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

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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 urgent for treatment. These differences in perception may contribute to differences in response to chest pain and unique coping strategies. Delay in seeking medical care for chest pain in the general population have been well documented however limited studies focus on delay time in ethnic groups. There is little research to date as to whether ethnicity is associated with time the 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 practice for these populations.

Objectives

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

Inclusion criteria

Types of participants

Patients from different ethnic minority groups presented to the emergency department with chest pain.

Types of exposure

This review examined studies that evaluated the association between ethnicity and delay time 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.

Types of 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A comprehensive search was undertaken for relevant published and unpublished studies written in English with no date restriction.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, 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, or emergency medicine organizational websites and/or conferences. The search strategy also included checking the reference lists of included studies and contacting 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 using standardized critical appraisal instruments from the Joanna Briggs Institute. Adjudication was produced by the third reviewer.

Data collection

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 time that met the inclusion criteria were included in this systematic review. Delay times varied across ethnic groups, including Black, Hispanic, Asian, South Asian, Southeast Asian, and Chinese. Seven studies reported delay time 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 their 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 the delay time among culturally and linguistically diverse migrants in multicultural countries. The exploration of seeking care behaviors 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 2012.¹ It accounted for one-fifth of all deaths in Europe annually,² and it also caused one of every six deaths in the USA in 2009.³ 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 2012.⁴ Acute coronary syndromes is a leading cause of mortality and morbidity worldwide, particularly among industrialized countries.⁵ Acute coronary syndromes is a spectrum of clinical manifestations of CHD ranging from unstable angina (UA), non-ST-segment elevation myocardial infarction (NSTEMI) and ST-segment elevation myocardial infarction (STEMI).⁶ Chest pain is the most common symptom of ACS and also recognized as one of the most common presentations to an emergency department (ED).⁷ 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.⁸

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.⁹⁻¹¹ 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 onset.¹² 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.¹³⁻¹⁵ The National Heart Foundation of Australia has promoted the 'Heart Attack Action Plan' to help reduce the delay time when patient experience chest pain or heart attack symptoms¹⁶ (Appendix I). 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.¹⁰ 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.^{9-11, 31}

Factors influencing delay have been grouped into three domains; i) socio-demographic and clinical factors; ii) cognitive and emotional factors; and iii) social factors.¹⁷⁻³⁰ 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,^{32, 33} is one of the significant non-modifiable risk factors for cardiovascular disease.³⁴⁻³⁷ 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.³⁸⁻⁴⁶

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.^{18, 22, 26, 47, 48} 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.^{43, 49} