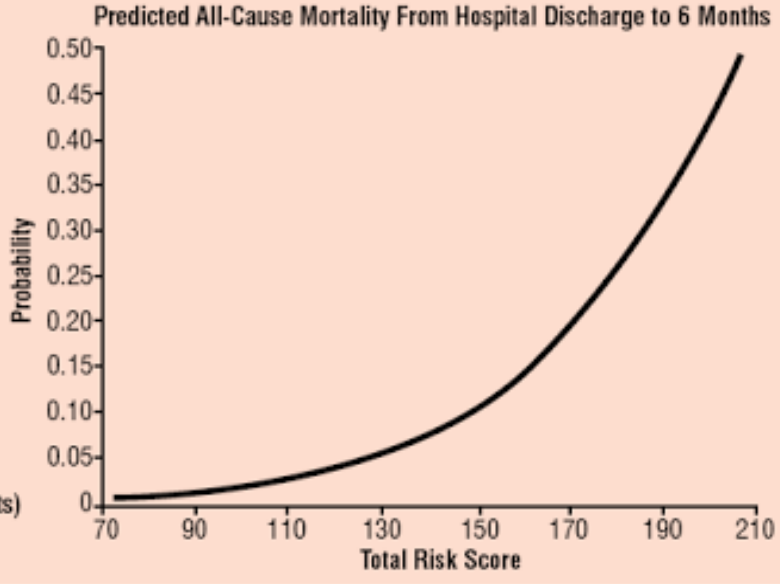
⑧ Elevated Cardiac Enzymes	15
⑨ No In-Hospital Percutaneous Coronary Intervention	14

Points

① _____
② _____
③ _____
④ _____
⑤ _____
⑥ _____
⑦ _____
⑧ _____
⑨ _____

Total Risk Score _____ (Sum of Points)

Mortality Risk _____ (From Plot)



Appendix III: Australasian Triage Scale

Australasian Triage Scale

ATS Cat.	Response/Time	Description	Clinical Descriptors
Cat. 1	Immediate simultaneous assessment and treatment	Immediately life-threatening	Cardiac arrest Respiratory arrest
Cat. 2	Assessment and treatment within 10 minutes	Imminently life-threatening	Chest pain of likely cardiac nature Very severe pain Airway risk Severe respiratory distress
Cat. 3	Assessment and treatment within 30 minutes	Potentially life-threatening	Severe hypertension Moderlately severe blood loss Moderate shortness of breath Seizure
Cat. 4	Assessment and treatment within 60 minutes	Potentially serious	Mild haemorrhage Minor head injury chest injury without rib pain or respiratory distress
Cat. 5	Assessment and treatment within 120 minutes	Less urgent	Minimal pain with no high risk features Low risk history and now asymptomatic Minor wounds

Appendix IV: Standard Australian Classification of Countries, 2011, Version 2.3

Australian Bureau of Statistics

1269.0, Standard Australian Classification of Countries, 2011, Version 2.3
Released at 11.30am (Canberra time) 18 August 2014

Table 1.3 Major groups, minor groups and countries

Major groups / Minor groups / Countries	
1	**OCEANIA AND ANTARCTICA**
11	**Australia (includes External Territories)**
1101	Australia
1102	Norfolk Island
1199	Australian External Territories, nec
12	**New Zealand**
1201	New Zealand
13	**Melanesia**
1301	New Caledonia
1302	Papua New Guinea
1303	Solomon Islands
1304	Vanuatu
14	**Micronesia**
1401	Guam
1402	Kiribati
1403	Marshall Islands
1404	Micronesia, Federated States of
1405	Nauru
1406	Northern Mariana Islands
1407	Palau
15	**Polynesia (excludes Hawaii)**
1501	Cook Islands
1502	Fiji
1503	French Polynesia
1504	Niue
1505	Samoa
1506	Samoa, American
1507	Tokelau
1508	Tonga
1511	Tuvalu
1512	Wallis and Futuna
1513	Pitcairn Islands
1599	Polynesia (excludes Hawaii), nec
16	**Antarctica**
1601	Adelie Land (France)
1602	Argentinian Antarctic Territory
1603	Australian Antarctic Territory
1604	British Antarctic Territory
1605	Chilean Antarctic Territory
1606	Queen Maud Land (Norway)
1607	Ross Dependency (New Zealand)

2	**NORTH-WEST EUROPE**		
	21	**United Kingdom, Channel Islands and Isle of Man**	
		2102	England
		2103	Isle of Man
		2104	Northern Ireland
		2105	Scotland
		2106	Wales
		2107	Guernsey
		2108	Jersey
	22	**Ireland**	
		2201	Ireland
	23	**Western Europe**	
		2301	Austria
		2302	Belgium
		2303	France
		2304	Germany
		2305	Liechtenstein
		2306	Luxembourg
		2307	Monaco
		2308	Netherlands
		2311	Switzerland
	24	**Northern Europe**	
		2401	Denmark
		2402	Faroe Islands
		2403	Finland
		2404	Greenland
		2405	Iceland
		2406	Norway
		2407	Sweden
		2408	Aland Islands
3	**SOUTHERN AND EASTERN EUROPE**		
	31	**Southern Europe**	
		3101	Andorra
		3102	Gibraltar
		3103	Holy See
		3104	Italy
		3105	Malta
		3106	Portugal
		3107	San Marino
		3108	Spain
	32	**South Eastern Europe**	
		3201	Albania
		3202	Bosnia and Herzegovina
		3203	Bulgaria
		3204	Croatia
		3205	Cyprus
		3206	Former Yugoslav Republic of Macedonia (FYROM)
		3207	Greece
		3208	Moldova
		3211	Romania
		3212	Slovenia
		3214	Montenegro
		3215	Serbia
		3216	Kosovo

3	**33**	**Eastern Europe**	
		3301	Belarus
		3302	Czech Republic
		3303	Estonia
		3304	Hungary
		3305	Latvia
		3306	Lithuania
		3307	Poland
		3308	Russian Federation
		3311	Slovakia
		3312	Ukraine
4	**NORTH AFRICA AND THE MIDDLE EAST**		
	41	**North Africa**	
		4101	Algeria
		4102	Egypt
		4103	Libya
		4104	Morocco
		4105	Sudan
		4106	Tunisia
		4107	Western Sahara
		4108	Spanish North Africa
		4111	South Sudan
	42	**Middle East**	
		4201	Bahrain
		4202	Gaza Strip and West Bank
		4203	Iran
		4204	Iraq
		4205	Israel
		4206	Jordan
		4207	Kuwait
		4208	Lebanon
		4211	Oman
		4212	Qatar
		4213	Saudi Arabia
		4214	Syria
		4215	Turkey
		4216	United Arab Emirates
		4217	Yemen
5	**SOUTH-EAST ASIA**		
	51	**Mainland South-East Asia**	
		5101	Myanmar, The Republic of the Union of
		5102	Cambodia
		5103	Laos
		5104	Thailand
		5105	Vietnam
	52	**Maritime South-East Asia**	
		5201	Brunei Darussalam
		5202	Indonesia
		5203	Malaysia
		5204	Philippines
		5205	Singapore
		5206	Timor-Leste

6 NORTH-EAST ASIA

61 Chinese Asia (includes Mongolia)

6101 China (excludes SARs and Taiwan)
6102 Hong Kong (SAR of China)
6103 Macau (SAR of China)
6104 Mongolia
6105 Taiwan

62 Japan and the Koreas

6201 Japan
6202 Korea, Democratic People's Republic of (North)
6203 Korea, Republic of (South)

7 SOUTHERN AND CENTRAL ASIA

71 Southern Asia

7101 Bangladesh
7102 Bhutan
7103 India
7104 Maldives
7105 Nepal
7106 Pakistan
7107 Sri Lanka

72 Central Asia

7201 Afghanistan
7202 Armenia
7203 Azerbaijan
7204 Georgia
7205 Kazakhstan
7206 Kyrgyzstan
7207 Tajikistan
7208 Turkmenistan
7211 Uzbekistan

8 AMERICAS

81 Northern America

8101 Bermuda
8102 Canada
8103 St Pierre and Miquelon
8104 United States of America

82 South America

8201 Argentina
8202 Bolivia, Plurinational State of
8203 Brazil
8204 Chile
8205 Colombia
8206 Ecuador
8207 Falkland Islands
8208 French Guiana
8211 Guyana
8212 Paraguay
8213 Peru
8214 Suriname
8215 Uruguay
8216 Venezuela, Bolivarian Republic of
8299 South America, nec

8	**83**	**Central America**	
		8301	Belize
		8302	Costa Rica
		8303	El Salvador
		8304	Guatemala
		8305	Honduras
		8306	Mexico
		8307	Nicaragua
		8308	Panama
	84	**Caribbean**	
		8401	Anguilla
		8402	Antigua and Barbuda
		8403	Aruba
		8404	Bahamas
		8405	Barbados
		8406	Cayman Islands
		8407	Cuba
		8408	Dominica
		8411	Dominican Republic
		8412	Grenada
		8413	Guadeloupe
		8414	Haiti
		8415	Jamaica
		8416	Martinique
		8417	Montserrat
		8421	Puerto Rico
		8422	St Kitts and Nevis
		8423	St Lucia
		8424	St Vincent and the Grenadines
		8425	Trinidad and Tobago
		8426	Turks and Caicos Islands
		8427	Virgin Islands, British
		8428	Virgin Islands, United States
		8431	St Barthelemy
		8432	St Martin (French part)
		8433	Bonaire, Sint Eustatius and Saba
		8434	Curacao
		8435	Sint Maarten (Dutch part)

9	**SUB-SAHARAN AFRICA**		
	91	**Central and West Africa**	
		9101	Benin
		9102	Burkina Faso
		9103	Cameroon
		9104	Cabo Verde
		9105	Central African Republic
		9106	Chad
		9107	Congo, Republic of
		9108	Congo, Democratic Republic of
		9111	Cote d'Ivoire
		9112	Equatorial Guinea
		9113	Gabon
		9114	Gambia
		9115	Ghana
		9116	Guinea
		9117	Guinea-Bissau
		9118	Liberia
		9121	Mali
		9122	Mauritania
		9123	Niger
		9124	Nigeria
		9125	Sao Tome and Principe
		9126	Senegal
		9127	Sierra Leone
		9128	Togo
9	**92**	**Southern and East Africa**	
		9201	Angola
		9202	Botswana
		9203	Burundi
		9204	Comoros
		9205	Djibouti
		9206	Eritrea
		9207	Ethiopia
		9208	Kenya
		9211	Lesotho
		9212	Madagascar
		9213	Malawi
		9214	Mauritius
		9215	Mayotte
		9216	Mozambique
		9217	Namibia
		9218	Reunion
		9221	Rwanda
		9222	St Helena
		9223	Seychelles
		9224	Somalia
		9225	South Africa
		9226	Swaziland
		9227	Tanzania
		9228	Uganda
		9231	Zambia
		9232	Zimbabwe
		9299	Southern and East Africa, nec

Appendix V: Research Timelines

Time, Ethnicity and Delay study timelines

	2013	2014			2015			2016		
Research activity	Aug-Dec	Jan-Apr	May-Aug	Sep-Dec	Jan-Apr	May-Aug	Sep-Dec	Jan-Apr	May-Aug	Sep-Dec
Planning										
Literature review										
Methodology										
Applying Ethics approval										
TED 1 Study										
JBI tanning										
Registering title										
Preparing protocol										
submitting protocol										
Developing systematic review										
Submitting manuscript										
TED 2 Study										
Planning										
Developing proposal										
Data collection										
Data analysis										
Writing reports										
Submitting manuscript										
TED 3 Study										
Planning										
Developing proposal										
Developing data entry software										
Data collection										
Data analysis										
Writing reports										
Submitting manuscript										
Thesis preparation										
Analysis TED 1-3										
Thesis writing and editing										
Reviewing by supervisor										
Incorporate feedback										
Thesis submission										

Appendix VI: JBI Appraisal and data extraction Instruments

JBI MAStARI appraisal instrument for Randomised Control/ Pseudo-randomised Trial

JBI Critical Appraisal Checklist for Randomised Control / Pseudo-randomised Trial

Reviewer _____ Date _____

Author _____ Year _____ Record Number _____

	Yes	No	Unclear	Not Applicable
1. Was the assignment to treatment groups truly random?	☐	☐	☐	☐
2. Were participants blinded to treatment allocation?	☐	☐	☐	☐
3. Was allocation to treatment groups concealed from the allocator?	☐	☐	☐	☐
4. Were the outcomes of people who withdrew described and included in the analysis?	☐	☐	☐	☐
5. Were those assessing outcomes blind to the treatment allocation?	☐	☐	☐	☐
6. Were the control and treatment groups comparable at entry?	☐	☐	☐	☐
7. Were groups treated identically other than for the named interventions	☐	☐	☐	☐
8. Were outcomes measured in the same way for all groups?	☐	☐	☐	☐
9. Were outcomes measured in a reliable way?	☐	☐	☐	☐
10. Was appropriate statistical analysis used?	☐	☐	☐	☐
	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info. ☐

Comments (Including reason for exclusion)

JBI MAStARI appraisal instrument for comparable Cohort/Case Control

JBI Critical Appraisal Checklist for Comparable Cohort/ Case Control

Reviewer _____ Date _____

Author _____ Year _____ Record Number _____

		Yes	No	Unclear	Not Applicable
1.	Is sample representative of patients in the population as a whole?	☐	☐	☐	☐
2.	Are the patients at a similar point in the course of their condition/illness?	☐	☐	☐	☐
3.	Has bias been minimised in relation to selection of cases and of controls?	☐	☐	☐	☐
4.	Are confounding factors identified and strategies to deal with them stated?	☐	☐	☐	☐
5.	Are outcomes assessed using objective criteria?	☐	☐	☐	☐
6.	Was follow up carried out over a sufficient time period?	☐	☐	☐	☐
7.	Were the outcomes of people who withdrew described and included in the analysis?	☐	☐	☐	☐
8.	Were outcomes measured in a reliable way?	☐	☐	☐	☐
9.	Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info. ☐

Comments (Including reason for exclusion)

JBI MAStARI data extraction instrument for comparative

JBI Data Extraction Form for Experimental / Observational Studies

Reviewer _____ Date _____

Author _____ Year _____

Journal_____ Record Number _____

Study Method

RCT	☐	Quasi-RCT	☐	Longitudinal	☐
Retrospective	☐	Observational	☐	Other	☐

Participants

Setting

Population

Sample size

Group A _____ Group B _____

Interventions

Intervention A

Intervention B

Authors Conclusions:

Reviewers Conclusions:

Appendix VII: Variable and SPSS code book of TED II

Variable and SPSS code book of TED II

No.	Variable	SPSS variable name	Coding Instruction	Type of Variable	Type of measure	Level of measure
1	Identification number	ID	Number assigned to each case	Continuous		Nominal
2	Age	Age	Year of age	Continuous	Mean, Range, STD	Scale
3	Age Category	Age_Cat	1 = <45 2 = 45 - 55 3 = 56 - 65 4 = 66 - 75 5 = 76 -85 6 = 86 - 95 7 = >95	Categorical	Frequency, percentage	Nominal
4	Gender	Gender	1 = Males 2 = Females	Categorical	Frequency, percentage	Nominal
5	Medicare	Medicare	1 = Medicare 0 = No Medicare	Categorical	Frequency, percentage	Nominal
6	Distance from Hospital	Dis_Hsp	Kilometre(s)	Continuous	Mean, Range, STD	Scale
7	Distance from Hospital Category	Dis_Hsp_Cat	1 = < 5 2 = 5 - 10 3 = 10.01 - 15 4 = > 15 5 = NT 6 = Intstate 99 = unknown	Categorical	Frequency, percentage	Nominal
8	Socioeconomic status	SEIFA	1 to 10 99 = unknown	Categorical	Frequency, percentage	Nominal
9	Region of Country of birth	COB_RG	1 = North West Europe 2 = Southeast Europe 3 = Northeast Asia 4 = Southeast Asia 5 = South and central Asia 6 = North Africa and Middle East 7 = Sub Saharan Africa 8 = Americas 9 = Oceania 10 = Others 11 = Australia	Categorical	Frequency, percentage	Nominal
10	CALD Status	CALD	0 = Non-CALD 1 = CALD	Categorical	Frequency, percentage	Nominal
11	Priority	Prior	1 to 5 98 = Error record	Categorical	Frequency, percentage	Nominal

No.	Variable	SPSS variable name	Coding Instruction	Type of Variable	Type of measure	Level of measure
12-32	Symptoms presentation (21 variables)	21 variable names	0 = N 1 = Y	Categorical	Frequency, percentage	Nominal
33	First Medical Contact	Fst_MC	1 = Ambulance 2 = ED 3 = GP 4 = ED/TF	Categorical	Frequency, percentage	Nominal
34	Ambulance Use	Ambulance	0 = No 1 = Yes	Categorical	Frequency, percentage	Nominal
35	Referral	Refrl	0 = No 1 = Yes	Categorical	Frequency, percentage	Nominal
36	Ambulance Use specific	Amb_Spcf	0 = No_Amb 1 = Non-Refr_ Amb 2 = Ref_Amb 3 = Ref_wo_Amb	Categorical	Frequency, percentage	Nominal
37	Day of Presentation	Trge_Day	1 = Mon 2 = Tue 3 = Wed 4 = Thu 5 = Fri 6 = Sat 7 = Sun	Categorical	Frequency, percentage	Scale
38	Time of Preseantation	Trge_Tm	24 hr	Continuous		Ordinal
39	Time of presentation category	Trge_Tm_Cat	1 = 9.00 – 17.00 2 = 17.01 -8.59	Categorical	Frequency Percentage	Nominal
40	Time to treatment	Tm_Trtmt	Minute(s)	Continuous	Mean, Median, Range STD	Scale
41	Time to treatment Category	Tm_Trtmt_Cat	1 = < 10 2 = 10 - 30 3 = 31 - 60 4 = 61- 120 5 = >120	Categorical	Frequency, percentage	Nominal
42	Time to treatment match guidelines	Tm_Trtmt_GL	0 = N If Priority = 2 and Time_Trtmt_cat ≠ 1 1 = Y If Priority = 2 and Time_Trtmt_cat = 1 98 = other priority	Categorical	Frequency, percentage	Nominal

No.	Variable	SPSS variable name	Coding Instruction	Type of Variable	Type of measure	Level of measure
43	ATS Admission time	ATS_Ad_Tm	Hour(s)	Continuous	Mean, Median, Range, STD	Scale
44	ATS Admission time Category	ATS_Ad_Cat	1 = ≤ 4 0 = >4 98 = N/A	Categorical	Frequency, percentage	Nominal
45	ED stay	ED_Stay	Hour(s)	Continuous	Mean, Median, Range, STD	Scale
46	ED stay indicator	ED_Indct	1 = ≤ 4 0 = >4 98 = N/A	Categorical	Frequency, percentage	Nominal
47	Episode end status	Epsd_End	1 =Cardiac services 2 = Other admissions 3 = Discharged 4 = Death 99 = unknown	Categorical	Frequency, percentage	Nominal
48	Length of Hospital Stay	Lgth_Hosp	Day(s)	Continuous	Mean, Median, Range, STD	Scale
49	Concordance evidence-based practice for ACS 1 Ambulance 2 Central CP 3 Priority 2 4 Time to Tx within 10 minutes	Cncd_ACS	0 = No 1 = Yes	Categorical	Frequency, percentage	Nominal

Appendix VIII: Variables and SPSS code book of TED III

Variables and SPSS code book of TED III

No.	Variable	SPSS variable name	Coding Instruction	Type of Variable	Type of measure	Level of measure
1	Identification number	ID	Number assigned to each case. Initial two digids with 01-10 for each region	Continuous		Nominal
2	Age	Age	Year of age	Continuous	Mean, Range, STD	Scale
3	Age Category	Age_Cat	1 = <45 2 = 45 - 55 3 = 56 - 65 4 = 66 - 75 5 = 76 -85 6 = 86 - 95 7 = >95	Categorical	Frequency, percentage	Nominal
4	Gender	Gender	1 = Males 2 = Females	Categorical	Frequency, percentage	Nominal
5	Marital status	Martl	1 = Married/defacto (M) 2 = Never married (N) 3 = Divorce (D) 4 = Widowed (W) 5 = Separated (S) 99 = Uuknown (U)	Categorical	Frequency Percentage	Nominal
6	Medicare	Medc	1 = Medicare 0 = No Medicare	Categorical	Frequency, percentage	Nominal
7	Distance from Hospital	Dist_Hsp	Kilometre(s)	Continuous	Mean, Range, STD	Scale
8	Distance from Hospital Category	Dist_Cat	1 = < 5 2 = 5 - 10 3 = 10.01 - 15 4 = > 15 5 = NT 6 = Intstate 99 = unknown	Categorical	Frequency, percentage	Nominal
9	Socioeconomic status	SEIFA	1 to 10 99 = unknown	Categorical	Frequency, percentage	Nominal
10	Region of Country of birth	COB_RG	1 = North West Europe 2 = Southeast Europe 3 = Northeast Asia 4 = Southeast Asia 5 = South and central Asia 6 = North Africa and Middle East 7 = Sub Saharan Africa 8 = Americas 9 = Oceania 10 = Australia	Categorical	Frequency, percentage	Nominal

No.	Variable	SPSS variable name	Coding Instruction	Type of Variable	Type of measure	Level of measure
11	CALD Status	CALD	0 = No (Australian-Born) 1 = Yes (Overseas-Born)	Categorical	Frequency, percentage	Nominal
12	Language	Lang	1 = English 0 = Other 2 = English and other(s) 98 = Not Documented	Categorical	Frequency Percentage	Nominal
13	Cultural Note	Cul_Nte	1 = Yes 0 = No	Categorical	Frequency Percentage	Nominal
14	Family History of CHD	FH_CHD	0 = No 1 = Yes	Categorical	Frequency Percentage	Nominal
15	History of CHD	Hx_CHD	0 = No 1 = Yes	Categorical	Frequency Percentage	Nominal
16	Hypertension	HT	0 = No 1 = Yes	Categorical	Frequency Percentage	Nominal
17	DM	DM	0 = No 1 = Yes	Categorical	Frequency Percentage	Nominal
18	Hyperlipidaemia	HLP	0 = No 1 = Yes	Categorical	Frequency Percentage	Nominal
19	Prior MI	Pr_MI	0 = No 1 = Yes	Categorical	Frequency Percentage	Nominal
20	Prior PCI	Pr_PCI	0 = No 1 = Yes	Categorical	Frequency Percentage	Nominal
21	Prior FBL	Pr_FBL	0 = No 1 = Yes	Categorical	Frequency Percentage	Nominal
22	Prior CABG	Pr_CABG	0 = No 1 = Yes	Categorical	Frequency Percentage	Nominal
23	Prior Stroke/TIA	Pr_Strk	0 = No 1 = Yes	Categorical	Frequency Percentage	Nominal
24	Prior CHF	Pr_CHF	0 = No 1 = Yes	Categorical	Frequency Percentage	Nominal
25	Smoking	SMK	0 = No 1 = Current 2 = Past 98 = Not documented	Categorical	Frequency Percentage	Nominal
26	Alcohol	ALC	0 = No 1 = Current 2 = Past 98 = Not documented	Categorical	Frequency Percentage	Nominal
27-47	Symptoms presentation (21 variables)	21 variable names	0 = No 1 = Yes	Categorical	Frequency, percentage	Nominal
48	Pain Score	Pain	0-10 98 = Not Documented	Continuous	Mean, Range, STD	Scale

No.	Variable	SPSS variable name	Coding Instruction	Type of Variable	Type of measure	Level of measure
49	Day of symptom onset	SO_D	1 = Mon 2 = Tue 3 = Wed 4 = Thu 5 = Fri 6 = Sat 7 = Sun	Categorical	Frequency, percentage	Nominal
50	Time of Symptom onset	SO_Tm	1 = 6.00 – 18.00 2 = 18.01 -5.59	Categorical	Frequency, percentage	Nominal
51	Activity during onset	ACT_SO	1 = at rest 2 = active activities 3 = inactive activities 4 = after meal 5= Others 98 = Not documented	Categorical	Frequency, percentage	Nominal
52	Location of event	Locate	1 = Home 2 = Work place 3 = Public 4 = Nursing Home 98 = Not documented	Categorical	Frequency, percentage	Nominal
53	First Medical Contact	Fst_MC	1 = Ambulance 2 = ED 3 = GP 4 = ED/TF	Categorical	Frequency, percentage	Nominal
54	Contact Day	Fst_MC_D	1 = Mon 2 = Tue 3 = Wed 4 = Thu 5 = Fri 6 = Sat 7 = Sun	Categorical	Frequency, percentage	Nominal
55	Contact Time	Fst_MC_Tm	1 = 6.00 – 18.00 2 = 18.01 -5.59	Categorical	Frequency, percentage	Nominal
56	Ambulance Use	Ambulance	0 = N 1 = Y	Categorial	Frequency, percentage	Nominal
60	Referral	Referral	0 = No 1 = Yes	Categorial	Frequency, percentage	Nominal
61	Decision time	Dcsn_Tm	Minute(s)	Continuous	Mean, Median, Range STD	Scale
62	Decision time Category	Dcsn_Cat	1 = ≤ 10 2 = > 10 99 = Unknown	Categorial	Frequency, percentage	Nominal
63	Priority	Prior	1 to 5 98 = Error record	Categorical	Frequency, percentage	Nominal

No.	Variable	SPSS variable name	Coding Instruction	Type of Variable	Type of measure	Level of measure
64	Day of Presentation	Triage_Day	1 = Mon 2 = Tue 3 = Wed 4 = Thu 5 = Fri 6 = Sat 7 = Sun	Categorical	Frequency, percentage	Scale
65	Triage Time	Trge_Tm	24 hr	Continuous	Mean, Median, Range STD	Ordinal
66	Triage Time category	Trge_Tm_Cat	1 = 9.00 – 17.00 2 = 17.01 -8.59	Categorical	Frequency Percentage	Nominal
67	Prehospital delay time	PDT	Hour (s)	Continuous		Ordinal
68	Prehospital delay time Category	PDT_Cat	1 = < 1 2 = 1 - 3 3 = 3.01 - 6 4 = 6.01 - 12 5 = > 12 99 = unknown	Categorical	Frequency, percentage	Nominal
69	Time to treatment	Tm_Trtmt	Minute(s)	Continuous	Mean, Median, Range STD	Scale
70	Time to treatment Category	Tm-Trtmt_Cat	1 = < 10 2 = 10 - 30 3 = 31 - 60 4 = 61- 120 5 = >120	Categorical	Frequency, percentage	Nominal
71	Time to treatment match guidelines	Tm_Trtmt_GL	0 = N If Priority = 2 and Tm_Trtmt_cat ≠ 1 1 = Y If Priority = 2 and TmTrtmt_cat = 1 98 = other priority	Categorical	Frequency, percentage	Nominal
72	First 12 lead ECG	Fst_ECG	1 = Ambulance 2 = ED 3 = GP 4 = ED/TF 98 = Not applicable	Categorical	Frequency, percentage	Nominal
73	Time of first ECG	ECG_Tm	1 = ≤ 10 2 = > 10 98 = N/A 99 = Unknown	Categorical	Frequency, percentage	Nominal
74	S-T-segment deviation	ST_DEV	0 = No 1 = Elevation 2 = Depression 3 = Deviation 99 = Unknown	Categorical	Frequency, percentage	Nominal

No.	Variable	SPSS variable name	Coding Instruction	Type of Variable	Type of measure	Level of measure
75	ECG Diagnosis	ECG_Diag	0 = Non-ACS 1 = ACS 98 = Not Applicable 99 = Unknown	Categorical	Frequency, percentage	Nominal
76	Heart rate (mean)	HR	Beats/min	Continuous	Mean, Median, Range STD	Scale
77	Heart Rate Category	HR-Cat	1 = < 50 2 = 50-100 3 = > 100 98 = Not documented	Categorical	Frequency, percentage	Nominal
78	Systolic BP	Sys_BP	mmHg	Continuous	Mean, Median, Range STD	Scale
79	Systolic BP Category	BP_Cat	1 = < 80 2 = 80-180 3 = > 180 98 = Not documented	Categorical	Frequency, percentage	Nominal
80	Troponin T level	Tnt_T	0 = Higher than normal range 1 = Nornmal 98 = Not applicable 99 = Unknown	Categorical	Frequency, percentage	Nominal
81	Troponin T serial	Tnt_Srl	0 = Negative 1 = Positive 98 = Not applicable 99 = Unknown	Categorical	Frequency, percentage	Nominal
82	CK-MB	CK_MB	0 = Higher than normal range 1 = Nornmal 98 = Not applicable 99 = Unknown	Categorical	Frequency, percentage	Nominal
	Creatinine serum	Cr_Lev		Continuous	Mean, Median, Range STD	Scale
83	Creatinine serum	Cr_Cat	0 = Higher than normal range 1 = Nornmal	Categorical	Frequency, percentage	Nominal
84	CHF at present	CHF_Prst	0 = No 1 = Yes	Categorial	Frequency, percentage	Nominal
85	Cardiac arrest at present	CA_Prst	0 = No 1 = Yes	Categorial	Frequency, percentage	Nominal

No.	Variable	SPSS variable name	Coding Instruction	Type of Variable	Type of measure	Level of measure
86	ATS Admission Time	ATS_Tm	Hour(s)	Continuous	Mean, Median, Range, STD	Scale
87	ATS Admission Time category	ATS_Tm_cat	1 = ≤ 4 0 = >4 98 = N/A	Categorical	Frequency percentage	Nominal
88	ED stay	ED_Stay	Hour(s)	Continuous	Mean, Median, Range, STD	Scale
89	ED stay indicator	ED_Indct	1 = ≤ 4 0 = >4 98 = N/A	Categorical	Frequency percentage	Nominal
90	Episode end status	Epsd_End	1 =Cardiac services 2 = Other admissions 3 = Discharged 4 = Death 99 = unknown	Categorical	Frequency percentage	Nominal
91	Therapy Type	THPY_Typ	1 = PCI 2 = CABG 3 = Fibrinolysis 4 = Medication 98 = N/A	Categorical	Frequency percentage	Nominal
92	D2B time	D2B	Minute(s)	Continuous	Mean, Median, Range, STD	Scale
93	D2B ttime category	D2B_Cat	1 = ≤ 60 2 = 61 - 90 3 = 91 - 240 4 = > 240 98 = N/A	Categorical	Frequency, percentage	Nominal
94	Delay time	Delay_Tm	Hour(s)	Continuous	Mean, Median, Range, STD	Scale
95	Delay time Cartegory	Delay_Cat	1 = <1 2 = 1 - 3 3 = 3.1 - 6 4 = 6.1 - 9 5 = 9.01 - 12 6 = > 12 98 = N/A	Categorical	Frequency, percentage	Nominal
96	Discharge Diagnosis DRG	Diag_DRG	0 = Non- ACS 1 = ACS	Categorical	Frequency, percentage	Nominal
97	Discharge Diagnosis ICD-10	Diag_ICD	0 = Non- ACS 1 = ACS	Categorical	Frequency, percentage	Nominal

No	Variable	SPSS variable name	Coding Instruction	Type of Variable	Type of measure	Level of measure
98	Length of Hospital stay	Lgth_Hosp	Day(s)	Continuous	Mean, Median, Range, STD	Scale
99	Readmission 6 months	RADM_6	0 = No 1 = Yes	Categorical	Frequency, percentage	Nominal
100	Cause of readmission 6 month (ICD-10)		0 = Non- ACS 1 = ACS 98 = N/A	Categorical	Frequency, percentage	Nominal
101	Readmission 1 year	RADM_1	0 = No 1 = Yes	Categorical	Frequency, percentage	Nominal
102	Cause of readmission 1 year (ICD-10)		0 = Non- ACS 1 = ACS 98 = N/A	Categorical	Frequency, percentage	Nominal
103	Readmission Time	RADM_T	Days	Continuous	Mean, Median, Range, STD	Scale
104	Readmission Time (days)	RADM_Cat	1 = ≤ 30 2 = > 30 98 = N/A	Categorical	Frequency, percentage	Nominal

Appendix IX: TED 3 Study Data extract form

TED III Data extract form

TED Study: Time, Ethnicity and Delay

Flinders Medical Centre, South Australia

Data Extract Form

Definition of the registrants:
"patients presented to emergency department with chest pain"

Participant ID

1. Patients Demographics

1.1 date of Birth

1.2 Gender ○ Male ○ Female

1.3 Marital status ○ Married ○ Single ○ De Facto ○ Divorce ○ Separate ○ Widow

1.4 Health insurance ○ Medicare ○ Private ○ None/self pay

1.5 Post code

1.6 Country of birth

1.7 Region ○ Eastern Europe ○ Western Europe ○ Northern Europe ○ Southern Europe ○ Eastern Asia ○ Western Asia ○ Southeast Asia ○ Southern Asia ○ Africa ○ Australia ○ America ○ Others

1.8 Language spoken at home ○ English ○ Other

---

2. Medical History

2.1 Family history of CHD ○ Yes ○ No ○ N/D

2.2 Hypertension ○ Yes ○ No ○ N/D

2.3 Diabetes Mellitus ○ Yes ○ No ○ N/D

2.4 Hyperlipidaemia ○ Yes ○ No ○ N/D

2.5 Smoking history ○ Current ○ Past ○ Never

2.6 Alcohol ○ current ○ past ○ Never

2.7 Prior MI ○ Yes ○ No ○ When

2.8 Prior PCI ○ Yes ○ No ○ When

2.9 Prior Fibrinolysis ○ Yes ○ No ○ When

2.10 Prior Stroke/TIA ○ Yes ○ No ○ When

2.11 Prior CHF ○ Yes ○ No ○ When

2.12 Weight (Kg)

2.13 Height (cm)

2.14 BMI

- ○ Under weight, <18.5
- ○ Normal, 18.5 - 24.99
- ○ Overweight, 25 - 29.99
- ○ Obese, 30 or more

3 Presentation and Triage

3.1 First medical contact (select one)

- ○ Ambulance/paramedics ○ ED
- ○ Other

3.2 Time of receive call (ambulance sheet)

3.3 Estimated Time of symptom onset

3.4 Day of presentation

- ○ Monday
- ○ Tuesday
- ○ Wednesday
- ○ Thursday
- ○ Friday
- ○ Saturday
- ○ Sunday
- ○ Time

3.5 Triage Time

3.6 Time of medical Treatment initiation

3.7 Heart Rate (beats/minute)

3.8 Systolic BP (mm Hg)

3.9 CHF at present ○ Yes ○ No ○ N/D

3.10 Cardiac arrest prior to or on arrival at hospital ○ Yes ○ No ○ N/D

3.11 First 12-lead ECG taken

- ○ Ambulance ○ ED
- ○ Others

3.12 Diagnosis from ECG

3.13 ST Elevation ○ Yes ○ No

3.14 Elevated Troponin

- ○ Yes ○ No ○ N/D
- ○ Amount/Type of Troponin

3.15 Creatinine Serum (mg/dL)

3.16 Location of event

- ○ Home
- ○ Workplace
- ○ Other

3.17 Mode of transport

- ○ Ambulance
- ○ Other

3.18 GRACE Score **NSTEACS**
In hospital mortality and
6 month post-discharge mortality

3.19 GRACE Score **STEACS**
In hospital mortality and
6 month post-discharge mortality

4. Clinical Outcomes

4.1 PCI	○ Yes ○ No ○ Date/time of first procedure
4.2 Comment on PCI	
4.3 Fibrinolysis	○ Yes ○ No ○ Date/Time of first procedure
4.4 Prescribed fibrinolytic agents	
4.5 Coronary Artery Bypass Graft	○ Yes ○ No ○ Date/Time of procedure
4.6 Angiogram	○ Yes ○ No ○ Date/Time of first procedure
4.7 Provisional diagnosis (EDIS)	
4.8 Discharge diagnosis	
4.9 Readmission within 6 months	○ Yes ○ No ○ N/D ○ ICD- 10/AN-DRGS
4.10 Date of readmission	
4.11 Death	○ Yes ○ No ○ ICD - 10/AN-DRGS
4.12 Date of Death	

Appendix X: Ethical Applications and Site Specific Assessment Application for TED II and TED III

Submission Code Date: 24/10/2014 14:29:54 Reference: Online Form

9. DECLARATIONS

9. Declaration by Research Personnel Nominated in Section 2

Project Title	Characteristics and outcomes of culturally and linguistically diverse (CALD) migrants presenting with chest pain: a cross-sectional analysis of a cohort of emergency presentation (1 July 2012 and 30 June 2014)

I/we certify that:

1. All information supplied in this form is factual and as complete as possible;
2. I/we have had access to and read the NHMRC National Statement on Ethical Conduct in Human Research 2007 (National Statement) and the Australian Code for the Responsible Conduct of Research 2007 (The Code)
3. The research will be conducted in accordance with the ethical and research governance arrangements of the organisations involved.
4. I/we have consulted any relevant legislation and regulations, and the project described will be conducted in accordance with these.
5. I/we will only commence this research project after obtaining approval from the HREC and authorisation via the site specific assessment process required by the Public Health Organisation.

Coordinating / Principal Investigator(s)

Mrs Kannikar Wechkunanukul
Flinders University
Signature 30/10/14 Date

Professor Robyn Clark
Flinders University
Signature 30/10/14 Date

Associate Researchers

Professor Hugh Grantham
Flinders University
Signature 4/11/14 Date

Dr David Teubner
Flinders University
Signature 4/11/14 Date

Ethical Application for TED III

Submission Code Date: 04/11/2014 12:28:42 Reference: Online Form

9. DECLARATIONS

9. Declaration by Research Personnel Nominated in Section 2

Project Title	Ethnic differences in delay time in seeking medical care for chest pain amongst culturally and linguistically diverse (CALD)migrants: a randomised retrospective medical record review study from 1 July 2012 and 30 June 2014

I/we certify that:

1. All information supplied in this form is factual and as complete as possible;
2. I/we have had access to and read the NHMRC National Statement on Ethical Conduct in Human Research 2007 (National Statement) and the Australian Code for the Responsible Conduct of Research 2007 (The Code)
3. The research will be conducted in accordance with the ethical and research governance arrangements of the organisations involved.
4. I/we have consulted any relevant legislation and regulations, and the project described will be conducted in accordance with these.
5. I/we will only commence this research project after obtaining approval from the HREC and authorisation via the site specific assessment process required by the Public Health Organisation.

Coordinating / Principal Investigator(s)

Prof Robyn Clark
Flinders University
Signature 5 / 11 / 14 Date

Mrs Kannikar Wechkunanukul
Flinders University
Signature 4 / 11 / 2014 Date

Associate Researchers

Professor Hugh Grantham
Flinders University
Signature 4 / 11 / 14 Date

Dr David Teubner
Flinders University
Signature 5 / 11 / 14 Date

Site Specific Assessment Application for TED II

Submission Code Date: 11/11/2014 14:22:03 HREC Reference: Online Form

Declaration by the Principal Investigator and Investigators

Project title:	Characteristics and outcomes of culturally and linguistically diverse (CALD) migrants presenting with chest pain: a cross-sectional analysis of a cohort of emergency presentation (1 July 2012 and 30 June 2014)

I/we certify that:

1. All information in this form is truthful and as complete as possible.
2. I/we have had access to and read the NHMRC *National Statement on Ethical Conduct in Human Research 2007* (National Statement) and the *Australian Code for the Responsible Conduct of Research* 2007 (The Code).
3. The research will be conducted in accordance with the ethical and research arrangements of the organisations involved.
4. I/we have consulted any relevant legislation and regulations, and the project will be conducted in accordance with these.
5. I/we will only commence this research project after obtaining approval from a SA Health HREC and authorisation from the Public Health Organisation.

Name Kannikar Wechkunanukul
Role Student

Signature: ..... **Date** 19/11/2014

Name Robyn Clark
Role Supervisor

Signature: ..... **Date** ...../...../.....

Name Hugh Grantham
Role Principal Investigator

Signature: ..... **Date** 19/11/14

Name David Teubner
Role Investigator

Signature: ..... **Date** 20/11/14

Site Specific Assessment Application for TED III

Submission Code Date: 11/11/2014 14:14:05 HREC Reference: Online Form

Declaration by the Principal Investigator and Investigators

Project title:	Ethnic differences in delay time in seeking medical care for chest pain amongst culturally and linguistically diverse (CALD)migrants: a randomised retrospective medical record review study from 1 July 2012 and 30 June 2014

I/we certify that:

1. All information in this form is truthful and as complete as possible.
2. I/we have had access to and read the NHMRC *National Statement on Ethical Conduct in Human Research 2007* (National Statement) and the *Australian Code for the Responsible Conduct of Research* 2007 (The Code).
3. The research will be conducted in accordance with the ethical and research arrangements of the organisations involved.
4. I/we have consulted any relevant legislation and regulations, and the project will be conducted in accordance with these.
5. I/we will only commence this research project after obtaining approval from a SA Health HREC and authorisation from the Public Health Organisation.

Name Kannikar Wechkunanukul
Role Student

Signature: ..... **Date** 19/11/2014

Name Robyn Clark
Role Supervisor

Signature: ..... **Date** ...../...../.....

Name Hugh Grantham
Role Principal Investigator

Signature: ..... **Date** 19/11/14

Name David Teubner
Role Investigator

Signature: ..... **Date** 21/11/14

Appendix XI: Support documents for ethical applications

Letter of Authorisation for TED Study

Dr David Teubner
Emergency Medicine
School of Medicine
Paramedic Unit
School of Medicine
Rm W250 Sturt Buildings
GPO Box 2100
Adelaide SA 5001
Tel: 08 8201 7914
Fax: 08 8201 2150
Dadiv.teubner@flinders.edu.au
www.flinders.edu.au
CRICOS Provider No. 00114A

15 October 2014

Kannikar Wechkunanukul
School of Nursing and Midwifery
Flinders University
Phone Direct: +61 8 8201 3452
Email: kannikar.w@flinders.edu.au

Re: Accessing Emergency Department Information System (EDIS)

Dear Kannikar,

I am aware of the purpose and scope of the Time, Ethnicity and Delay (TED) study which aims to determine characteristics and outcomes among culturally and linguistically diverse (CALD) migrants suffering from chest pain in relation to delay time in seeking medical care and examine the differences in delay in seeking medical care for chest pain and outcomes between CALD subgroups.

I am writing this letter to respond to your requesting to access and extract certain dataset collected between 1 July 2012 and 30 June 2014 of the EDIS for the TED study. My understanding is that with my authorization for accessing and extracting of data, these datasets will be anonymised and used by you and your research team to perform research in relation to TED study.

The purpose of this letter is to authorise your research team, including Kannikar Wechkunanukul, Hugh Grantham and Robyn Clark to access and extract certain dataset described above and to incorporate those anonymised datasets from the EDIS into TED study that will be specifically used as outline in TED study.

Sincerely yours,
Dr David Teubner

inspiring achievement

Insurance and Indemnity Approval

Hannah Wechkunanukul

From: Markic, John (Health) <John.Markic@health.sa.gov.au>
Sent: Monday, 17 November 2014 1:57 PM
To: Hannah Wechkunanukul
Cc: Steve Semmler; Health:FMC Research Ethics
Subject: FW: Require advice please

Dear Hannah

I refer to your Studies titled:

- *Characteristics and outcomes of culturally and linguistically diverse (CALD) migrants presenting with chest pain: a cross –sectional analysis of a cohort of emergency presentation (1 July 2012-30June 2014),* and
- *Ethnic differences in delay time in seeking medical care for chest pain amongst culturally and linguistically diverse (CALD)migrants: a randomised retrospective medical record review study from 1 July 2012 and 30 June 2014 ,*

and advise that the indemnity and insurance being provided by Flinders University is acceptable.

Regards

John Markic
Manager, Insurance Services
Corporate Governance and Policy
SA Health
Government of South Australia

Tel: 08 8463 6089
Fax: 08 8463 6070
E-mail: john.markic@health.sa.gov.au

Web site: www.health.sa.gov.au

From: Steve Semmler [mailto:steve.semmler@flinders.edu.au]
Sent: Monday, 17 November 2014 1:37 PM
To: Hannah Wechkunanukul
Cc: Markic, John (Health)
Subject: RE: Require advice please

Hi Hannah
I have copied John Markic from Health SA, who will respond to my email to you.

I have read your ethics application titled" Characteristics and outcomes of culturally and linguistically diverse (CALD) migrants presenting with chest pain: a cross –sectional analysis of a cohort of emergency presentation (1 July 2012-30June 2014)" and advise that the University's general and liability protections will indemnify the Flinders University research participants.
Cheers

Steve Semmler
Insurance Officer
Flinders University

1

Appendix XII: Ethics Approval and Site Specific Assessment Approval for TED II and TED III

Ethics Approval for TED II

Southern Adelaide Clinical
Human Research Ethics Committee

Government of South Australia
Southern Adelaide Health Service

Ethics application approval

You are reminded that this letter constitutes ethical approval only. You must not commence this research project at a SA Health site until separate authorisation from the Chief Executive or delegate of that site has been obtained.

18 November 2014

Dear Professor Clark

This is a formal correspondence from the Southern Adelaide Clinical Human Research Ethics Committee (SAC HREC EC00188). This committee operates in accordance with the "National Statement on Ethical Conduct in Human Research (2007)." No hard copy correspondence will be issued.

Application Numbers: 458.14 - HREC/14/SAC/479

Title: Characteristics and outcomes of culturally and linguistically diverse (CALD) migrants presenting with chest pain: a cross-sectional analysis of a cohort of emergency presentation (1 July 2012 and 30 June 2014)

Chief investigator: Professor Robyn Clark

Approved public health site: Flinders Medical Centre

The Issue: The Southern Adelaide Clinical Human Research Ethics Committee (SAC HREC) have reviewed and approved the above application. The approval extends to the following documents/changes:

- SA Health Low and Negligible Risk (LNR) application form dated 30 October 2014
- Letter of support from Dr David Teubner, Researcher, Emergency Medicine, School of Medicine, Flinders University dated 15 October 2014

Approval Period: 18 November 2014 – 18 November 2015

Please read the terms and conditions of ethical approval below, as researchers have a significant responsibility to comply with reporting requirements and the other stated conditions.

For example, the implications of not providing annual reports and requesting an extension for research prior to approval expiring could lead to the suspension of the research, and has further serious consequences.

Please retain a copy of this approval for your records.

Flinders Medical Centre
The Flats G5 – Rooms 3 and 4
Flinders Drive, Bedford Park SA 5042
T: 08 8204 6453
E:Research.ethics @health.sa.gov.au

Ethics Approval for TED III

Southern Adelaide Clinical
Human Research Ethics Committee

Government of South Australia
Southern Adelaide Health Service

Ethics application approval

You are reminded that this letter constitutes ethical approval only. You must not commence this research project at a SA Health site until separate authorisation from the Chief Executive or delegate of that site has been obtained.

06 November 2014

Dear Professor Clark

This is a formal correspondence from the Southern Adelaide Clinical Human Research Ethics Committee (SAC HREC EC00188). This committee operates in accordance with the "National Statement on Ethical Conduct in Human Research (2007)." No hard copy correspondence will be issued.

Application Numbers: 461.14 - HREC/14/SAC/484

Title: Ethnic differences in delay time in seeking medical care for chest pain amongst culturally and linguistically diverse (CALD) migrants: a randomised retrospective medical record review study from 1 July 2012 and 30 June 2014

Chief investigator: Professor Robyn Clark

Approved public health sites: Flinders Medical Centre

The Issue: The Southern Adelaide Clinical Human Research Ethics Committee (SAC HREC) have reviewed and approved the above application. The approval extends to the following documents/changes:

- Low and negligible risk application form dated 05 November 2014.
- Letter of support from Dr David Teubner, Emergency Medicine, School of Medicine dated 15 October 2014.

Approval Period: 04 November 2014 to 03 November 2015

Please read the terms and conditions of ethical approval below, as researchers have a significant responsibility to comply with reporting requirements and the other stated conditions.

For example, the implications of not providing annual reports and requesting an extension for research prior to approval expiring could lead to the suspension of the research, and has further serious consequences.

Please retain a copy of this approval for your records.

Flinders Medical Centre
The Flats G5 – Rooms 3 and 4
Flinders Drive, Bedford Park SA 5042
T: 08 8204 6453
E:Research.ethics @health.sa.gov.au

Site Specific Assessment Approval for TED II

FLINDERS MEDICAL CENTRE

Government of South Australia
Southern Adelaide Health Service

14 January 2015

Professor Hugh Grantham
Paramedics Unit, School of Medicine
GPO Box 2100
ADELAIDE SA 5001

Dear Professor Grantham

HREC reference number: HREC/14/SAC/479 (458.14)
SSA reference number: SSA/14 /SAC/483
Project title: Characteristics and outcomes of culturally and linguistically diverse (CALD) migrants presenting with chest pain: a cross-sectional analysis of a cohort of emergency presentation (1July 2012 and 30 June 2014)
Ethics approval: 18 November 2014 – 18 November 2015

RE: Site Specific Assessment Review

Thank you for submitting an application for authorisation of this project. I am pleased to inform you that authorisation has been granted for this study to commence at the following sites: Flinders Medical Centre

- Site Specific Assessment form
- CV for Professor Hugh Grantham
- SAC HREC approval letter dated 18 November 2014
- SA Health indemnity approved dated 07 January 2015

HREC reviewed documents listed on the approval letter dated 18 November 2014 from the SAC HREC are accepted as part of the site authorisation.

Should you have any queries about the consideration of your Site Specific Assessment form, please contact Bev Stewart-Campbell on 08 8204 4507.

The SSA reference number should be quoted in any correspondence about this matter.

If University personnel are involved in this project, the Principal Investigator should notify the University before commencing their research to ensure compliance with University requirements including any insurance and indemnification requirements.

Yours sincerely

Bev Stewart-Campbell
Research Governance Officer
Southern Adelaide Clinical Human Research Ethics Committee

Flinders Medical Centre
The Flats G5 – Rooms 3 and 4
Flinders Drive, Bedford Park SA 5042
T: 08 8204 6453
F: 08 8204 4586
E:Research.ethics @health.sa.gov.au

Site Specific Assessment Approval for TED III

FLINDERS MEDICAL CENTRE

Government of South Australia
Southern Adelaide Health Service

14 January 2015

Professor Hugh Grantham
Paramedics Unit, School of Medicine
GPO Box 2100
ADELAIDE SA 5001

Dear Professor Grantham

HREC reference number: HREC/14/SAC/484 (461.14)
SSA reference number: SSA/14 /SAC/549
Project title: Ethnic differences in delay time in seeking medical care for chest pain amongst culturally and linguistically diverse (CALD) migrants: a randomised retrospective medical record review study from 1 July 2012 and 30 June 2014
Ethics approval: 04 November 2014 to 03 November 2015

RE: Site Specific Assessment Review

Thank you for submitting an application for authorisation of this project. I am pleased to inform you that authorisation has been granted for this study to commence at the following sites: Flinders Medical Centre

- Site Specific Assessment form
- CV for Professor Hugh Grantham
- SAC HREC approval letter dated 06 November 2014
- SA Health indemnity approved dated 07 January 2015

HREC reviewed documents listed on the approval letter dated 06 November 2014 from the SAC HREC are accepted as part of the site authorisation.

Should you have any queries about the consideration of your Site Specific Assessment form, please contact Bev Stewart-Campbell on 08 8204 4507.

The SSA reference number should be quoted in any correspondence about this matter.

If University personnel are involved in this project, the Principal Investigator should notify the University before commencing their research to ensure compliance with University requirements including any insurance and indemnification requirements.

Yours sincerely

Bev Stewart-Campbell
Research Governance Officer
Southern Adelaide Clinical Human Research Ethics Committee

Flinders Medical Centre
The Flats G5 – Rooms 3 and 4
Flinders Drive, Bedford Park SA 5042
T: 08 8204 6453
F: 08 8204 4586
E:Research.ethics @health.sa.gov.au

Appendix XIII: Data Management Agreement

Data Management Agreement

School of Nursing and Midwifery
GPO Box 2100
Adelaide SA 5001
Tel: 08 8201 3452
Fax: 08 8276 1602
Kannikar.w@flinders.edu.au
www.flinders.edu.au

Letter of Research Agreement

This Research Agreement is between Ms Kannikar Wechkunanukul, a PhD candidate, School of Nursing and Midwifery, Flinders University ("KW") and Professor Robyn A Clark (Principal Supervisor), a Professor of Nursing (Acute Care and Cardiovascular Research), School of Nursing and Midwifery, Flinders University and Prof Hugh Grantham (Associate Supervisor), Professor of Paramedics, Paramedic Unit, School of Medicine Flinders University, and Dr David Teubner, Researcher Emergency Medicine, School of Medicine, Flinders University ("DT").

This agreement is to confirm the professional and ethical management of data for 2 proposed studies which will form part of the PhD for Ms Kannikar Wechkunanukul. The studies are entitled:

1. *Characteristics and outcomes of culturally and linguistically diverse (CALD) migrants with chest pain: a cross-sectional analysis of a cohort of emergency presentations (1 July 2012 - 30 June 2014) ("TED Study 1")*

2. *Ethnic differences in delay time in seeking medical care for chest pain amongst culturally and linguistically diverse (CALD) migrants: a randomised retrospective medical record review study from 1 July 2012 and 30 June 2014 ("TED Study 2")*

The proposed studies are designed to produce research outcomes by analysing data extracted from the Emergency Department Information System (EDIS) and from associated medical records (not part of this agreement). The EDIS data extraction is currently managed by Dr David Teubner. We agree that

1. Only one electronic copy of the EDIS data extraction will be held by the Flinders researchers.

2. The single copy of the EDIS data extraction will be kept in a secured firewalled file on the Flinders University server. Password access will be limited to those named above.

3. The single electronic copy of the EDIS data extraction will be deleted at the end of this project.

4. The EDIS data extraction will only be used for the outcomes described in the 2 proposals above (TED Study 1 and TED Study 2).

5. All EDIS data will be de-identified and only aggregated outcomes will be reported and published.

6. As a PhD candidate KW will own the Intellectual Property (IP) of all derived outcomes and data collected by from medical records.

7. KW cannot claim IP of the EDIS data extraction.

8. The EDIS data extraction will be acknowledged in all reports and publications of the TED Study 1 and TED Study 2.

9. DT will be acknowledged and participate as co-author and co-investigator on all reports and publications of the TED Study 1 and TED Study 2.

We, the undersigned have read, understand and agree to comply with all conditions listed in this agreement.

Ms Kannikar Wechkunanukul	..... Signature	...../...../..... Date
Dr David Teubner	..... Signature	...../...../..... Date
Prof Robyn Clark	..... Signature	...../...../..... Date
Prof Hugh Grantham	..... Signature	...../...../..... Date

Appendix XIV: JBI Systematic Review (TED I)

JBI Levels of Evidence

Levels of Evidence - Effectiveness	
Level 1 – Experimental Designs	Level 1.a – Systematic review of Randomized Controlled Trials (RCTs)
	Level 1.b – Systematic review of RCTs and other study designs
	Level 1.c – RCT
	Level 1.d – Pseudo-RCTs
Level 2 – Quasi-experimental Designs	Level 2.a – Systematic review of quasi-experimental studies
	Level 2.b – Systematic review of quasi-experimental and other lower study designs
	Level 2.c – Quasi-experimental prospectively controlled study
	Level 2.d – Pre-test – post-test or historic/retrospective control group study
Level 3 – Observational – Analytic Designs	Level 3.a – Systematic review of comparable cohort studies
	Level 3.b – Systematic review of comparable cohort and other lower study designs
	Level 3.c – Cohort study with control group
	Level 3.d – Case – controlled study
	Level 3.e – Observational study without a control group
Level 4 – Observational – Descriptive Studies	Level 4.a – Systematic review of descriptive studies
	Level 4.b – Cross-sectional study
	Level 4.c – Case series
	Level 4.d – Case study
Level 5 – Expert Opinion and Bench Research	Level 5.a – Systematic review of expert opinion
	Level 5.b – Expert consensus
	Level 5.c – Bench research/ single expert opinion

TED I: JBI Systematic Review Search results

Mediline (OvidSP) 1946-20 October 2014

#	**Searches**
1	Myocardial Ischemia/
2	Acute Coronary Syndrome/
3	Chest Pain/
4	angina pectoris/ or angina, unstable/
5	coronary disease/ or coronary artery disease/ or coronary occlusion/ or coronary stenosis/ or coronary thrombosis/
6	myocardial infarction/ or anterior wall myocardial infarction/ or inferior wall myocardial infarction/ or myocardial stunning/
7	Plaque, Atherosclerotic/
8	chest pain*.tw.
9	((myocardial or cardiac or heart) adj2 (infarct* or isch?emi*)).tw.
10	(AMI or MI).tw.
11	(STEMI or NSTEMI).tw.
12	(ST adj2 (elevat* or depress*)).tw.
13	(heart adj2 attack*).tw.
14	(coronary adj2 (syndrome* or disease* or event* or occlusion* or stenos* or thrombo*)).tw.
15	(ACS or STEACS or NSTEACS or CAD or CHD).tw.
16	(unstable adj4 angina).tw.
17	(atherosclero* or athero-sclero* or atherothrombo* or athero-thrombo*).tw.
18	or/1-17
19	"Emigrants and Immigrants"/
20	exp Ethnic groups/
21	Refugees/
22	culture/ or acculturation/ or cross-cultural comparison/ or cultural characteristics/ or cultural diversity/ or ethnology/ or human migration/
23	Cultural competency/
24	Vulnerable populations/
25	Ethnology.fs.
26	multilingualism/ or Communication barriers/ or Language/
27	(Language adj2 proficien*).tw.
28	(Ethnic* or Ethnolog* or "Linguistic diversity" or "Linguistically diverse" or multilingual* or multi-lingual* or refugee* or CALD or Immigrant* or Emigrant* or Migrant* or Cultural* or sociocultural* or Minorit* or Race? or Racial* or Foreign-born or overseas-born or "Languages other than English" or LOTE or "non-English speaking background*" or NESB).tw.
29	or/19-28
30	Early diagnosis/ or Time factors/ or Delayed diagnosis/ or Patient Acceptance of Health Care/ or Health Knowledge, Attitudes, Practice/ or Decision Making/ or Health Behavior/ or Time-to-treatment/
31	((Time* or timing) adj3 (call* or arriv* or interval* or treat* or door or treat*)).tw.
32	(Delay* or prompt* or rapid*).tw.
33	((Seek* or call*) adj3 (help or treat* or care or medical or attention or assistance or emergenc*)).tw.
34	or/30-33
35	18 and 29 and 34
36	limit 35 to english language

CINAHL 1981-20 October 2014

#	Query
S36	S18 AND S29 AND S34
S35	S18 AND S29 AND S34
S34	S30 OR S31 OR S32 OR S33
S33	TI (((Seek* or call*) N3 (help or treat* or care or medical or attention or assistance or emergenc*))) OR AB (((Seek* or call*) N3 (help or treat* or care or medical or attention or assistance or emergenc*)))
S32	TI ((Delay* or prompt* or rapid*)) OR AB ((Delay* or prompt* or rapid*))
S31	TI (((Time* or timing) N3 (call* or arriv* or interval* or treat* or door or treat*))) OR AB (((Time* or timing) N3 (call* or arriv* or interval* or treat* or door)))
S30	(MH "Early Diagnosis") OR (MH "Time Factors") OR (MH "Diagnosis, Delayed") OR (MH "Health Knowledge") OR (MH "Attitude to Health") OR (MH "Decision Making, Patient") OR (MH "Decision Making") OR (MH "Decision Making, Family") OR (MH "Help Seeking Behavior") OR (MH "Health Behavior")
S29	S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28
S28	TI (Ethnic* or Ethnolog* or "Linguistic diversity" or "Linguistically diverse" or multilingual* or multi-lingual* or refugee* or CALD or Immigrant* or Emigrant* or Migrant* or Cultural* or sociocultural* or Minorit* or Race# or Racial* or Foreign-born or overseas-born or "Languages other than English" or LOTE or "non-English speaking background*" or NESB) OR AB (Ethnic* or Ethnolog* or "Linguistic diversity" or "Linguistically diverse" or multilingual* or multi-lingual* or refugee* or CALD or Immigrant* or Emigrant* or Migrant* or Cultural* or sociocultural* or Minorit* or Race# or Racial* or Foreign-born or overseas-born or "Languages other than English" or LOTE or "non-English speaking background*" or NESB)
S27	TI (Language N2 proficien*) OR AB (Language N2 proficien*)
S26	(MH "Multilingualism") OR (MH "Communication Barriers") OR (MH "Communication Skills") OR (MH "English as a Second Language") OR (MH "Accents and Dialects") OR(MH "Language")
S25	(MW ethnology)
S24	(MH "Special Populations") OR (MH "Vulnerability")
S23	(MH "Cultural Competence")
S22	(MH "Culture") OR (MH "Acculturation") OR (MH "Cultural Diversity") OR (MH "Cultural Values") OR (MH "Ethnology") OR (MH "Ethnological Research")
S21	(MH "Refugees")
S20	(MH "Ethnic Groups+")
S19	(MH "Immigrants")
S18	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17
S17	TI (atherosclero* OR athero-sclero* OR atherothrombo* OR athero-thrombo*) OR AB (atherosclero* OR athero-sclero* OR atherothrombo* OR athero-thrombo*)
S16	TI (unstable) N4 (angina) OR AB (unstable) N4 (angina)
S15	TI (ACS OR STEACS OR NSTEACS OR CAD OR CHD) OR AB (ACS OR STEACS OR NSTEACS OR CAD OR CHD)
S14	TI ((coronary) N2 (syndrome* OR disease* OR event* OR occlusion* OR stenos* OR thrombo*)) OR AB ((coronary) N2 (syndrome* OR disease* OR event* OR occlusion* OR stenos* OR thrombo*))
S13	TI (heart) N2 (attack*) OR AB (heart) N2 (attack*)
S12	TI ((ST) N2 (elevat* OR depress*)) OR AB ((ST) N2 (elevat* OR depress*))
S11	TI (STEMI OR NSTEMI) OR AB (STEMI OR NSTEMI)
S10	TI (AMI OR MI) OR AB (AMI OR MI)
S9	TI (((myocardial or cardiac or heart) N2 (infarct* or isch#emi*))) OR AB (((myocardial or cardiac or heart) N2 (infarct* or isch#emi*)))
S8	TI "chest pain" OR AB "chest pain"
S7	(MH "Atherosclerosis")
S6	(MH "Myocardial Infarction")
S5	MH Coronary Disease OR MH Coronary Arteriosclerosis OR MH Coronary Stenosis OR MH Coronary Thrombosis
S4	(MH "Angina Pectoris") OR (MH "Angina, Unstable")
S3	(MH "Chest Pain")
S2	(MH "Acute Coronary Syndrome")
S1	(MH "Myocardial Ischemia")

Embase (OvidSP) 1974-21 October 2014

#	**Searches**
1	heart muscle ischemia/ or ischemic heart disease/ or myocardial disease/
2	acute coronary syndrome/ or non st segment elevation acute coronary syndrome/
3	thorax pain/
4	unstable angina pectoris/ or angina pectoris/ or impending heart infarction/
5	coronary artery disease/ or coronary artery occlusion/ or coronary artery obstruction/ or coronary artery thrombosis/
6	exp heart infarction/
7	atherosclerosis/ or atherosclerotic cardiovascular disease/ or atherosclerotic plaque/ or coronary artery atherosclerosis/
8	chest pain*.tw.
9	((myocardial or cardiac or heart) adj2 (infarct* or isch?emi*)).tw.
10	(AMI or MI).tw.
11	(STEMI or NSTEMI).tw.
12	(ST adj2 (elevat* or depress*)).tw.
13	(heart adj2 attack*).tw.
14	(coronary adj2 (syndrome* or disease* or event* or occlusion* or stenos* or thrombo*)).tw.
15	(ACS or STEACS or NSTEACS or CAD or CHD).tw.
16	(unstable adj4 angina).tw.
17	(atherosclero* or athero-sclero* or atherothrombo* or athero-thrombo*).tw.
18	or/1-17
19	migration/ or immigration/ or illegal immigrant/ or immigrant/
20	exp ethnic group/ or race/ or "ethnic and racial groups"/ or "ethnic or racial aspects"/ or race difference/
21	refugee/
22	cultural anthropology/ or cultural bias/ or cultural value/ or cultural factor/ or ethnology/
23	cultural competence/ or cultural safety/ or cultural sensitivity/
24	vulnerable population/
25	multilingualism/ or language ability/ or bilingualism/ or language/ or communication disorder/
26	(Language adj2 proficien*).tw.
27	(Ethnic* or Ethnolog* or "Linguistic diversity" or "Linguistically diverse" or multilingual* or multi-lingual* or refugee* or CALD or Immigrant* or Emigrant* or Migrant* or Cultural* or sociocultural* or Minorit* or Race? or Racial* or Foreign-born or overseas-born or "Languages other than English" or LOTE or "non-English speaking background*" or NESB).tw.
28	or/19-27
29	early diagnosis/ or time/ or chronology/ or reaction time/ or turnaround time/ or therapy delay/ or patient attitude/ or patient compliance/ or patient participation/ or patient preference/ or refusal to participate/ or decision making/ or patient decision making/ or health behavior/ or attitude to health/ or health belief/ or health belief model/ or time to treatment/
30	((Time* or timing) adj3 (call* or arriv* or interval* or treat* or door or treat*)).tw.
31	(Delay* or prompt* or rapid*).tw.
32	((Seek* or call*) adj3 (help or treat* or care or medical or attention or assistance or emergenc*)).tw.
33	or/29-32
34	18 and 28 and 33
35	limit 34 to english language

List of included studies in TED I

1. Ben-Shlomo Y, Naqvi H, Baker I. Ethnic differences in healthcare-seeking behaviour and management for acute chest pain: secondary analysis of the MINAP dataset 2002–2003. *Heart* 2008;**94**(3):354-359.

2. Canto JG, Taylor Jr HA, Rogers WJ, Sanderson B, Hilbe J, Barron HV. Presenting characteristics, treatment patterns, and clinical outcomes of non-black minorities in the National Registry of Myocardial Infarction 2. *Am J Cardiol* 1998;**82**(9):1013-1018.

3. Goldberg RJ, Gurwitz JH, Gore JM. Duration of, and temporal trends (1994-1997) in, prehospital delay in patients with acute myocardial infarction: the second National Registry of Myocardial Infarction. *Arch Intern Med* 1999;**159**(18):2141-2147.

4. Kendall H, Marley A, Patel JV, Khan JM, Blann AD, Lip GY, Dwivedi G. Hospital delay in South Asian patients with acute ST-elevation myocardial infarction in the UK. *European Journal of Preventive Cardiology* 2013;**20**(5):737-742.

5. King KM, Khan NA, Quan H. Ethnic variation in acute myocardial infarction presentation and access to care. *Am J Cardiol* 2009;**103**(10):1368-1373.

6. McGinn AP, Rosamond WD, Goff DC, Jr, Taylor HA, Miles JS, Chambless L. Trends in prehospital delay time and use of emergency medical services foe acute myocardial infarction: experience in 4 US communities from 1987-2000. *Am Heart J* 2005;**150**:392-400.

7. Sheifer SE, Rathore SS, Gersh BJ, Weinfurt KP, Oetgen WJ, Breall JA, Schulman KA. Time to presentation with acute myocardial infarction in the elderly associations with race, sex, and socioeconomic characteristics. *Circulation* 2000;**102**(14):1651-1656.

8. Syed M, Khaja F, Wulbrecht N, Alam M, Sabbah HN, Goldstein S, Borzak S, Rybicki BA. Effect of delay on racial differences in thrombolysis for acute myocardial infarction. *Am Heart J* 2000;**140**(4):643-650.

9. Ting HH, Bradley EH, Wang Y, et al. Factors associated with longer time from symptom onset to hospital presentation for patients with st-elevation myocardial infarction. *Arch Intern Med* 2008;**168**(9):959-968.

10. Ting HH, Chen AY, Roe MT, et al. Delay from symptom onset to hospital presentation for patients with non–st-segment elevation myocardial infarction. *Arch Intern Med* 2010;**170**(20):1834-1841

List of excluded studies

Clark L, Bellam S, Shah A, Feldman J. Analysis of prehospital delay among inner-city patients with symptoms of myocardial infarction: implications for therapeutic intervention. J Natl Med Assoc 1992;84(11):931.

Reason of exclusion: Statistical analysis was not reliable

DeVon HA, Burke LA, Nelson H, Zerwic JJ, Riley B. Disparities in Patients Presenting to the Emergency Department with Potential Acute Coronary Syndrome: It Matters if You Are Black or White. Heart & lung : the journal of critical care 2014;43(4):270-277.

Reason of exclusion: Sample not representative - Included only participants with fluent English, collected data only between 7.00 and 23.00.

Gibler WB, Armstrong PW, Ohman EM, Weaver WD, Stebbins AL, Gore JM, Newby LK, Califf RM, Topol EJ. Persistence of delays in presentation and treatment for patients with acute myocardial infarction: The GUSTO-I and GUSTO-III experience. Ann Emerg Med 2002;39(2):123-130.

Reason of exclusion: Sample not representative - Included only patients who received fibrinolysis treatment

Goff Jr DC, Feldman HA, McGovern PG, Goldberg RJ, Simons-Morton DG, Cornell CE, Osganian SK, Cooper LS, Hedges JR. Prehospital delay in patients hospitalized with heart attack symptoms in the United States: the REACT trial. Am Heart J 1999;138(6):1046-1057.

Reason of exclusion: High percentage of missing data (45%) among ethnic groups

Harralson TL. Factors influencing delay in seeking treatment for acute ischemic symptoms among lower income, urban women. Heart & Lung: The Journal of Acute and Critical Care 2007;36(2):96-104.

Reason of exclusion: Sample not representative - Included only participants with fluent English, collected data only during weekdays.

McSweeney JC, Lefler LL, Fischer EP, Naylor Jr AJ, Evans LK. Women's prehospital delay associated with myocardial infarction: does race really matter? J Cardiovasc Nurs 2007;22(4):279-285.

Reason of exclusion: Sample not representative - Included only participants speaking English or Spanish who can access a telephone (telephone survey).

Zerwic JJ, Ryan CJ, DeVon HA, Drell MJ. Treatment seeking for acute myocardial infarction Symptoms: differences in delay across sex and race. Nurs Res 2003;52(3):159-167.

Reason of exclusion: Sample not representative - Included only participants with fluent English.

Appendix XV: Published works arising from this thesis

Australian Critical Care xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Australian Critical Care

journal homepage: www.elsevier.com/locate/aucc

Review Paper

Global review of delay time in seeking medical care for chest pain: An integrative literature review

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ABSTRACT

Objectives: The aim of this review is to summarise research from a range of countries describing the differences in time taken to seek medical care for chest pain and factors which contribute to delay times.
Methods: An integrative literature review was undertaken using the Medline, CINAHL and Scopus databases for publications between 1994 and 2014. Articles dealing with delay time, and the factors associated with delay time, were extracted from the literature.
Results: The search yielded 395 articles of which 205 full-text articles were assessed for eligibility. Finally, twenty-three articles met the inclusion criteria for the review. It was found that time to seeking treatment (delay times) varied between countries, ranging from 1.6 to 12.9 h, with a mean of 3.4 h. The mean delay times reported in all the selected studies were greater than the recommended time-frame for seeking treatment. As well, time to decision to seek treatment (decision time) was reported as a major component of delay time. Meanwhile, the utilisation rates of ambulance services ranged from 3.1% in Brazil to 61.0% in Australia.

A majority of the reviewed studies reported on the factors associated with longer delay times, including old age, female gender, ethnicity, low education level, history of chronic disease, lack of knowledge of the symptoms, and underutilisation of ambulance services. Only three studies included a sub-analysis by ethnicity, reporting that ethnic groups had longer delay times than Caucasians.
Conclusion: Variability in delay times occurred across countries and within continents. The mean time taken to seek care for chest pain in the countries reviewed did not meet the recommended times according to international guidelines. Demographic and social factors, as well as cognitive and emotional factors, influenced delay times. Further research on these influencing factors is recommended, including the impact of ethnicity on patient's care-seeking behaviours for chest pain.

1. Introduction

Coronary heart disease (CHD) accounts for 1.8 million, or one-fifth of all deaths, in Europe annually.[1] In Australia, more than 20,000 deaths were caused by CHD in 2012,[2] and approximately 190 heart attacks occur each day.[3] Chest pain is the most common symptom (75% of presentations) of acute coronary syndrome (ACS)[2] and is also recognised as one of the most common presentations to emergency departments (ED).[4] The timely arrival of patients with chest pain to the ED and rapid evidence-based treatment are important factors in patient survival and outcomes.[5] Boersma et al. found that 65 lives were saved for every 1000 treated patients when the initial treatment was administered within the first hour of the onset of symptoms.[6] Additionally, the 1-year mortality rate for ACS was found to increase with greater delay time. A current study from Australia and New Zealand found that most patients delay the seeking of medical care for ACS, and therefore, do not receive the potential maximum benefit of their treatment.[7]

A number of researchers have focused on the factors which influence delay time in seeking care for chest pain in order to provide a clear picture of healthcare-seeking behaviour for a

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1036-7314/

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cardiac event.[8–10] Geographic factors related to inequities in access to cardiac healthcare services in Australia affected delay time, and researchers also recommended the development of innovative approaches to improve cardiac care accessibility.[8] There were variations in the time taken to seek care for chest pain amongst a range of countries, which may be related to socioeconomic status and the standard of the healthcare system in each country.[9,11] Social, cognitive, and emotional responses of patients to ACS symptoms played a crucial role in their decision to seek care, such as the pattern of symptoms, failures in symptom recognition, a mismatch between symptom expectations and actual experiences, the absence of chest pain, and a lack of knowledge of the treatments.[12] They also referred to a number of social factors which were related to longer delay time, such as the location of the home, living alone, resting or sleeping during the cardiac event, and feelings of embarrassment.

Herlitz et al.[13] found that ethnicity was related to increased pre-hospital delays for acute myocardial infarction, and underutilisation of emergency services for acute chest pain. The authors reported that pre-hospital delays for acute myocardial infarction increased among Asian and Latino populations in the USA, while underutilisation of emergency services increased among South Asians in the UK. Researchers have recommended further studies to be carried out in order to gain a deeper insight into patient perspectives on ACS and the influencing factors, particularly on those where little research has been conducted, such as ethnicity in diverse cultural groups.[9,14,15] Researchers recommended that further research should focus on time delays associated with these same influencing factors.[12]

2. Aim

The aim of this review is to summarise research from a range of countries describing the differences in time taken to seek medical care for chest pain and factors which contribute to delay times.

3. Methods

An integrative literature review is a specific review method that summarises the existing empirical and/or theoretical literature to provide a more comprehensive understanding of a particular phenomenon or healthcare problem.[16] This type of review is an approach that allows for the inclusion of a range of diverse methodologies (i.e., experimental and non-experimental research) and has the potential to play a greater role in evidenced-based practice.[17]

3.1. Information sources and search

The MEDLINE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Scopus databases were searched for literature published in the period 1994–2014 limited to publication in English only. The keywords used in the search were 'chest pain', 'heart attack', 'acute coronary syndrome', 'ACS', 'myocardial infarction', 'myocardial ischemia', 'angina', 'unstable angina', 'delay', 'delay time', 'seeking care/treatment/help', 'healthcare seeking', and 'prehospital delay'. The Boolean operator 'or' and 'and' were used to expand or limit the search respectively. The search terms combined with 'or' including set 1: chest pain or ACS or heart attack, heart attack or acute coronary syndrome or ACS, angina or unstable angina or angina pectoris, myocardial infarction or myocardial ischaemia or acute coronary syndrome; and set 2: delay or delay time, delay and seeking care, delay or seeking care, seeking care or health care seeking, seeking care or prehospital delay and prehospital or delay. Then the terms in set1 were combined with terms in set 2 with the Boolean operator 'and' for specific search. Additional manual search from reference lists of included articles were undertaken and these additional articles were assessed against the eligibility criteria to ensure the literature review was comprehensive. All search results were imported into an EndNote X7 Library, pooled, and then removed the duplicated records.

3.2. Eligibility criteria

The eligibility criteria for this literature review included studies that: (a) included patients presenting to an emergency department with chest pain; (b) had a primary or secondary objective focusing on delay time; (c) measured and reported on delay time quantitatively; (d) mainly focused on pre-hospital delay; (e) was original research, rather than a review or meta-analysis; (f) was conducted in a single country rather than in multiple countries in a single study; (g) was mainly quantitative in approach within level I to level III of the National Health and Medical Research Council (NHMRC) evidence hierarchy; and (h) was available in full-text.

3.3. Data analysis and evaluation

This integrative literature review included a methodological quality assessment through the updated methodology process defined by Whittemore and Knafl[17] and a checklist for writing an integrative review recommended by Torraco[18] in conjunction with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines and checklist for the reporting of systematic reviews.[19]

The data analysis process includes the steps of data reduction, display, and comparison, conclusion drawing, and verification.[17,18] The current review performed the data reduction through a sub-group classification of the selected studies based on their research design, including randomised controlled trials and comparative studies. The level I to level III of the National Health and Medical Research Council (NHMRC) evidence hierarchy included randomised controlled trials (RCT), pseudo-randomised controlled trials, and comparative studies (cohort and case–control studies).[20]

The data from each study was extracted into a manageable spreadsheet using Microsoft Excel® spreadsheet software (KW). The extracted data from the reviewed studies were displayed and compared in tables based on variables of interest, including delay time, factors associated with longer delays, and the effects of ethnicity (KW). Finally, the conclusions of the integrative review were presented in Tables 1–3 (KW, HG and RC).

3.4. Definitions

Pre-hospital delay time is defined as the interval between the time of symptom onset and hospital arrival.[21,22] Decision time is defined as the interval from the time of symptom onset to accessing the emergency response system or to initiating travel to the hospital.[21] This review considered the definition of 'time of symptom onset', defined by Goldberg et al., as the time during which the patient reported becoming acutely or severely ill, prompting him/her to seek medical care.[23] Finally, the regions used for the analysis were chosen according to the United Nation Classification of Countries.[24]

4. Results

4.1. Description of studies

A total of 395 relevant articles were found in the databases. Altogether, 57 duplicates were removed and 133 articles were excluded

Please cite this article in press as: Wechkunanukul K, et al. Global review of delay time in seeking medical care for chest pain: An integrative literature review. *Aust Crit Care* (2016), http://dx.doi.org/10.1016/j.aucc.2016.04.002

Table 1
Pre-hospital delay time and findings from studies in different countries.

Author(s)/year	Country/study size	Median PDT (h)	EMS use (%)	Key findings related to delay time	Ethnicity sub-analysis
Alshahrani et al. (2013)[26]	Saudi Arabia $n = 189$	5.00 (M) 12.90 (F)	8.0	Median decision time was 2.5 h	N/A
Atzema et al. (2011)[27]	Canada $n = 4403$	2.00	41.7	46.3% of patients arrived at hospital ≤2 h 73.6% of patients arrived at hospital ≤6 h	Chinese 1.4% South Asian 3.9%
Ayrik et al. (2006)[46]	Turkey $n = 178$	1.83	21.0	22% of patients arrived at hospital ≤1 h 74% of patients arrived at hospital >1 h	N/A
Dracup et al. (1997)[28]	Australia $n = 317$	6.40	61.0	14% of patients arrived at hospital ≤1 h 54% of patients arrived at hospital >6 h	N/A
Eshah (2013)[29]	Jordan $n = 150$	4.00	N/A	28% of patients arrived at hospital ≤1 h 41.3% of patients arrived at hospital ≥6 h	N/A
Fukuoka et al. (2005)[30]	Japan $n = 145$	3.50	45.0	12% of patients arrived at hospital ≤1 h 40% of patients arrived at hospital ≥6 h	N/A
Horne et al. (2000)[31]	UK $n = 88$	2.20	45.0	Failure to call ambulance was associated with significantly longer delay time	N/A
Khan et al. (2007)[32]	Pakistan $n = 720$	3.04	N/A	36% of patients arrived at hospital ≤2 h 34% of patients arrived at hospital ≥6 h	N/A
Luepker et al. (2000)[33]	USA $n = 59,944$	2.33	33	No significant differences in delay time between intervention and reference groups	N/A
Mooney et al. (2014)[34]	Ireland $n = 1944$	4.04	39	Median PDT time post-intervention in Intervention group was 1.7 h, while control group was 7.1 h	N/A
Mussi et al. (2014)[25]	Brazil $n = 97$	1.62	3.1	96.9% of patients arrived at hospital by car Mean of decision time was 0.94 h	N/A
Noureddine et al. (2006)[35]	Lebanon $n = 204$	4.52	N/A	11.9% of patients arrived at hospital ≤1 h 31.8% of patients delayed between 1 and 3 h 24.8% of patients delayed >12 h	N/A
Ottesen et al. (1996)[36]	Denmark $n = 5978$	3.25	N/A	34% of patients arrived at hospital ≤2 h 68% of patients arrived at hospital ≤6 h	N/A
Ottesen et al. (2004)[45]	Denmark $n = 250$	1.78	N/A	Median decision time was 1.23 h, responsible for 69% of PDT	N/A
Peng et al. (2014)[37]	China $n = 1088$	2.16	59.1	48.6% of patients arrived at hospital ≤2 h	N/A
Perkins-Porras et al. (2009)[38]	UK $n = 228$	2.00	45.0	60% of delays attributed to decision time 60.8% of patients had decision time ≤1 h 53.7% of patients arrived at hospital ≤1 h	N/A
Pitsavos et al. (2006)[39]	Greece $n = 2172$	3.50	N/A	22% of patients arrived at hospital ≤2 h 38% of patients delay >6 h	N/A
Quinn (2005)[40]	USA $n = 100$	3.30	N/A	Mainly examined the relationship between variables and delay time	White 91% Other 9%
Srimahachota et al. (2007)[41]	Thailand $n = 9373$	4.00	N/A	Time from symptom onset to admission was considered as sub-optimal	N/A
Tabriz et al. (2012)[47]	Iran $n = 513$	2.45	EMS only	19% of patients arrived at hospital ≤2 h 9% of patients arrived at hospital ≥6 h Decision time was 1 h, 40.8% of PDT	N/A
Taylor et al. (2005)[42]	Australia $n = 150$	3.17	EMS only	52.7% of patients arrived at hospital >3 h Mean of decision time was 2 h, responsible for 82.8% of PDT	N/A
Ting et al. (2010)[43]	USA $n = 104,662$	2.60	N/A	59% of patients arrived at hospital >2 h Delay time has not changed significantly from 2001 to 2006	White 80.5% Black 11.4% Asian 1.1% Hispanic 3.5%
Yan et al. (2009)[44]	China $n = 498$	1.83	37.3	Median decision time was 60 min 57.2% of patients delay ≤2 h	N/A

PDT, prehospital delay time; EMS, emergency medical services; N/A, not applicable.

Table 2
Factors influencing longer delay time in seeking medical care for chest pain.

Socio-demographic and clinical factors	Cognitive and emotional factors	Social factors
Single status[27,38,39]	Severity of pain[25,29–32]	Setting of episode[37,38,42]
Old age[27,36,38,39,41,43,44,46,47]	Symptom assessment[25,31,32,35,42,45,46]	No witness of episode[26,29,35,38,46]
Female[36,39,43,45–47]	Symptom appraisal[25,35,38,39,42,45]	Event during daytime[27,36,37,43]
Ethnicity (non-white)[27,43]	Atypical symptom[27,31,32,36,37,45]	Response from others[35]
Low education level[28,37,39,44]	Lack of symptom knowledge[25,26,35]	Not calling Ambulance[27,28,31,37,38,44,46]
Low socioeconomic status[27–29]	Worried about bothering others[35,37]	
History of chronic diseases[36,39,41,43,46,47]	Wait for pain to ease[25,35,42]	
History of previous MI[36–38,40,45,47]	Embarrassed to seek help[35,42]	

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Table 3
Comparison of pre-hospital delay time between developed and developing countries.

Country	Region	Median pre-hospital delay time (h)		Universal Health Coverage
		Developed country	Developing country	
Australia[28]	Oceania	6.40		√
Ireland[34]	Europe	4.04		√
Greece[39]	Europe	3.50		√
Japan[30]	Asia	3.50		√
The USA[40]	Americas	3.30		
Denmark[36]	Europe	3.25		√
Australia[42]	Oceania	3.17		√
The USA[43]	Americas	2.60		
The USA[33]	Americas	2.33		
The UK[31]	Europe	2.20		√
Canada[27]	Americas	2.00		√
The UK[38]	Europe	2.00		√
Denmark[45]	Europe	1.78		√
Saudi Arabia[26]	The Middle East		5.00	√
Lebanon[35]	The Middle East		4.52	
Thailand[41]	Asia		4.00	√
Jordan[29]	The Middle East		4.00	√
Pakistan[32]	Asia		3.04	
Iran[47]	The Middle East		2.45	
China[37]	Asia		2.16	√
China[44]	Asia		1.83	√
Turkey[46]	The Middle East		1.83	√
Brazil[25]	Americas		1.62	√
Mean pre-hospital delay time of group		3.08	3.05	

by title/abstract. An additional two articles were found in the reference lists of the initial included studies, yielding a total of 207 full-text articles which were subsequently assessed for eligibility. The 184 full-text articles were excluded as they did not meet the inclusion criteria. Eventually, 23 articles were included in the integrative literature review (see Fig. 1).

4.2. Methodological quality

The included studies were conducted in 17 countries in five regions. Six (26.2%) studies were conducted in Europe, five (21.7%) in the Americas, five (21.7%) in Asia, and five (21.7%) in the Middle East. The remaining two (8.7%) studies were conducted in Oceania.

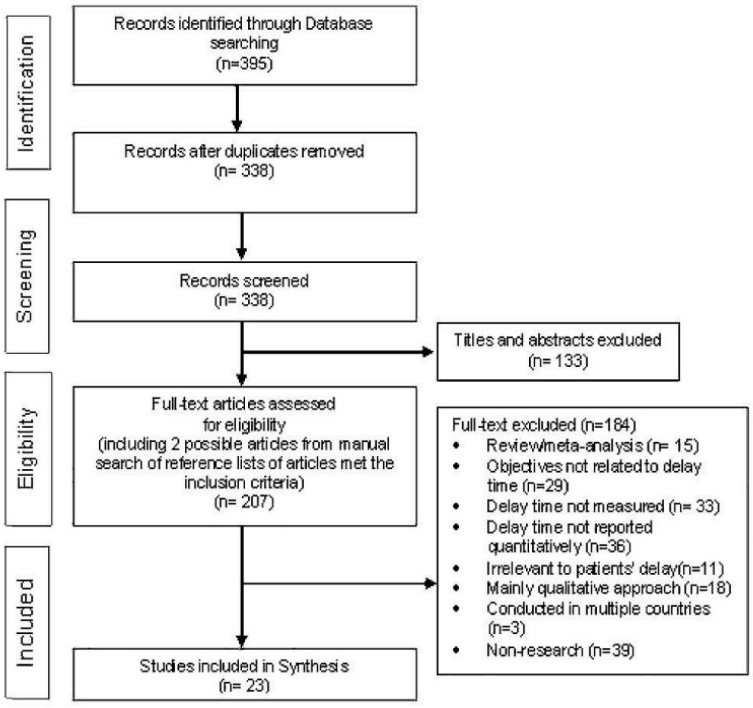

Fig. 1. The flow diagram of literature search and inclusion of studies.

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Sample size of included studies varied from 88[31] to 104,662.[43] This review included studies within level I to level III of the National Health and Medical Research Council (NHMRC) evidence hierarchy, including two RCT studies,[33,34] ten prospective comparative studies,[28,29,31,35,36,38,40,41,44,45] nine retrospective comparative studies,[27,30,32,37,39,42,43,46,47] and two mixed methods studies.[25,26]

In total, 153,811 participants were included in this review. The mean age of participants of all reviewed studies ranged from 51.9[42] to 68.0[45] years. Male was the majority gender of all 23 studies ranging from 55.7%[25] to 87%.[30] All 23 studied recruited patients at the same condition (i.e., presented to hospital with chest pain). Statistical analyses were performed appropriately. Continuous variables were presented as mean with standard deviation (SD) or median with interval quartile range (IQR), and *t*-test were used for comparisons. Categorical variables were presented as frequency and percentage, and Chi-square test were used for comparisons. The outcomes, delay time, were measured and statistically analysed appropriately. For RCT studies, the follow up had been taken at the reasonable period of time 18 months[33] and 24 months.[34]

4.3. Variability in delay times

There was variability in delay times in all the selected studies. The median pre-hospital delay time in seeking medical care for chest pain varied from country to country, ranging from 1.6 h in Brazil[25] to 12.9 h in Saudi Arabia[26] (see Table 1). The mean pre-hospital delay time was 3.4 h. Nineteen studies[26–44] from 15 countries in five regions reported a delay time of longer than 2 h. The delay time in Europe, America, and Asia ranged between 2.0 and 4.0 h,[31,34,36,38,39,45] 1.6 and 3.3 h,[25,27,33,40,43] and 1.8 and 4.0 h[30,32,37,41,44] respectively. Studies from the Middle East region showed the broadest range of delay times being between 1.8 h and 12.9 h.[26,29,35,46,47] Australia, representing the Oceania region, reported delay times in two studies over 8 years of 6.4 h in 1997[28] and 3.1 h in 2005.[42]

Six publications reported on the proportion of patients arriving at a hospital within 1.0 h,[28–30,35,38,46] ranging from 11.9% in Lebanon[35] to 28.0% in Jordan.[29] Eight studies[27,28,32,36,37,39,44,47] found that the proportion of patients who presented to an ED within 2 h ranged from 19.0% in Iran[47] to 57.2% in China.[44] The majority of the literature reported that approximately 40–50% of patients delayed presenting to an ED within 6 h of the onset of chest pain[28–30,32,39] (see Table 1).

The components of delay time were also reported on, including decision time. Seven studies[25,26,38,42,44,45,47] measuring the components of delay time revealed that decision time contributed to the largest proportion of pre-hospital delays, ranging from 40.8% in Iran[47] to 82.8% in Australia[42] (see Table 1).

The utilisation of an ambulance to travel to hospital varied from 3.1% in Brazil[25] to 61.0% in Australia[28]. Among the European countries, 39.0%[34] to 45.0%[38] of patients were transported to hospital by ambulance, 37.3%[44] to 59.1%[37] in Asian countries, and 33.0%[33] to 41.7%[27] in North America. Patients in the Middle East arrived at the hospital by ambulance from 8.0%[26] to 21.0%.[46]

4.4. Factors associated with longer delay times

There was some similarity in the variables associated with delay time among the reviewed studies. These factors were classified into three domains: socio-demographic and clinical factors, cognitive and emotional factors, and social factors. A summary of the variables associated with longer pre-hospital delay times is presented in Table 2.

The most common factors reported in the reviewed articles were old age, female gender, history of chronic disease, and history of previous myocardial infarction. Difficulties with symptom assessment and appraisal, and atypical symptoms were also commonly associated with longer delay times, as were the absence of a witness to the episode, and not making a decision to call an ambulance.

4.5. Impact of ethnicity

Of the 23 selected articles, six studies[25,27,33,38,40,43] identified participants from different ethnic backgrounds; however, only three studies[27,40,43] included a sub-analysis of ethnicity. A Canadian study[27] included patients from two ethnic groups (Chinese and South Asian) into a sub-analysis and reported that both ethnic groups were a significant predictor of delayed presentation. A study from the USA[43] analysed the relationship between delay time and five ethnic backgrounds (White, Black, Asian, Hispanic, and Other), and concluded that non-white ethnic background was associated with longer delay times. Another US[40] study reported that ethnicity (Caucasian and Other) was not related to the time taken to seek care. Three other studies[25,33,38] only reported findings related to ethnicity according to characteristics.

5. Discussion

5.1. Variability in delay times

In this review we aimed to describe delay times in seeking medical care for chest pain in different countries. The time taken to seek care after suffering chest pain varied between individual countries even within the same region. The variability in the time taken to present to a hospital across countries is consistent with the conclusions of the ENACT study (The European Network for Acute Coronary Treatment) and other multinational studies.[9–11] People in developed countries did not appear to seek help more rapidly than those living in developing countries and vice versa (see Table 3). Importantly, delay time in all countries was greater than the optimal recommended timeframe for ACS management. There did, however, appear to be a reduction in delay times over the 20 years of this review; however, the included studies were too dissimilar to compare, particularly in relation to the differences in the countries being studied and the methods used. This review showed that decision time to seek help was reported as a major component of the entire delay time, a finding which is consistent with previous studies.[11,48,49] Moser et al.[12] and Dracup et al.[21] stated that the decision to seek care relates to multiple variables, including demographics, socio-economics, and cognitive and emotional factors. Other researchers have suggested that these modifiable factors should be focused on in order to diminish pre-hospital delay times.[50]

5.2. Factors associated with longer delay time

A study conducted by Nguyen et al.[51] found that elderly and female patients were more likely to delay their decision to seek care than other groups, a relationship that is supported by this review. The REACT (The Rapid Early Action for Coronary Treatment) trial[52] noted that cultural and low socio-economic statuses were also associated with delay time. Low socioeconomic status may include patients with low education and income levels, and migrant status, which may contribute to a lack of health literacy. Jordan et al.[53] concluded that health literacy is considered to be a vital element in understanding and accessing healthcare.

The marked variation in delay times reported in different countries may relate to the unique social and cultural contexts of each individual nation.[9] Differences in the healthcare system, and in health policy, are evident in developed countries such as Australia, Canada, New Zealand, the UK, and the USA,[54,55] and also

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between countries in the Asia region such as Japan, South Korea, Taiwan, Hong Kong, and Thailand.[56,57] Dracup et al.[9] indicated that the culture and the unique context of each country play a crucial role in people's responses to chest pain. Similarly, the conclusions from other two multinational studies supported that differences in culture and/or the healthcare system may have an impact on care-seeking behaviour for chest pain.[58,59] In addition, the unique management of ACS across countries may also have an impact on access to ambulance services and emergency care and the relationship to delay time. The GRACE (The Global Registry of Acute Coronary Events)[60] and the ENACT study[10] noted differences in internal practices and outcomes between various countries, even within the same continent.

5.3. Impact of ethnicity

Ethnic groups are often excluded or under-represented from research thereby creating a lack of information about the behaviour of these populations.[61–64] As well, a relatively small proportion of ethnic groups within a sample may impede a sub-analysis of this issue in some studies. Language barriers provide an additional impediment to research in non-English speaking background populations. Thus, research in patients from ethnic populations or migrant backgrounds is limited.[12,64]

Sheikh et al.,[61] noted that a researcher's own attitudes towards the recruitment of ethnic groups play a key role in the inclusion of ethnicity. The same study also found that US researchers were more positive than UK academics about including ethnic groups in their research. Ranganathan and Bhopal[64] and Mason, Hussain-Gambles[63] noted the consistency of underrepresentation and inequality in research participation among ethnic groups which might due to investigator's bias, conceptual bias and proportion of ethnic participants. Individuals do not appear to differ in their willingness to participate in research. One study found that there was no significant difference in willingness to participate in research between a range of ethnic groups and Caucasians.[65] This review identified only three studies that considered culture and ethnicity, and we submit that further work in this area is called for.

5.4. Recommendations for practice and research

A set of guidelines for the management of, and clinical care standards for, ACS have been developed and updated by many health organisations in order to advance the safety and quality of care to improve patient outcomes.[3,66,67] A number of campaigns and health education programmes have been conducted by health agencies worldwide with the aim of shortening delay times. The PROMOTION study (Patient Response to Myocardial Infarction Following a Teaching Intervention Offered by Nurses) is an example of a multinational randomised controlled trial using a single face-to-face educational experience in conjunction with reinforcement by telephone to encourage patients to respond quickly when confronted with ACS symptoms.[68] Disappointingly, they reported that this educational and counselling intervention did not help in reducing delay times or improving the rate of ambulance service utilisation. Other researchers suggested that public education campaigns alone are an inadequate strategy for decreasing delay times, and those more effective strategies to address the predictors of delay time need to be considered.[33,69,70] The timely management of chest pain is a well-understood concept, with the phrase 'time is muscle' often being quoted. While a great deal of effort has been invested in improving the efficiency of the health system once contact has been made, a large proportion of the avoidable delay occurs prior to the decision to call for help. Therefore, further study on factors influencing patient delay times, and their decision delay times, is warranted, particularly the impact of ethnicity on patient's care-seeking behaviours when experiencing chest pain.

5.5. Limitations

Although this integrative literature review has involved studies conducted in a range of countries, only 23 eligible articles were included. Therefore, the outcomes of the review may not reflect all regions and may not represent genuine delay times across the globe. However, we have analysed the available data on delay times which reveals that there are differences in the countries studied in the selected articles. Restricting the search to only English language publications is another limitation of this review. However, van Weijen[71] noted that approximately 80% of all articles are published in English and that most researchers prefer to publish their work in English rather than in their native language. Other studies also support the increasingly global trend of research being published in English.[72–74] Although research in other languages may contribute to the data on ethnicity, the majority of studies on this topic have been conducted in developed countries which are popular destinations for migrants such as the USA, the UK, Australia, and Canada.[75] Articles from these countries are generally published in English. Only published peer review papers were included in this review, abstracts and non-peer reviewed conference papers were not included.

6. Conclusion

On a global basis, the time taken to seek medical care for chest pain varies from country to country and does not appear to be related to any particular region or national development status. However, delay times in all of the reviewed studies were longer than the recommended ideal delay time. The differences in sociodemographics, and the social context of each country could be the underlying cause of variability in delay times. Additionally, cognitive and emotional factors were also thought to play a crucial role in time delays. To improve care for all patients experiencing chest pain, further investigations of potential predictors is warranted, particularly of ethnicity and culture in multicultural countries.

Conflict of interest

The authors of this paper have no conflicts of interest in conducting this review. The authors declare that this review was conducted in the absence of any financial or commercial relationships that could be construed as a potential conflict of interest.

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References

1. Nichols M, Townsend N, Scarborough P, Rayner M. Cardiovascular disease in Europe 2014: epidemiological update. *Eur Heart J* 2014;**35**(42):2950–9.
2. Nichols M, Peterson K, Alston L, Allender S. *Australian heart disease statistics 2014*. Melbourne: National Heart Foundation of Australia; 2014.
3. Australian Commission on Safety and Quality in Health Care. *Acute coronary syndromes clinical care standard*. Sydney: Australian Commission on Safety and Quality in Health Care; 2014.
4. Niska R, Bhuiya F, Xu J. National hospital ambulatory medical care survey: 2007 emergency department summary. *Natl Health Stat Rep* 2010;**26**(26):1–31.
5. Steg PG, James SK, Atar D, Badano LP, Lundqvist CB, Borger MA, et al. ESC guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. *Eur Heart J* 2012;**33**(20):2569–619.

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6. Boersma E, Maas ACP, Deckers JW, Simoons ML. Early thrombolytic treatment in acute myocardial infarction: reappraisal of the golden hour. *Lancet* 1996;**348**:771–5.
7. McKinley S, Aitken LM, Marshall AP, Buckley T, Baker H, Davidson PM, et al. Delays in presentation with acute coronary syndrome in people with coronary artery disease in Australia and New Zealand. *Emerg Med Australas* 2011;**23**(2):153–61.
8. Clark RA, Coffee N, Turner D, Eckert K, van Gaans D, Wilkinson D, et al. Application of geographic modeling techniques to quantify spatial access to health services before and after an acute cardiac events. *Circulation* 2012;**125**:2006–14.
9. Dracup K, Moser DK, McKinley S, Ball C, Yamasaki K, Kinm CJ, et al. An international perspective on the time to treatment for acute myocardial infarction. *J Nurs Scholarsh* 2003;**35**(4):317–23.
10. Fox KAA, Cokkinos DV, Deckers J, Keli U, Maggioni A, Steg G. The ENACT study: a pan European survey of acute coronary syndromes. *Eur Heart J* 2000;**21**:1440–9.
11. McKinley S, Dracup K, Moser DK, Ball C, Yamasaki K, Kim CJ, et al. International comparison of factors associated with delay in presentation for AMI treatment. *Eur J Cardiovasc Nurs* 2004;**3**(3):225–30.
12. Moser DK, Kimble LP, Alberts MJ, Alonzo AA, Croft JB, Dracup K, et al. Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke: a scientific statement from the American Heart Association Council on cardiovascular nursing and stroke council. *Circulation* 2006;**114**:168–82.
13. Herlitz J, WireklintSundström B, Bång A, Berglund A, Svensson L, Blomstrand C. Early identification and delay to treatment in myocardial infarction and stroke: differences and similarities. *Scand J Trauma Resusc Emerg Med* 2010;**18**(1):48.
14. Goff Jr DC, Sellers DE, McGovern PG, Meischke H, Goldberg RJ, Bittner V, et al. Knowledge of heart attack symptoms in a population survey in United states. *Arch Intern Med* 1998;**158**:2329–38.
15. Goldberg RJ, Spencer F, Fox KAA, Brieger D, Steg G, Gurfinkel E, et al. Prehospital delay in patients with acute coronary syndromes (from the Global Registry of Acute Coronary Events [GRACE]). *Am J Cardiol* 2009;**103**:596–603.
16. Broome ME. *Integrative literature reviews for the development of concepts. Concept development in nursing: foundations, techniques and applications*. Philadelphia: WB Saunders Company; 2000. p. 231–50.
17. Whittemore R, Knafl K. The integrative review: updated methodology. *J Adv Nurs* 2005;**52**(5):546–53.
18. Torraco RJ. Writing integrative literature reviews: guidelines and examples. *Hum Resour Dev Rev* 2005;**4**(3):356–67.
19. Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Rev* 2015;**4**(1):1.
20. National Health and Medical Research Council. *Guide to the development, implementation and evaluation of clinical practice guidelines*, vol. 88. Canberra: National Health and Medical Research Council; 1999.
21. Dracup K, Moser DK, Eisenberg M, Meischke H, Alonzo AA, Braslow A. Causes of delay in seeking treatment for heart attack symptoms. *Soc Sci Med* 1995;**40**(3):379–92.
22. King KB, McQuire MA. Symptom presentation and time to seek care in women and men with acute myocardial infarction. *Heart Lung* 2007;**36**:235–43.
23. Goldberg RJ, Steg PG, Sadiq I, Granger C, Jackson EA, Buddaj A, et al. Extent of, and factors associated with delay to hospital presentation in patients with acute coronary syndrome (The GRACE Registry). *Am J Cardiol* 2002;**89**:791–6.
24. *United Nations Classification of countries by major area and region of the world*; 2012.
25. Mussi FC, Mendes AS, Queiroz TL, Costa ALS, Pereira Á, Caramelli B. Pre-hospital delay in acute myocardial infarction: judgement of symptoms and resistance to pain. *Rev Assoc Med Bras* 2014;**60**(1):63–9.
26. Alshahrani H, McConkey R, Wilson J, Youssef M, Fitzsimons D. Female gender doubles pre-hospital delay times for patients experiencing ST segment elevation myocardial infarction in Saudi Arabia. *Eur J Cardiovasc Nurs* 1474;**2013**, 515113507159.
27. Atzema CL, Austin PC, Huynh T, Hassan A, Chiu M, Wang JT, et al. Effect of marriage on duration of chest pain associated with acute care myocardial infarction before seeking care. *Can Med Assoc J* 2011;**183**(13):1482–91.
28. Dracup K, McKinley SM, Moser DK. Australian patients' delay in response to heart attack symptoms. *Med J Aust* 1997;**166**:233–6.
29. Eshah NF. Seeking medical attention among Jordanian patients with acute myocardial infarction. *Eur Sci J* 2013;**9**(21).
30. Fukuoka Y, Dracup K, Rankin SH, Froelicher ES, Kobayashi F, Hirayama H, et al. Prehospital delay and independent/independent construal of self among Japanese patients with acute myocardial infarction. *Soc Sci Med* 2005;**60**:2025–34.
31. Horne R, James D, Petrie K, Weinman J, Vincent R. Patient's interpretation of symptoms as a cause of delay in reaching hospital during acute myocardial infarction. *Heart* 2000;**83**:388–93.
32. Khan MS, Jafary FH, Faruqui AM, Rasool SI, Hatcher J, Chaturvedi N, et al. High prevalence of lack of knowledge of symptoms of acute myocardial infarction in Pakistan and its contribution to delayed presentation to the hospital. *BMC Public Health* 2007;**7**(1):284.
33. Luepker RV, Raczynski J, Osganian S, Goldberg RJ, Finnegan JRJ, Hedges JR, et al. Effect of a community intervention on patient delay and emergency medical service use in acute coronary heart disease: the Rapid Early Action for Coronary Treatment (REACT) Trial. *J Am Med Assoc* 2000;**284**(1):60–7.
34. Mooney M, McKee G, Fealy G, O' Brien F, O'Donnell S, Moser D. A randomized controlled trial to reduce prehospital delay time in patients with acute coronary syndrome (ACS). *J Emerg Med* 2014;**46**(4):495–506.
35. Noureddine S, Adra M, Arevian M, Dumit NY, Puzantian H, Shehab D, et al. Delay in seeking health care for acute coronary syndromes in a Lebanese sample. *J Transcult Nurs* 2006;**17**(4):341–8.
36. Ottesen MM, Kober L, Jorgensen S, Torp-Pedersen C, The TRACE Study Group. Determinants of delay between symptoms and hospital admission in 5978 patients with acute myocardial infarction. *Eur Heart J* 1996;**17**:429–37.
37. Peng YG, Feng JJ, Guo LF, Li N, Liu WH, Li GJ, et al. Factors associated with prehospital delay in patients with ST-segment elevation acute myocardial infarction in China. *Am J Emerg Med* 2014;**32**(4):349–55.
38. Perkins-Porras L, Whitehead DL, Strike PC, Steptoe A. Pre-hospital delay in patients with acute coronary syndrome: factors associated with patient decision time and home-to-hospital delay. *Eur J Cardiovasc Nurs* 2009;**8**:26–33.
39. Pitsavos C, Kourlaba G, Panagiotakos DB, Stefanadis C. Factors associated with delay in seeking health care for hospitalized patients with acute coronary syndromes: the GREECS study. *Hellenic J Cardiol* 2006;**47**:329–36.
40. Quinn JR. Delay in seeking care for symptoms of acute myocardial infarction: applying a theoretical model. *Res Nurs Health* 2005;**28**:283–94.
41. Srimahachota S, Kanjanavanit R, Boonyaratavej S, Boonsom W, Veerakul G, Tresukosol D. Demographic, management practices and in-hospital outcomes of Thai Acute Coronary Syndrome Registry (TACSR): the difference from the western world. *J Med Assoc Thail* 2007;**90**(1):1–11.
42. Taylor DM, Garewal D, Carter M, Bailey M, Aggarwal A. Factors that impact upon the time to hospital presentation following the onset of chest pain. *Emerg Med Australas* 2005;**17**(3):204–11.
43. Ting HH, Chen AY, Roe MT, Chan PS, Spertus JA, Nallamothu BK, et al. Delay from symptom onset to hospital presentation for patients with non-ST-segment elevation myocardial infarction. *Arch Intern Med* 2010;**170**(20):1834–41.
44. Yan H, Song L, Yong J, Son Y, Hu D. The association between pre-infarction angina and care seeking behaviours and its effects on early reperfusion rates for acute myocardial infarction. *Int J Cardiol* 2009;**135**:86–92.
45. Ottesen MM, Diaxen U, Torp-Pederson C, Kober L. Prehospital delay in acute coronary syndrome – an analysis of the components of delay. *Int J Cardiol* 2004;**96**:97–103.
46. Ayrik C, Ergene U, Kinay O, Nazli C, Unal B, Ergene O. Factors influencing emergency department arrival time and in-hospital management of patients with acute myocardial infarction. *Adv Ther* 2006;**23**(2):244–55.
47. Tabriz AA, Sohrabi M-R, Kiapour N, Yazdani S. Factors associated with delay in thrombolytic therapy in patients with ST-elevation myocardial infarction. *J Tehran Heart Center* 2012;**7**(2):65.
48. Finn JC, Bett N, Shilton TR, Cunningham C, Thompson PL. Patient delay in responding to symptom of possible heart attack. *Med J Aust* 2007;**187**:293–8.
49. Weaver WD. Time to thrombolytic treatment: factors affecting delay and their influence on outcome. *J Am Coll Cardiol* 1995;**25**(7 Suppl.):3S–9S.
50. Khraim FM, Scherer YK, Dorn JM, Carey MG. Predictors of decision delay to seeking health care among Jordanians with acute myocardial infarction. *J Nurs Scholarsh* 2009;**41**(3):260–7.
51. Nguyen HL, Saczynski JS, Gore JM, Goldberg RJ. Age and sex differences in duration of prehospital delay in patients with acute myocardial infarction: a systematic review. *Circ Cardiovasc Qual Outcomes* 2010;**3**(1):82–92.
52. Goff Jr DC, Feldman HA, McGovern PG, Goldberg RJ, Simons-Morton DG, Cornell CE, et al. Prehospital delay in patients hospitalized with heart attack symptoms in the United States: the REACT trial. *Am Heart J* 1999;**138**(6):1046–57.
53. Jordan JE, Buchbinder R, Briggs AM, Elsworth GR, Busija L, Batterham R, et al. The health literacy management scale (HeLMS): a measure of an individual's capacity to seek, understand and use health information within healthcare setting. *Patient Educ Couns* 2013;**91**:28–35.
54. Blendon RJ, Schoen C, DesRoches C, Osborn R, Zapert K. Common concerns amid diverse systems: health care experiences in five countries. *Health Aff (Millwood)* 2003;**22**(3):106–21.
55. Schoen C, Doty MM. Inequities in access to medical care in five countries: findings from the 2001 Commonwealth Fund International Health Policy Survey. *Health Policy* 2004;**67**(3):309–22.
56. Gauld R, Ikegami N, Barr MD, Chiang TL, Gould D, Kwon S. Advanced Asia's health systems in comparison. *Health Policy* 2006;**79**(2–3):325–36.
57. Hughes D, Leethongdee S. Universal coverage in the land of smiles: lessons from Thailand's 30 Baht health reforms. *Health Aff (Millwood)* 2007;**26**(4):999–1008.
58. Liao L, Whellan DJ, Tabuchi K, Schulman KA. Differences in care-seeking behavior for acute chest pain in the United States and Japan. *Am Heart J* 2004;**147**(4):630–5.
59. McKinley SM, Moser DK, Dracup K. Treatment-seeking behavior for acute myocardial infarction symptoms in North America and Australia. *Heart Lung* 2000;**29**(4):237–47.
60. Fox KAA, Goodman SG, Klein W, Brieger D, Steg PG, Dabbous O. Management of acute coronary syndromes. Variations in practice and outcome: Finding from the Global Registry of Acute Coronary Events (GRACE). *Eur Heart J* 2002;**23**:1177–89.
61. Sheikh A, Halani L, Bhopal R, Netuveli G, Patridge MR, Car J, et al. Facilitating the recruitment of minority ethnic people into research: qualitative case study of South Asians and Asthma. *PLoS Med* 2009;**6**(10):1–11.
62. Sheikh A, Netuveli G, Kai J, Panesar SS. Comparison of reporting of ethnicity in US and European randomised controlled trials. *BMJ* 2004;**329**(7457):87–8.
63. Mason S, Hussain-Gambles M, Leese B, Atkin K, Brown J. Representation of South Asian people in randomised clinical trials: analysis of trials' data. *BMJ* 2003;**326**(7401):1244–5.

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64. Ranganathan M, Bhopal R. Exclusion and inclusion of nonwhite ethnic minority groups in 72 north American and European cardiovascular cohort studies. *PLoS Med* 2006;**3**(3):0329–36.
65. Wendler D, Kington R, Madans J, Wye GV, Christ-Schmidt H, Pratt LA, et al. Are racial and ethnic minorities less willing to participate in health research. *PLoS Med* 2006;**3**(2):0201–10.
66. Windecker S, Kolh P, Alfonso F, Collet JP, Cremer J, Falk V, et al. 2014 ESC/EACTS Guidelines on myocardial revascularization: the Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). Developed with the special contribution of the European Association of Percutaneous Cardiovascular Interventions (EAPCI). *Eur Heart J* 2014;**35**:2541–619.
67. Amsterdam EA, Wenger NK, Brindis RG, Casey DE, Ganiats TG, Holmes DR, et al. 2014 AHA/ACC Guideline for the management of patients with non-ST-elevation acute coronary syndromes: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Circulation* 2014;**130**(25):e344–426.
68. Dracup K, McKinley S, Riegel B, Moser DK, Meischke H, Doering LV, et al. A randomized clinical trial to reduce patient prehospital delay to treatment in acute coronary syndrome. *Circ Cardiovasc Qual Outcomes* 2009;**2**(6):524–32.
69. Meischke H, Eisenberg MS, Schaeffer SM, Larsen MP, Henwood DK. Impact of direct mail intervention on knowledge, attitudes, and behavioral intentions regarding use of emergency medical services for symptoms of acute myocardial infarction. *Eval Health Prof* 1994;**17**(4):402–17.
70. Pattenden J, Watt I, lewin RJP, Stanford N. Decision making process in people with symptoms of acute myocardial infarction: qualitative study. *Br Med J* 2002;**324**(7344):1006.
71. Van Weijen D. The language of (future) scientific communication. *Res Trends* 2012;**31**:7–9.
72. Montgomery SL. *Does science need a global language? English and the future of research*. University of Chicago Press; 2013.
73. Kirchik O, Gingras Y, Larivière V. Changes in publication languages and citation practices and their effect on the scientific impact of Russian science (1993–2010). *J Am Soc Inf Sci Technol* 2012;**63**(7):1411–9.
74. Lira RPC, Vieira RMC, Gonçalves FA, Ferreira MCA, Maziero D, Passos THM, et al. Influence of English language in the number of citations of articles published in Brazilian Journals of Ophthalmology. *Arq Bras Oftalmol* 2013;**76**:26–8.
75. United Nations. *The number of international migrants worldwide reaches 232 million*. New York: United Nations; 2013. No. 2013/2.

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Presenting characteristics and management of chest pain among culturally and linguistically diverse populations: a comprehensive review

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Background: Delays in seeking medical care for chest pain in general population have been well documented. However, responding to, and managing chest pain symptoms among culturally and linguistically diverse (CALD) populations is a little known and poorly explained area. This literature review compares differences in delay time and management of seeking care for chest pain between CALD patients worldwide.

Methods: A comprehensive literature review of English language publications was performed using the Medline, CINALH and other relevant databases. The reference lists of all identified reports and articles were searched for additional studies.

Results: The search yielded 5696 articles and 306 full-text articles were assessed for eligibility. Thirteen articles have been included in this study. CALD groups with chest pain were more likely to be younger than Caucasians and presented with atypical symptoms. Seven studies reported differences in seeking care behaviour. Delay times across studies ranging from 1 hour to 8.8 hours with mean and median of 3.09 and 2.25 hours respectively. Eleven studies concluded ethnicity was a significantly associated with longer delay time ($p<0.05$). The median delay times were 2.05, 2.95, 2.58, 2.3 hours for Caucasians, blacks, Asian and Hispanic respectively. Ambulance utilisation ranged from 34.4% to 81.4%, with the mean of 49.08%. CALD were less likely to use ambulance than whites.

Conclusion: CALD patients have differences in responses to, symptoms of and presentations of cardiac events. They were more likely to delay longer than general population. Further research is recommended to explore this phenomenon and improve in practices.

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Prevalence of asymptomatic coronary heart disease in the siblings of young myocardial infarction patients

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Background: There is paucity of data on the prevalence of coronary heart disease (CHD) in the young. The aim of this study is to estimate the prevalence of asymptomatic CHD in siblings of young patients with myocardial infarction (MI) using stress echocardiography (SE) and coronary CT angiography (CCTA).

Methods: Prospective observational data was collected on siblings of patients aged ≤55 years presenting with acute MI and having coronary stenosis ≥50% on invasive coronary angiography in at least one epicardial coronary artery. Inclusion criteria included age of 30-55 and 30-60 years for males and females respectively. Outcome of interest was clinically significant CHD by CCTA, which was defined by either moderate (50 - 69%) and/or severe (≥70%) luminal stenosis.

Results: Preliminary data were available for 20 participants and of these 9 (45%) were male. 13 (65%) participants were smokers, 1 (5%) had diabetes, 4 (20%) had hypertension and 5 (25%) had dyslipidaemia. All of the SE were negative for the presence of ischaemia. Clinically significant CHD by CCTA was detected in 5 (25%, 95% CI (8.7%, 49.1%)) participants and 2 (10%, 95% CI (1.2%, 31.7%)) participants were found to have severe luminal stenosis. The median radiation does was 4.2 (IQR 1.3) mSv and the median coronary calcium score was 0 (IQR 69.5).

Conclusion: A quarter of siblings of young MI patients are found to have asymptomatic but clinically significant CHD detected on CCTA of which 40% is severe.

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Prevalence, clinical features and treatment of spontaneous coronary artery dissection: a single-centre experience

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Background: Spontaneous Coronary Artery Dissection (SCAD) is rare yet increasingly recognised cause of Acute Coronary Syndrome (ACS). This first-in-Australia study aims to determine the prevalence, characteristics and treatment of SCAD. Pre-specified subset analyses of females below 60 with ACS were also performed.

Methods: Screening of medical records from August 2012 until August 2014 revealed 1730 cases presenting with ACS to Monash Health with 36 patients (2.1%) having angiographically confirmed SCAD. The pre-specified subset analysis revealed 127 female patients below 60 with ACS, with 25 confirmed SCAD. Incidence, clinical characteristics, risk factors and treatment modalities were assessed.

Results: Mean age of SCAD was 54.3 years. From 36 SCAD cases, 31 were females and 5 were males. Baseline characteristics were evaluated based on sex. No females had a history of diabetes (0 of 31 versus 1 of 5, $p < 0.010$). Hypertension (13

"CHEST PAIN & CALD"

Presenting characteristics and management of chest pain among culturally and linguistically diverse populations

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Background

Responding to, and managing of chest pain symptoms among culturally and linguistically diverse (CALD) populations is a little known and poorly explained area.

Objectives

To compares differences in delay time and management of seeking care for chest pain between CALD groups.

Methods

A comprehensive review was performed using the Medline and relevant databases. Data was extracted from English language, no time limit publications.

Results

- Thirteen articles were included with a total of 1,670,422 participants.
- Delay times varied from 1 hour to 8.8 hours with mean of 3.09. Prehospital delay times for each ethnic group are presented in Table 1.
- Ambulance use ranged from 34.4% to 81.4%, with the mean of 49.08%
- Ethnicity was associated with a longer delay time and seeking care behaviour including ambulance underutilisation.
- CALD groups were more likely to be younger (Table 1), and presented with atypical symptoms than Caucasian groups.
- Factors associated with a longer delay time among CALD groups presented in Table 2

Conclusions

CALD patients have differences in responses to, symptoms and presentations of cardiac events. They were more likely to delay longer than general population. Further research is recommended to explore this phenomenon and improve in practices.

Table 1 Prehospital delay times and mean ages

Author/ Year	Prehospital delay time (hrs)				Age (years)			
	White	Black	Asian	Hispanic	White	Black	Asian	Hispanic
Ben-Shlomo et al 2008	3.1		3.1					
Canto et al 1998	2		2.1	2.3	67		68	65
Clark et al 1992	2	3		4				
Goff Jr et al 1999	2	3.3		2.2				
Goldberg et al1999	2.1	2.4	2.2	2.3				
Henderson et al 2001	3.2	3.5	12.	9.2	57.3	54.5	57.1	57.5
Kendall et al 2013	2.1		2.6		63		58	
Lee et al 2000	2.6	6.5			67	65		
McSweeney et al 2007	1.5	1			66.7	62.7		
Richards et al 2000	5	11			68.6	56.7		
Taylor et al 1998	2	2.4			67	63		
Ting et al 2008	2	2.4	2.1	2.3				
Ting et al 2010	2.6	2.	3	2.8				
Mean	2.5	3.9	3.9	3.6	67	62.7	58	61.3

Authors used ethnic terms from the original articles

Table 2 Factors associated with a longer delay time

Associated Factor
Culture and languages as barriers impede rapid seeking care
Cognitive and emotional factors
Cultural and socioeconomic status
Higher risk of heart disease
Longer time to conceive history of chest pain
Eligibility of public insurance
Differences in ECG presentation
Missing data often occurred among ethnic groups

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Variability of delay time in seeking medical care for chest pain: a global review

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Background: Previous research has demonstrated that delay in seeking medical care for chest pain may have major effects on patient's survival. This review aimed to compare the delay time in seeking care for chest pain within ethnic groups around the globe.

Methods: A comprehensive literature review was performed using the Medline, CINALH and Scopus databases, delay time data from research published between 1994 and 2014 was extracted.

Results: The search yielded 395 articles and 205 full-text articles were assessed for eligibility. Twenty-three articles have been included. Delay times varied across countries ranging from 1.62 hours (Brazil) to 12.9 hours (Saudi Arabia) with mean and median of 3.40 and 3.04 hours respectively. Seven studies reported that decision time was the largest proportion of pre-hospital delay time ranging from 40.8% in Iran to 82.8% in Australia. Six publications reported patients arrived at hospital within 1 hour, ranging from 11.9% in Lebanon to 28% in Jordan. Utilisation of ambulance ranged from 3.1%, Brazil to 61%, Australia. Only three studies included sub-analysis by ethnicity and reported ethnicity was a significant predictor of delayed presentation, and non-Caucasians had a longer delay time than Caucasians.

Conclusion: Variability in delay time occurred regardless of geographic region and health care system. The time taken to seek care for chest pain has not improved for 20 years. The differences in culture and attitudes in each country could influence on seeking care behaviour. Further research is recommended to review the impact of CALD background on patient's outcomes.

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Vascular access in cath lab, costs and complications

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BG: Radial artery approach (RAA) for diagnostic angiography and intervention is considered the preferred access site, however little is known about the costs of radial or femoral artery approach (FAA). We compared the two strategies in terms of cost effectiveness, hospital stay and post-operative complication in a regional New Zealand secondary care centre.

Method: Analysis of 200 consecutive patients undergoing elective and acute diagnostic cardiac catheterisation was studied. Patients awaiting transfer to tertiary centres were excluded from the analysis of the hospital stay variable. Equipment and procedural data was retrospectively analysed for all cases.

Results: Intra-operative cost was $141 for RAA vs. $150 for FAA (RR 1%, P 0.91). 63% of patients undergoing a RAA stayed < 1 day versus only 35% of FAA stayed < 1 day (P 0.003). The mean length of stay for a RAA was 0.54 days vs. FAA 1.2 days. In elective patients RAA mean length of stay < 0.2 days, vs. FAA 0.7 days (p<0.001). Mean contrast volume in RAA was 100 ml vs 120ml with FAA (P 0.002). Fluoroscopy times were 4mins for FFA vs. 5mins for RAA (p=0.8). No patients undergoing RAA experienced a procedure related complication vs. 3/100 FAA patients had major bleeding complications.

Conclusion: Radial approach is cost effective and safer than femoral in a real world secondary care regional PCI centre. These results are consistent with the international trials.

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Vulnerable plaque features on computed tomography coronary angiography are associated with long-term acute coronary syndrome events

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Background: Vulnerable-plaque (VP) features detected on computed-tomography-coronary-angiography (CTCA) correlate well with thin-cap-fibroatheroma classified on intravascular-ultrasound and optical-coherence-tomography. Studies have shown their association with acute-coronary-syndrome (ACS) on medium term follow-up.

Methods: We examined CTCA scans of patients who have long-term follow-up data with suspected coronary-artery-disease at MonashHeart between 2009 and 2012. CTCA images were qualitatively assessed for lesion severity and presence of VP-features, defined as the presence of positive-remodelling (PR), spotty-calcification (SC) and low-attenuation- plaque (LAP) with <30 Hounsfield-units, by two experienced observers. The primary end-point was ACS events on long-term follow-up.

Results: 364 vessels were analysed from 122 patients (62.3±10.8 years, 68% male) who had mean follow-up of 53.5±13.2 months. There were 308 vessels with mild (<50%) or no stenosis, 39 with moderate (50-69%) stenosis and 17 with severe (>70%) stenosis. No VP-features were found in 332 vessels, 11 had only 1 feature (PR), 22 had 2 features (PR and LAP n=16; PR and SC n=6) and 6 had 3 features. During follow-up, 7 patients had an ACS event. All had VP characteristics, with 4 having 3 VP-features (p<0.001) and 3 having 2 features (LAP and PR) (p<0.001). There were no ACS events

"TIME & CHEST PAIN"

Variability of Delay Time in Seeking Medical Care for Chest Pain: A Global Review

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Background

Previous research has demonstrated that delay in seeking medical care for chest pain may have major effects on patient's survival.

Objectives

To compare the delay times in seeking care for chest pain within ethnic groups around the globe.

Methods

A comprehensive literature review was performed using the Medline and relevant databases. Data between 1994 and 2014 was extracted.

Results

- Twenty three articles were included with a total of 153, 820 participants.
- Delay times varied from 1.62 hours (Brazil) to 12.9 hours (Saudi Arabia) with mean of 3.40 (Table 1).
- Decision time was the largest proportion of prehospital delay time ranging from 40.8% (Iran) to 82.8% (Australia) (Figure 1).
- patients reach hospital within 1 hour, ranging from 11.9% (Lebanon) to 28% (Jordan).
- Ambulance use ranged from 3.1% (Brazil) to 61% (Australia) with mean of 36.5%
- Only three studies included subanalysis by ethnicity

Conclusions

Variability in delay time occurred regardless of geographic region and health care system. The time taken to seek care for chest pain has not improved for two decades. The differences in culture and attitudes in each country could influence on seeking care behaviour. A further research is recommended to review the impact of ethnic background on patient's outcomes.

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Table 1 Prehospital delay times from different countries

Country	Prehospital delay time (hr)		Ambulance (%)	Universal Health Cover
	Developed Country	Developing Country		
Australia[1]	6.40		61.0	✓
Ireland[2]	4.04		39.0	✓
Greece[3]	3.50			✓
Japan[4]	3.50		45.0	✓
The USA[5]	3.30			
Denmark[6]	3.25			✓
Australia[7]	3.17			✓
The USA[8]	2.60			
The USA[9]	2.33		33.0	
The UK[10]	2.20		45.0	✓
Canada[11]	2.00		41.7	✓
The UK[12]	2.00		45.0	✓
Denmark[13]	1.78			✓
Saudi Arabia[14]		5.00 (female-12.90)	8.0	✓
Lebanon[15]		4.52		
Thailand[16]		4.00		✓
Jordan[17]		4.00		✓
Pakistan[18]		3.04		
Iran[19]		2.45		
China[20]		2.16	59.1	✓
China[21]		1.83	37.3	✓
Turkey[22]		1.83	21.0	✓
Brazil[23]		1.62	3.1	✓
Mean	3.08	3.05	36.5	

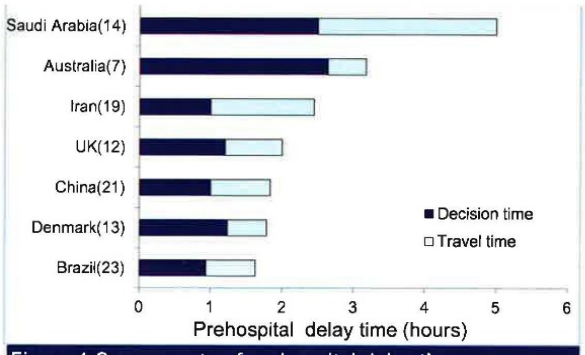

Figure 1 Components of prehospital delay time

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Presenting characteristics and processing times for culturally and linguistically diverse (CALD) patients with chest pain in an emergency department: Time, Ethnicity, and Delay (TED) Study II

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ABSTRACT

Background: To date there has been limited published data presenting the characteristics and timeliness of the management in an Emergency Department (ED) for culturally and linguistically diverse (CALD) patients presenting with chest pain.
This study aimed to describe the presenting characteristics and processing times for CALD patients with chest pain compared to the Australian-born population, and current guidelines.
Methods: This study was a cross sectional analysis of a cohort of patients who presented with chest pain to the metropolitan hospital between 1 July 2012 and 30 June 2014.
Results: Of the total study population (n = 6640), 1241 (18.7%) were CALD and 5399 (81.3%) were Australian-born. CALD patients were significantly older than Australian-born patients (mean age 62 vs 56 years, $p < 0.001$). There were no differences in the proportion of patients who had central chest pain (74.9% vs 75.7%, $p = 0.526$); ambulance utilisation (41.7% vs 41.1%, $p = 0.697$); and time to initial treatment in ED (21 vs 22 min, $p = 0.375$). However, CALD patients spent a significantly longer total time in ED (5.4 vs 4.3 h, $p < 0.001$). There was no difference in guideline concordance between the two groups with low rates of 12.5% vs 13%, $p = 0.556$. Nonetheless, CALD patients were 22% (95% CI, 0.65, 0.95, $p = 0.015$) less likely to receive the guideline management for chest pain.
Conclusions: The initial emergency care was equally provided to all patients in the context of a low rate of concordance with three chest pain related standards from the two guidelines. Nonetheless, CALD patients spent a longer time in ED compared to the Australian-born group.

1. Introduction

Acute Coronary Syndrome (ACS) is a leading cause of death worldwide [1]. In 2011, 190 heart attacks occurred daily in Australia [2], and every one and a half minutes, one American dies from a coronary event [3]. Chest pain is recognized as one of the most common symptoms of ACS and is also the most common chief complaint to emergency departments (ED) [4]. The optimal benefits of treatment are achieved when a patient receives timely treatment within the first hour of the initial onset of symptoms [5]. Every minute of delay time in seeking medical care when an individual has ACS increases mortality rates in both the short- and long-term [6]. Delay time has been defined as the interval between the onset of the symptoms and the initiation of definitive medical care, including pre-hospital and in-hospital delay [7]. Researchers have found a number of potential factors which influence delay time in seeking care for chest pain, such as being of older age, female gender, not having knowledge and awareness of ACS symptoms, underuse of ambulance services, ethnicity and cultural backgrounds, and a lack of knowledge or misconceptions about ACS [8,9].

Ethnicity has been found to be associated with a longer time to seek medical help for chest pain and underutilisation of emergency services [10]. There is research to support the notion that there are ethnic variations in prevalence, incidence, symptoms, and healthcare-seeking

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behaviours among patients from different ethnic backgrounds [11,12]. However, the causes of these variations are complex and difficult to fully explain, or to address, from a single perspective because socio-economic, cultural, lifestyle, and environmental factors have been found to influence these differences between ethnic groups [13,14]. It is important for health professionals and agencies to learn about and understand these differences, and the importance of cultural values in healthcare delivery, in order to improve appropriate services for these ethnic populations [15,16]. However, there are very little existing data on ethnic variations in terms of characteristics of patients, presentations, care-seeking behaviours, and access to care in some countries [17,18].

Chew et al. [19] stated that, regardless of improvements in the guidelines for the management of ACS, cultural differences are considered as one of the likely factors that influence the time-effectiveness and risk appropriateness of ACS care. Inequity and accessibility issues, in healthcare among culturally and linguistically diverse (CALD) migrants have been highlighted on the public health agenda for decades [20]. Several public education campaigns have been implemented to reduce the time taken to reach treatment, but delay and hesitation in accessing care is still occurring [21,22]. It is important to gain insight into the differences in the characteristics and presentations of CALD patients as compared to the predominant population and the concordance with current evidence based practice guidelines.

This study used the term 'guideline concordance' rather than 'guideline adherence' to describe and compare behaviours of patients, clinicians or health care professionals in relation to the practice guidelines during suspected ACS episodes. Guideline concordance was referred to an agreement with the guidelines without explicit control or monitoring, but under naturalistic circumstance.

The Time, Ethnicity and Delay (TED) study was a triangulation of three distinct research approaches to investigate delays in seeking medical care for chest pain among CALD populations. The process of triangulation in TED study involves a systematic review (TED I) [23], a cross-sectional analysis of an emergency department cohort of patients presenting with chest pain (TED II), and a retrospective medical record review (TED III).

TED II focused on the differences in the characteristics of, processing times and clinical outcomes between, CALD and Australian-born patients presenting to an ED with chest pain. This study placed an emphasis on processing times in ED and guideline concordance with management of chest pain in the ED. The specific objectives of the study were:

1) to describe the characteristics of, and processing times in the ED for CALD patients presenting to the ED with chest pain;
2) to compare the differences in characteristics of, and processing times between CALD and Australian-born patients; and
3) to examine the effect of CALD status on the guideline concordance with the management of chest pain in the ED.

2. Methods

2.1. Study design and setting

This study was a cross-sectional analysis of an ED presentation dataset of a 593-bed specialist referral public metropolitan hospital. The ED in this setting provides emergency medical services 7 days a week. The Department of Cardiovascular Medicine provides all cardiology services except transplantation. There are approximately 75,000 ED visits annually with an admission rate of 40%. Of these, 5.5% of all visits present with chest pain (approximately 9000 in this study), one-third of all patients who presented to the ED with chest pain were born overseas.

2.2. Participants

The dataset included 151,249 presentations to the ED between 1 July 2012 and 30 June 2014. This study reviewed a subset of 8225 (5.5%) patients who presented to the ED with chest pain as their primary presenting complaint.

The inclusion criteria for this cross sectional analysis included:

1) chest pain presented as the chief complaint;
2) time of presentation (triage time) was recorded; and
3) country of birth was stated.

The exclusion criteria included:

1) country of birth being classified as one of the 'main English-speaking countries' based on the Australian Bureau of Statistics definition, including the United Kingdom, Ireland, New Zealand, Canada, the United States of America, and South Africa [24].

2.3. Definitions

- Culturally And Linguistically Diverse (CALD) was defined as a person born overseas in a country other than countries classified by the Australian Bureau of Statistics as a 'main English-speaking countries', speak a language other than English and may speak English as a second language [25,26].
- Distance from hospital was defined as the distance between the patient's residence and the hospital based on the postcode of the patient's residence.
- First medical contact was defined as the point at which the patient was either initially assessed by a paramedic, physician, or other medical professional in the pre-hospital setting, or when the patient arrived at the hospital emergency department [27].
- Presenting symptoms were defined as the patients' symptoms recorded at triage.
- Time to treatment was defined as the interval between triage time and the time patients were seen by a doctor in the ED [28]. Australasian Triage Scale (ATS) admission time was defined as the amount of time the patient spent in the ED before a decision to admit the patient was taken [29]. ED stay was defined as the period between when the patient presented at the ED and when that person was recorded as having physically departed the ED [29].
- Priority of care (priority) was defined as an ATS category (1 to 5) based on the guidelines on the implementation of the Australasian Triage Scale in emergency department [28]. 'Episode end status' was defined as the status of patient at the end of the non-admitted patient ED service episode [29].
- Length of hospital stay was defined as the amount of time a patient spent in the hospital after they arrived at ED until physically departed from hospital.
- Guideline concordance was developed by compositing the three selected criteria of guidelines for management of chest pain made on the basis of available data. The three criteria comprise: 1) ambulance as the first medical contact; 2) triage priority 1 or 2; and 3) time to treatment ≤ 10 min. The two guidelines included the guidelines for management of acute coronary syndrome 2006 [31] and the guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments [28].
- Cultural competence is a set of congruent behaviours, attitudes and policies that come together in a system, agency or among professionals and enable that system, agency or those professions to work effectively in cross-cultural situations [20].

2.4. Data source and data collection

Data from the clinical data system [Emergency Department Information System] EDIS were automatically captured in a Microsoft Access® software database which contained information on every ED visit from June 1993 onwards. The basic demographic information of the patients included in this study as well as ED functional information such as triage time, time of initiation of medical treatment in ED, time of admission to hospital, and time of ED departure were extracted from the EDIS.

2.5. Ethical consideration

This study was approved by the Clinical Human Research Ethics Committee, and conformed to the provisions of the Declaration of Helsinki (as revised in Brazil 2013) [32]. The ethic application approval number: 458.14-HREC/14/SAC/479 with Site Specific Assessment number: SSA/14/SAC/483.

2.6. Variables and data measurements

Demographic variables included age; gender; health insurance; distance from hospital; socio-economic status (Socio-Economic Indexes for Areas (SEIFA): Index of Relative Socio-economic Advantage and Disadvantage (IRSAD)); and CALD status. Country of birth was classified into Australia, the main English-speaking countries, and CALD countries, based on the Australian Bureau of Statistics classifications [24].

The presentation and processing time variables included: presenting symptoms; first medical contact; day of presentation (i.e., weekday and weekend); time of presentation (i.e., business hours: 9.00–17.00 and after hours: 17.01–8.59); time to treatment; Australasian Triage Scale (ATS) admission time; and ED stay (Table 1). There were 21 symptom variables extracted from the dataset (i.e., central chest pain, right/left chest pain, tight/heavy chest, arm pain, back pain, throat pain, jaw pain, shoulder pain, neck pain, rib pain, calf/leg pain, shortness of breath, diaphoresis, palpitations, nausea/vomiting, abdominal pain, headache, lethargy/fatigue, collapse, and heart burn (Table 2).

Time to treatment was classified into '≤10', '>10' minutes based on the Guidelines on the Implementation of the Australasian Triage Scale in an Emergency Department [28]. ATS admission time was classified into '≤4', '>4' hours based on the National Health Reform Agreement (NHRA) National Partnership Agreement on Improving Public Hospital

Table 1
Patient characteristics and clinical outcomes.

Characteristics	Australian-born (n = 5399)	CALD patients (n = 1241)	p
Age (years), mean ± SD	56 ± 19.6	62 ± 18.4	<0.001*
Age groups (n (%)			<0.001**
< 45	1567 (29.0)	243 (19.6)	
45–55	1109 (20.5)	195 (15.7)	
56–65	1019 (18.9)	239 (19.3)	
66–75	711 (13.2)	202 (16.3)	
76–85	646 (12.0)	264 (21.3)	
>85	347 (6.4)	98 (7.9)	
Male, n (%)	2828 (52.4)	636 (51.2)	0.472
Medicare (Universal Health Coverage), n (%)	5399 (100.0)	1179 (95.0)	<0.001**
Distance from hospital (kms), median (25th,75th)	6.8 (4.6, 13.6)	6.4 (4.4, 9.8)	<0.001***
SEIFA (1–5) status, n (%)	2951 (54.7)	714 (57.5)	0.066
First medical contact, n (%)			
Ambulance	2219 (41.1)	518 (41.7)	0.679
Emergency department	2197 (40.7)	521 (42.0)	0.405
General practitioner	528 (9.8)	133 (10.7)	0.320
Referral from other hospital	455 (8.4)	69 (5.6)	<0.001**
Priority at triage ≤ 2, n (%)	3120 (57.8)	805 (64.9)	<0.001**
Episode end status, n (%)			
Cardiac service	2361 (43.7)	555 (44.7)	0.526
Non-cardiac services	1258 (23.3)	307 (24.7)	0.282
Discharge	1692 (31.3)	365 (29.4)	0.185
Dead	4 (0.1)	2 (0.2)	0.357
Other[a]	84 (1.6)	12 (1.0)	0.117
Length in hospital (days), median (25th, 75th)	1 (0, 2)	1 (0, 2)	0.978

CALD: culturally and linguistically diverse, (25th, 75th): 25th percentile, 75th percentile, kms: kilometres.
SEIFA (1–5): Socio-Economic Indexes for Areas ranked 1 to 5.
Distance from hospital: distance from centre of residential postcode to hospital.
[a] Other: includes discharge at own risk and unknown.
* Significant $p < 0.05$ by Independent sample t-test.
** Significant $p < 0.05$ by Chi-square test.
*** Significant $p < 0.05$ by Mann–Whitney U test.

Services (NPA IPHS) [29]. ED stay was classified into two categories, '≤4' and '>4' hours based on the National Health Performance (NHP) indicator #21b [29] (Table 3).

The clinical outcome variables included: triage priority; episode end status (i.e., cardiac services, non-cardiac services, discharged, dead, other admission); length of hospital stay; and guidelines concordance. Measurement of the variable, 'guideline concordance' was created from the three variables available in this dataset related to the guidelines for management of chest pain: ambulance as first medical contact (Guidelines for the Management of Acute Coronary Syndromes 2006) [31], triage priority 1 or 2, and time to treatment within 10 min (Guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments) [28]. The 'guideline concordance' variable was analysed by combining three variables together as detailed above. Each variable was weighted one point equally if all three variables were met, that Individual case was considered meeting the 'guideline concordance' (value 'Yes'). This variable was classified into two categories 'Yes' and 'No' (Table 4).

Table 2
Proportion of presenting symptoms of Australian-born and CALD patients.

Rank	Australian-born (n = 5399)	%	Rank	CALD patient (n = 1241)	%
1	Central chest pain	75.7	1	Central chest pain	74.9
2	Right/left chest pain	19.6	2	Right/left chest pain	21.7
3	Shortness of breath	14.4	3	Shortness of breath	16.5
4	Tight/heavy chest	11.7*	4	Tight/heavy chest	14.2*
5	Arm pain	11.1	5	Arm pain	11.2
6	Back pain	4.8*	6	Back pain	6.8*
7	Nausea/vomiting	4.3	7	Dizziness	5.2*
8	Palpitation	4.0	8	Palpitation	4.8
9	Shoulder pain	3.8	9	Nausea/vomiting	4.1
10	Abdominal pain	3.5	10	Shoulder pain	3.9
11	Jaw pain	3.3	11	Abdominal pain	3.7
12	Dizziness	3.0*	12	Jaw pain	3.1
13	Diaphoresis	2.9	13	Neck	3.0
14	Neck	2.7	14	Diaphoresis	2.4
15	Headache	1.1	15	Headache	1.3
16	Fatigue	1.0	16	Fatigue	1.1
17	Throat pain	0.8	17	Heart burn	0.9
18	Heart burn	0.7	18	Throat pain	0.6
19	Rib pain	0.4*	19	Calf/leg pain	0.4
20	Calf/leg pain	0.4	20	Collapse	0.2
21	Collapse	0.2	21	Rib pain	0.0*

CALD: culturally and linguistically diverse.
* Significant $p < 0.05$ by Chi-square test.

2.7. Statistical analysis

The data were analysed using IBM SPSS Statistics Version 22.0 and the level of significance was set at $p < 0.05$ with 95% confidence interval. Patient presenting characteristics, clinical outcomes, processing times and guidelines concordance data were stratified by CALD status; CALD patients, and Australian-born patients. Categorical variables were described as frequencies and percentages and a chi-square test was used to compare between CALD and Australian-born patients. Continuous variables with normal distribution were presented as mean and standard deviation (SD), and an independent t-test was used for comparisons. For continuous variable with skewed distribution, data were presented as median (25th percentile, 75th percentile) and Mann–Whitney U tests were used for comparisons. The relationship between processing times and CALD status, adjusted for age, was examined using a general linear model.

Sub analysis comparing the differences in median processing times between CALD and Australian-born patients were performed for five subgroups, including 1) patients with central chest pain; 2) patients discharged home; 3) patients admitted to non-cardiac wards; 4) patients admitted to hospital; and 5) patients admitted to cardiac services. A Man-Whitney U test was used to compare the median processing times.

The logistic regression model was used to model the predictors associated with concordance with these guidelines for the management of chest pain in the ED, and to establish whether CALD status was an independent predictor of guideline concordance after controlling for covariates. Eight demographic and presenting factors (age, gender, distance from hospital, low socio-economic status, chest pain, day and time of presentation, and CALD status) were included in the multivariate model. (Table 5).

3. Results

In total, 8225 patients who presented with chest pain to the ED between 1 July 2012 and 30 June 2014 were reviewed for eligibility; 213 patients were excluded due to the lack of country of birth information. The remaining 8012 patients were allocated into two groups based on their country of origin, with 5399 patients being allocated to the

Table 3
Processing times in emergency department for patients presenting with chest pain.

Processing time	Australian-born n = 5399	CALD patients n = 1241	p	p adjusted for age
Time to treatment (minutes), median (25th,75th)	21.0 (7.0, 66.0)	22.0 (8.0, 66.3)	0.375	0.127
≤10 min, n (%)	1804 (33.4)	391 (31.5)	0.198	0.004♦
ATS admission time (hours), median(25th,75th)	2.5 (1.3, 3.7)	2.8 (1.9, 3.8)	0.051	0.625
≤4 h, n (%)	2075 (38.4)	549 (44.2)	< 0.001**	0.107
ED stay (hours), median (25th,75th)	4.3 (0.5, 7.0)	5.4 (2.9, 7.7)	< 0.001*	0.006♦♦
≤4 h, n (%)	2382 (44.5)	442 (35.9)	< 0.001**	0.001♦

CALD: culturally and linguistically diverse, ATS: Australasian Triage Scale, ED: emergency department.
Time to treatment: interval between triage time and the time the patient was seen by emergency department doctor.
ATS admission time: the amount of time the patient spent in the ED before the decision to admit was taken.
ED stay: the period between when the patient presented at the ED and when that person was recorded as having physically departed the ED.
(25th, 75th): 25th percentile, 75th percentile.
* Significant $p < 0.05$ by Mann–Whitney U test.
** Significant $p < 0.05$ by Chi-square test.
♦ Significant $p < 0.05$ by logistic regression model adjusted for age.
♦♦ Significant $p < 0.05$ by general linear model adjusted for age.

Australian-born group, and 2613 patients being allocated to the overseas-born group. Those overseas-born group patients whose countries of birth were classified as the main English-speaking countries [24] (i.e. the United Kingdom, Ireland, New Zealand, Canada, the United States of America, and South Africa) were excluded at this stage, leaving 1241 patients in the CALD group. Finally, 6440 patients were included in this study, including 5399 Australian-born and 1241 CALD patients (Fig. 1). The patient characteristics and clinical outcomes are described in Table 1.

3.1. Differences in characteristics and presentations

CALD patients who presented to the ED with chest pain were statistically significantly older than the Australian-born group (mean ± SD; 62 ± 18.4 years vs 56 ± 19.6 years, $p < 0.001$). Slightly over half of the CALD and the Australian-born groups were male (51% vs 52%, $p = 0.472$), and there was no significant gender difference between the groups. All patients in the Australian-born group were eligible for Medicare (Universal Health Coverage) compared to 95.0% of the CALD patient group ($p < 0.001$). CALD patients were more likely to live closer to the hospital than Australian-born group, with a statistically significant difference between the groups (median; 6.8 (4.6, 13.6) vs 6.4 (4.4, 9.8) kms, $p < 0.001$).

There was no difference in socio-economic status (SEIFA) between the two groups. There was also no statistically significant difference in the three specified types of first medical contact (ambulance, emergency department, and general practitioner) between the two groups (Table 1). However, the percentage of patients referred from other hospitals was significantly lower in the CALD group than in the Australian-born group (5.6% vs 8.4%, $p < 0.001$). There was no association between CALD status and day or time of presentation (Table 1).

The top five presenting symptoms were similar for the two groups, including central chest pain, right/left chest pain, shortness of breath, tight/heavy chest and arm pain (Table 2). Approximately two-thirds of both groups presented with central chest pain and there was no statistical difference between CALD and Australian-born patients on this measure (74.9% vs 75.7%, $p < 0.526$). A greater proportion of CALD patients presented to the ED with tight/heavy chest (14.2% vs 11.7%, $p = 0.014$), back pain (6.8% vs 4.8%, $p = 0.006$), and dizziness (5.2% vs 3.0%, $p < 0.001$), than Australian-born patients. There was no association between CALD status and the remaining 17 presenting symptoms, yet interestingly, the percentage of rib pain cases were significantly fewer for CALD patients than for Australian-born patients (0% vs 0.4%, $p = 0.036$) (Table 2).

3.2. Differences in processing times

Patients in the CALD group had a longer 'time to treatment' than those in the Australian-born group; however, this did not differ significantly (median 22.0 (8.0, 66.3) vs 21.0 (7.0, 66.0) minutes, $p = 0.375$). There were also no differences in the proportions of patients who received their initial assessment or treatment in the ED within the Australasian Triage Scale (ATS) timeframe, (≤10 min) between the CALD and the Australian groups (31.5% vs 33.4%, $p = 0.198$). The CALD group had a longer median time waiting for admission compared to Australian-born patients, but this was on the borderline of statistical significance (median 2.8 (1.9, 3.8) vs 2.5 (1.3, 3.7) hours, $p = 0.051$). The proportion of CALD patients admitted to the hospital within the timeframe of four hours as specified in the guidelines was significantly greater than those of Australian-born patients (44.2% vs 38.4%, $p < 0.001$) (Table 3).

There appeared to be an association between ED stay and CALD status. Patients in the CALD group spent a significantly longer total time in the ED than the Australian-born group (median 5.4 (2.9, 7.7) vs 4.3 (0.5, 7.0) hours, $p < 0.001$). The proportion of patients leaving the ED within a four-hour timeframe as recommended in the guidelines was significantly lower in the CALD group than those in the Australian-born group (35.9% vs 44.5% respectively, $p < 0.001$) (Table 3). The breakdown of time patients spent in ED into three components; 1) time to ED doctor after arrival; 2) time from assessment to doctor decision 3) time from

Table 4
Guidelines concordance with three criteria of two guidelines[a] for management of chest pain in emergency department.

Criteria	All n = 6640	Australian-born n = 5399	CALD n = 1241	p
Ambulance as first medical contact, n (%)	2737 (41.2)	2219 (41.1)	518 (41.7)	0.679
Triage priority 1 or 2, n (%)	3925 (59.1)	3120 (57.8)	805 (64.9)	0.001*
Time to treatment ≤ 10 min, n (%)	2195 (33.1)	1804 (33.4)	391 (31.5)	0.198
Guidelines concordance, n (%)	863 (13.0)	708 (13.1)	155 (12.5)	0.556

CALD: culturally and linguistically diverse, Time to treatment: interval between triage time and time patient seen by emergency department doctor.
[a] Guidelines for the Management of Acute Coronary Syndromes 2006 [31] and Guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments [28].
* Significant $p \leq 0.05$ by Chi-square test.

Table 5
Independent predictors of guidelines concordance with three criteria[a] of two guidelines[b] the management of chest pain in the emergency department.

Predictor	Odds ratio	95% Confidence Interval	p^*
Socio-demographic factor			
Age	1.03	1.02, 1.04	<0.001
Male gender	1.20	1.04, 1.40	0.015
Distance from hospital	1.00	0.99, 1.00	0.017
Low socio-economic status	1.47	1.26, 1.71	<0.001
Presenting factor			
Central chest pain	1.46	1.21, 1.77	<0.001
Presentation day (weekend)	1.20	1.01, 1.41	0.034
Presentation time (business hours)	0.86	0.74, 1.00	0.045
Cultural factor			
CALD status	0.78	0.65, 0.95	0.012

CALD: culturally and linguistically diverse.
* Significant $p < 0.05$.
[a] 1) Ambulance as the first medical contact; 2) triage priority 1 or 2; and 3) time to treatment ≤ 10 min.
[b] Guidelines for the Management of Acute Coronary Syndromes 2006 and Guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments.

doctor decision to discharge from ED, are presented and compared between the two groups in Fig. 2. The findings revealed a significantly longer waiting time in the second and third components among CALD group. There was no difference in time to the initial treatment/assessment between two groups.

In analysis of four subgroups, including 1) patient with central chest pain (n = 5017); 2) patient discharged home (n = 2057); 3) patients admitted to non-cardiac wards (n = 1565); and 4) patients admitted to hospital (n = 3642) there was no significant difference in processing times in ED (i.e., time to treatment, ATS admission time and ED stay) between CALD and Australian-born patients within these subgroups. Conversely, sub analysis of patients admitted to cardiac services (n = 2916) revealed a significantly longer processing time in CALD patients than Australian-born patients (see Fig. 3).

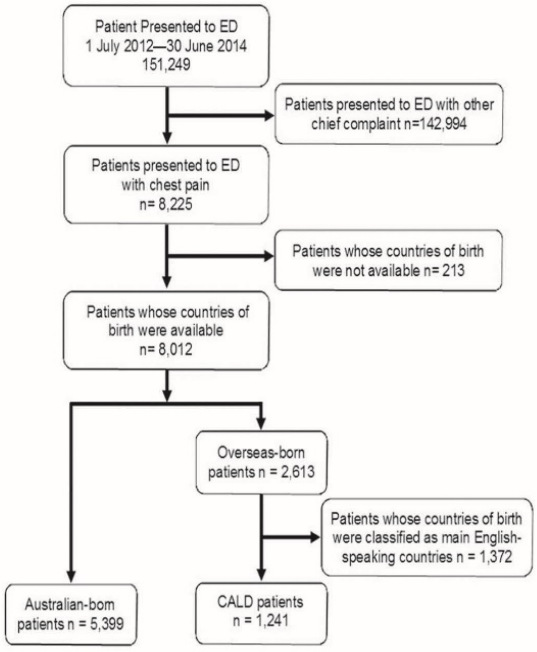

Fig. 1. Study flow diagram.

3.3. Differences in clinical outcomes

Clinicians nominated 'triage priority 1 or 2' more frequent to CALD patients than to the Australian-born patients (64.9% vs 57.8%, $p < 0.001$). The percentage of CALD patients admitted to cardiac services was higher than those in the Australian-born group, but this was not statistically significant (44.7% vs 43.7%, $p = 0.526$). Similarly, there was no association between CALD status and the remaining episode end status. The median length of stay in hospital was 1 (0, 2) day in both groups, and there was no association between length of time in hospital and CALD status (Table 1).

3.4. Guideline concordance and the independent predictors

The proportion of total patients who met guideline concordance (the three criteria: 1) ambulance as first medical contact; 2) triage priority 1 or 2; and 3) time to treatment within 10 min, of the two guidelines: 1) Guidelines for the Management of Acute Coronary Syndromes 2006 and 2) Guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments, was 13.0%. The percentage of the CALD group who met guidelines concordance was lower than those in the Australian group, but this was not statistically significant (12.5% vs 13.1%, $p = 0.556$) (Table 4).

Adjusting for the sociodemographic and presenting factors, CALD patients were 22% (95% CI, 0.65, 0.96, $p = 0.015$) less likely to meet 'guideline concordance' than Australian-born patients. Age, gender, distance from hospital, low socio-economic status, central chest pain, presentation day and presentation time made a statistically significant contributions to predicting the concordance with guidelines, $p < 0.050$ (Table 5). The strongest predictors of 'guideline concordance' were central chest pain symptoms and low socio-economic status which indicated that patients with central chest pain were 1.46 times (95% CI; 1.26, 1.77, $p < 0.001$) more likely to meet 'guideline concordance' than those with no chest pain. Similarly, patients with low socio-economic status were 1.47 times (95% CI; 1.26, 1.71, $p < 0.001$) more likely to achieve concordance with the guidelines for chest pain management than those with higher socio-economic status. Males were 1.20 times (95% CI; 1.04, 1.40, $p = 0.015$) more likely to meet 'guideline concordance' than females, while patients who presented on the weekend were also 1.20 times (95% CI; 1.01, 1.41, $p = 0.034$) more likely to meet concordance than those who presented on weekdays. The odds ratio of 1.03 (95% CI: 1.02, 1.04, $p < 0.001$) for age indicated that, for every additional year of age, patients were 1.03 times more likely to meet 'guideline concordance'. Patients were less likely to meet concordance with the guidelines (95% CI; 0.99, 1.00, $p = 0.017$) per kilometre away from hospital they lived. Presentation to the ED during business hours (9 am to 5 pm) decreased the chance of meeting the 'guideline concordance' by 14% (95% CI, 0.74, 1.00, $p = 0.045$) compared to presenting after hours (5.01 pm to 8.59 am).

4. Discussion

TED II was a large, cross-sectional study of 2 years of data from an ED dataset comparing the differences in characteristics and processing times between CALD and Australian-born patients presenting to an ED with chest pain. This study focused on ED process times and the concordance with the first three criteria (ambulance as first medical contact, triage priority 1 or 2, and time to treatment within 10 min) of the guidelines for management of chest pain (Guidelines for the Management of Acute Coronary Syndromes 2006 and Guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments. In total, 6640 patients were included; 1241 (18.7%) of who were classified into the CALD group and 5399 (81.3%) into the Australian-born group. The study population reflected the national proportion of the CALD population [33] and the national prevalence of specific self-reported cardiovascular condition [33].

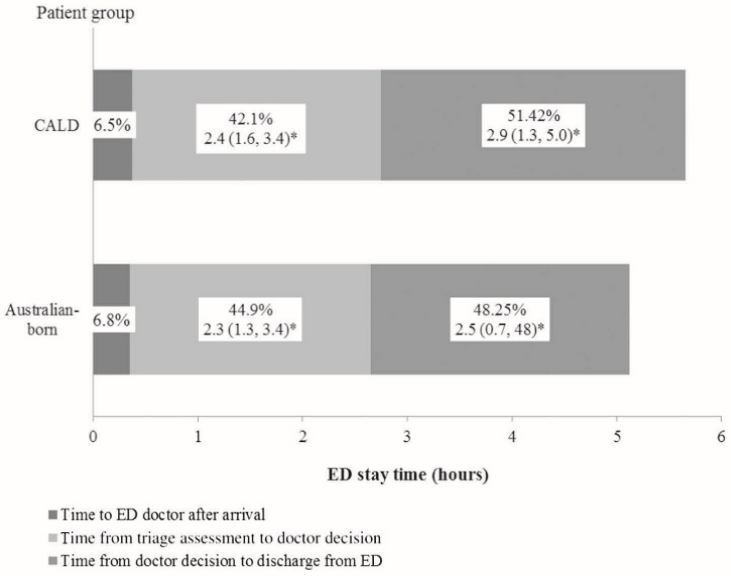

Fig. 2. Components of processing times in ED for patients presenting to ED with chest pain.

4.1. Differences in characteristics and presentations

The current study found that the CALD group was significantly older than the Australian-born group which is consistent with the previous studies in Australia [35,36]. In this study, the Australian-born group had a statistically significantly higher proportion of younger patients (<45 years) presenting to the ED with chest pain; this might be due to the increased rate of cardiovascular risk in the Australian-born population as a result of the upward trend of obesity in Australian children under 17 years of age [34].

The proportion of males was greater than females in relation to presentation of chest pain confirming recent national statistics and the findings of other studies worldwide. Although there were fewer females in both groups, the proportion of total females in this study increased by approximately 7% from a previous Australian study conducted around a decade ago [37].

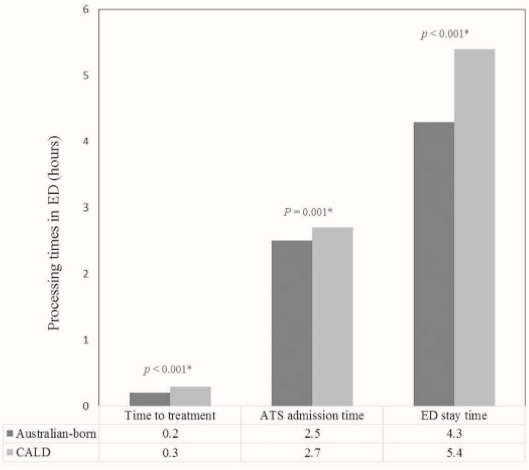

Fig. 3. Comparisons of processing times in ED for patients admitted to cardiac services.

Any differences in Medicare (Universal Health Coverage) accessibility between the two groups are likely to depend upon the Australian social and health-related payments and services system. All Australian-born people are eligible for Medicare. By contrast, some CALD patients are not eligible to access this system, such as newly-arrived migrants who face waiting periods of 104 weeks before being eligible to access most social security payments [38]. Similarly to the USA, foreign-born populations are not eligible for federally funded health insurance during their first five years of arrival [39]. Some studies concluded that a lower rate of access to care among CALD populations was due to uninsured status [40,41].

The two-thirds of patients in both groups presenting with central chest pain were comparable to a recent study conducted in Perth, Australia [42]. The main symptoms found in TED study II were consistent with those noted in a number of current Australian and international studies [43,44]. The low percentage (41%) of ambulance use in both groups may indicate a lack of awareness or knowledge of the chest pain action plan. The Australian Heart Foundation launched the 'Warning Sign of Heart Attack' campaign in 2009 to improve ambulance call rates when people experience chest pain or heart attack symptoms. Disappointedly, Bray et al. [45] found no difference in ambulance use following the campaign. A further investigation should be performed to gain a deep understanding in the root cause of underutilisation of emergency services.

4.2. Differences in processing times

The time variables in this study were limited to information extracted from the EDIS. Only three processing times in relation to delay time in seeking care for chest pain (i.e., time to treatment, ATS admission time, and ED stay) were available for comparison. Despite being limited, these processing times helped to reveal a picture of the components of in-hospital delay in the ED (Fig. 2). This study found no difference in 'time to treatment' and 'ATS admission time' between the two groups. It could imply equity in access to emergency care and no racial discrimination for all patients presenting to this centre. The finding was

consistent with Karice et al.'s [35] study which found a similar in-hospital processing time between English and non-English speaking patients.

Interestingly, within the patients admitted to cardiac services subgroup, CALD patients spent significantly longer than Australian patients in all stage of care in ED (Fig. 3). Also, all CALD patients were more likely than Australian-born group to spend a longer time in ED after the initial triage (Fig. 2). Whether communication barriers between CALD patients and the clinicians/doctors had an influence on their longer time during their assessment/treatment, is of vital interest for gaining an understanding of care processes in EDs for this population. CALD patients from different countries may interpret words from their native language to different words in English. For example, they may interpret 'chest' as breast, heart, or bust; and 'pain' as sore, or hurt. In addition to verbal communication, gestures and body language or silence in different cultures might play a key role in taking accurate information from patients to confirm the provisional diagnosis in ED. Due to limited data, the effect of communication and cultural barriers cannot be determined in this study. Qualitative study is recommended to perform to explain these longer processing times.

4.3. Guidelines concordance of the management of chest pain in the ED

The research team examined the holistic management of chest pain in relation to the guidelines for best practice. Due to the limited data extracted from the EDIS, only three variables (i.e., ambulance as first medical contact; triage priority 1 or 2; time to treatment within 10 min) were measured against the relevant guidelines (i.e., Guidelines for the management of acute coronary syndromes 2006, and Guidelines on the Implementation of the Australasian Triage Scale in Emergency Departments).

The findings showed a low rate of concordance with three of the chest pain related standards from two guidelines in ED in both groups. Since ambulance use and early treatment are acknowledged as vital for reaching optimal outcomes [8,46], a low rate of concordance to practice guidelines may impact on a patient's outcome, including survival and disability rate. The multivariate analysis demonstrated that demographics and presenting characteristics were significant predictors of guidelines concordance, including being CALD patients and having central chest pain.

This 'guidelines concordance' may not fully explain the entire complexity of cardiac care, and the delay in seeking medical care for chest pain. Further research on the complete components of delay time from symptom onset through to receiving definitive treatment is thus warranted. Under a low rate of guideline concordance, there is a significant room for practice improvement, and also a deeper understanding in conjunction with a better translation of evidence into clinical care is recommended.

4.4. Implications for research and practice

These findings could provide essential information for health providers and public health agencies in order to provide an appropriate standard of emergency care provision. The lack of concordance with guidelines for management of chest pain could alert the health organisations to evaluate the existing public awareness campaigns and consider other possible effective strategies. The findings from TED II will form a crucial database for further study on delay in seeking medical care for chest pain among CALD populations. The CALD group in this study consists of multiethnic subgroups; therefore further research on differences between ethnic groups is recommended.

5. Limitations

The TED II has a number of limitations. Firstly, the data from this study were collected from a single hospital. Nevertheless, this medical centre provides emergency care and full cardiac services for patients across South Australia, including patients from the rural and remote areas, thus yielding a large sample size of 6640. In addition, the demographics of this population, and the proportion of patients admitted to cardiac services were similar to those of the SNAPSHOT ACS study [19] which audited ACS care across Australia. The EDIS dataset provided only limited variables covering triage through to ED departure which led to some limitations in the analysis, more research is needed to review the outcomes of patients from the onset of symptoms (pre-hospital) through to hospital discharge.

This study also has a number of strengths. The data from the EDIS dataset were collected over entire years covering incidents of chest pain which may vary according to the different seasons. The missing data was only a small percentage (2.5%) and was only due to the lack of country of birth data. CALD patients in this study made up approximately 18% of all patients, which is similar to the proportion of CALD migrants in the population nationwide (14%). Importantly, TED II study population involved CALD patients from all regions around the world demonstrated the genuine multiculturalism.

6. Conclusion

TED II established important information about the characteristics, processing times, and clinical outcomes in an ED of CALD patients presenting to the ED with chest pain. CALD patients were older and less likely to have been eligible for public insurance than Australian-born counterparts. The initial treatment in ED was equally provided to all patients and yet CALD patients spent significantly longer time waiting in ED than Australian-born patients. We found no evidence of inequality of access to emergency care in our study, however further qualitative study in this area is recommended. A low rate of concordance with three of the chest pain related standards from two guidelines in both groups is of interest for further investigation in order to improve health care practices.

Conflict of interest

The authors of this paper have no conflicts of interest in conducting this study. The authors declare that this study was conducted in the absence of any financial or commercial relationships that could be construed as a potential conflict of interest.

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References

[1] S. Mendis, P. Puska, B. Norrving, Global Atlas on Cardiovascular Disease Prevention and Control, World Health Organisation, Geneva, 2011.
[2] Australian Commission on Safety and Quality in Health Care, Acute Coronary Syndromes Clinical Care Standard, Australian Commission on Safety and Quality in Health Care, Sydney, 2014.
[3] D. Mozaffarian, E.J. Benjamin, A.S. Go, et al., Heart disease and stroke statistics — 2015 update: a report from the American Heart Association, Circulation 131 (4) (2015) e29–322.
[4] R. Niska, F. Bhuiya, J. Xu, National hospital ambulatory medical care survey: 2007 emergency department summary, Natl. Health Stat. Rep. 26 (26) (2010) 1–31.
[5] E. Boersma, A.C.P. Maas, J.W. Deckers, M.L. Simoons, Early thrombolytic treatment in acute myocardial infarction: reappraisal of the golden hour, Lancet 348 (9030) (1996) 771–775.
[6] D.L. Giuspe, H. Suryapranata, J.P. Ottervanger, E.M. Antman, Time delay to treatment and mortality in primary angioplasty for acute myocardial infarction: every minute of delay counts, Circulation 109 (2004) 1223–1225.

[7] K. Dracup, D.K. Moser, M. Eisenberg, H. Meischke, A.A. Alonzo, A. Braslow, Causes of delay in seeking treatment for heart attack symptoms, Soc. Sci. Med. 40 (3) (1995) 379–392.
[8] D.K. Moser, L.P. Kimble, M.J. Alberts, et al., Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke: a scientific statement from thye American Heart Association Council on cardiovascular nursing and stroke council, Circulation 114 (2006) 168–182.
[9] K. Wechkunanukul, H. Grantham, R.A. Clark, Global review of delay time in seeking medical care for chest pain: an integrative literature review, Aust. Crit. Care (2016).
[10] H.H. Ting, A.Y. Chen, M.T. Roe, et al., Delay from symptom onset to hospital presentation for patients with non-ST-segment elevation myocardial infarction, Arch. Intern. Med. 170 (20) (2010) 1834–1841.
[11] M. Abdelnoor, J. Eritsland, C. Brunborg, S. Halvorsen, Ethnicity and acute myocardial infarction: risk profile at presentation, access to hospital management, and outcome in Norway, Vasc. Health Risk Manag. 8 (2012) 505.
[12] K. Wechkunanukul, H. Grantham, R. Clark, Presenting characteristics and management of chest pain among culturally and linguistically diverse populations: a comprehensive review, Heart Lung Circ. 24 (Supplement 3) (2015) S162.
[13] S.O. Henderson, R. Magana, C.S. Korn, T. Genna, P. Bretsky, Delayed presentation for care during acute myocardial infarction in a Hispanic population of Los Angeles County, Ethn. Dis. 12 (1) (2001) 38–44.
[14] K.M. King-Shier, S. Singh, P. LeBlanc, et al., The influence of ethnicity and gender on navigating an acute coronary syndrome event, Eur. J. Cardiovasc. Nurs. 14 (3) (2015) 240–247.
[15] J. Engebretson, J. Mahoney, E.D. Carlson, Cultural competence in the era of evidence-based practice, J. Prof. Nurs. 24 (3) (2007) 172–178.
[16] M. Sobralske, J. Katz, Culturally competent care of patients with acute chest pain, J. Am. Acad. Nurse Pract. 17 (9) (2005) 342–349.
[17] M. Chiu, P.C. Austin, D.G. Manuel, J.V. Tu, Comparison of cardiovascular risk profiles among ethnic groups using population health surveys between 1996 and 2007, Can. Med. Assoc. J. 182 (8) (2010) E301–E310.
[18] K.M. King, N.A. Khan, H. Quan, Ethnic variation in acute myocardial infarction presentation and access to care, Am. J. Cardiol. 103 (10) (2009) 1368–1373.
[19] D.P. Chew, J. French, T.G. Briffa, et al., Acute coronary syndromes care across Australia and New Zealand: the snapshot ACS study, Med. J. Aust. 199 (2013) 1–7.
[20] National Health and Medical Research Council, Cultural Competency in Health: A Guide for Policy, Partnership and Participation, National Health and Medical Research Council, Canberra, 2006.
[21] K.O. Anderson, C.R. Green, R. Payne, Racial and ethnic disparities in pain: causes and consequences of unequal care, J. Pain 10 (12) (2009) 1187–1204.
[22] B.D. Gushulak, L.S. Williams, National immigration health policy, Can. J. Public Health 95 (2004) 127–129.
[23] K. Wechkunanukul, H. Grantham, R. Damarell, R.A. Clark, The association between ethnicity (culturally and linguistically diverse migrants) and the time taken in seeking medical care for chest pain: a systematic review protocol, JBI Database Syst. Rev. Implement. Rep. 12 (9) (2014) 21–35.
[24] Australian Bureau of Statistics, Understanding migrant outcomes – enhancing the value of census data, Australia, Australian Bureau of Statistics, 2011 Contract No.: Cat No. 3417.0, 2011.
[25] Ethnic Communities' Council of Victoria, ECCV Glossary of Terms, Ethnic Communities' Council of Victoria, 2012.
[26] Federation of Ethnic Communities' Councils of Australia, Review of Australian Research on Older People From Culturally and Linguistically Diverse Backgrounds, Federation of Ethnic Communities' Councils of Australia, 2015.
[27] P.G. Steg, S.K. James, D. Atar, et al., ESC guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation, Eur. Heart J. 33 (20) (2012) 2569–2619.
[28] Australasian college for Emergency Medicine, Guidelines on the Implementation of the Australasian Triage Scale in Emergency Department, Australasian college for Emergency Medicine, Melbourne, 2013.
[29] Australian Institute of Health and Welfare, Australian hospital statistics 2013–14: emergency department care, Health Services Series No. 58. Cat. No. HSE 153, Australian Institute of Health and Welfare, Canberra, 2014.
[31] Acute Coronary Syndrome Guidelines Working Group, Guidelines for the management of acute coronary syndromes 2006, Med. J. Aust. 184 (8) (2006) S7.
[32] World Medical Association, World medical association Declaration of Helsinki: ethical principles for medical research involving human subjects, JAMA 310 (20) (2013) 2191–2194.
[33] Australian bureau of Statistics, Migration Australia, 2013–2014. Australian Bureau of Statistics, Cat. 3412.0 Contract No.: Cat. 3412.0, 2015.
[34] M. Nichols, K. Peterson, L. Alston, S. Allender, Australian Heart Disease Statistics 2014, National Heart Foundation of Australia, Melbourne, 2014.
[35] K. Hyun, J. Redfern, B. Aliprandi-Costa, et al., Variation in care between English speaking and culturally and linguistically diverse patients in SNAPSHOT ACS, Glob. Heart 9 (1) (2014) 127.
[36] A. Renzaho, Ischaemic heart disease and Australian immigrants: the influence of birthplace and language skills on treatment and use of health services, Health Inf. Manag. J. 36 (2) (2007) 26–36.
[37] D.M. Taylor, D. Garewal, M. Carter, M. Bailey, A. Aggarwal, Factors that impact upon the time to hospital presentation following the onset of chest pain, Emerg. Med. Australas. 17 (3) (2005) 204–211.
[38] Australian Goverment Department of Human Services, Newly Arrived Resident's Waiting Period, 2015 [cited 2015 25 September]. Available from: http://www.humanservices.gov.au/customer/enablers/newly-arrived-residents-waiting-period.
[39] K.P. Derose, J.J. Escarce, N. Lurie, Immigrants and health care: sources of vulnerability, Health Aff. (Millwood) 26 (5) (2007) 1258–1268.
[40] K.P. Derose, B.W. Bahney, N. Lurie, J.J. Escarce, Immigrants and health care access, quality, and cost, Med. Care Res. Rev. (2009).
[41] L.A. Lebrun, Effects of length of stay and language proficiency on health care experiences among immigrants in Canada and the United States, Soc. Sci. Med. 74 (7) (2012) 1062–1072.
[42] L.L. Coventry, A.P. Bremner, T.A. Williams, A. Celenza, I.G. Jacobs, J. Finn, Characteristics and outcomes of MI patients with and without chest pain: a cohort study, Heart Lung Circ. 24 (8) (2015) 796–805.
[43] L.L. Coventry, A.P. Bremner, T.A. Williams, A. Celenza, The effect of presenting symptoms and patient characteristics on prehospital delay in MI patients presenting to emergency department by ambulance: a cohort study, Heart Lung Circ. 24 (10) (2015) 943–950.
[44] A. Rawshani, A. Larsson, C. Gelang, et al., Characteristics and outcome among patients who dial for the EMS due to chest pain, Int. J. Cardiol. 176 (3) (2014) 859–865.
[45] J.E. Bray, D. Stub, P. Ngu, et al., Mass media campaigns' influence on prehospital behavior for acute coronary syndromes: an evaluation of the australian heart foundation's warning signs campaign, J. Am. Heart Assoc. 4 (7) (2015).
[46] C.B. Hutchings, C. Mann, M. Daya, et al., Patients with chest pain calling 9-1-1 or self-transporting to reach definitive care: which mode is quicker, Am. Heart J. 147 (2004) 35–41.

9

Presenting Characteristics and Processing Times for Culturally and Linguistically Diverse (Cald) Patients with Chest Pain in an Emergency Department: Time, Ethnicity and Delay (Ted) Study Ii

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Background: There is limited information about characteristics and timeliness of management in an Emergency Department (ED) for culturally and linguistically diverse (CALD) patients with chest pain. The aim of this study was to describe the presenting characteristics and process times in ED for CALD patients with chest pain and compare to the Australian-born population, and compare these outcomes with the recommendations from current guidelines

Methods: This study was a cross sectional analysis of a cohort of all patients who presented with chest pain to metropolitan tertiary referral service between 1 July 2012 and 30 June 2014 were included.

Results: Of the 6,640 patients who presented, 1,241(18.7%) were identified as CALD and 5,399 (81.3%) were Australian-born. CALD patients were significantly older than Australian-born patients (mean age 62 vs 56 years, $p<0.001$). There were no differences in central chest pain presentation (74.9% vs 75.7%, p =0.526); ambulance utilisation (41.7% vs 41.1%, p= 0.697); waiting time to initial treatment in ED (21 vs 22 minutes, p=0.375); and waiting time for admission to hospital after ED care (3.2 vs 3.3 hours, p=0.051). CALD patients were 22% less likely to receive the guideline management for chest pain; however, there was no difference in guideline adherence between two groups with equally low rates of 12.5% vs 13%, p=0.556.

Conclusions: There was no significant difference in emergency care provision between both groups. We hypothesise that cultural awareness was being practiced well in this centre in the context of low levels of guideline adherence for all patients with chest pain.

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10

Radial vs Femoral Approach: Does Access Point Influence Occupational Radiation Head Dose to Scrub Nurses?

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Background: There has been a notable trend towards using a radial approach during cardiac angiography in recent years. Studies show that irrespective of dose, cranial irradiation increases the risk of developing meningiomas by up to 10-fold [1,2], hence head dose monitoring should be a priority for departments.

Objectives: This study sought to determine whether head dose to operators and scrub nurses was affected by the choice of arterial access route.

Methods: A prospective study was performed over a period of 8 months monitoring the head dose to in-room personnel during both diagnostic and interventional coronary angiography cases. Data were collected using electronic detectors worn on the left temple by staff. The correlation between head dose to operating physician and the scrub nurse for both femoral and radial access points was evaluated.

Results: The head dose to scrub nurses was significantly higher during radial cases compared with femoral access.

Access	Mean dose per case (μSv) – Scrub Nurses	Number of cases	Average fluoroscopy time (mm:ss)
Radial	3.27	54	9:26
Femoral	1.15	40	11:54

Access	Mean dose per case (μSv) - Cardiologist	Number of cases	Average fluoroscopy time (mm:ss)
Radial	0.95	53	9:11
Femoral	0.8	51	11:41

Discussion: Whilst previous studies have shown that the dose for nurses is less than that of the operator for femoral access [3], limited data exists regarding head dose to nursing staff during radial cases. Further investigation is warranted to determine possible reasons for the increase in dose in radial access cases.

References

[1] Bondy ML, et al. Brain tumor epidemiology: Consensus from the Brain Tumor Epidemiology Consortium. Cancer 2008;113(S7):1953–68.
[2] Sadetzki S, et al. Radiation-induced meningioma: A descriptive study of 253 cases. Journal of Neurosurgery 2002;97(5): 1078–82.
[3] Cardoso CdO, et al. Padrão de Exposição Radiológica em Profissionais da Saúde Durante Procedimentos Cardiológicos Invasivos. Revista Brasileira de Cardiologia Invasiva 2014;22:320–3.

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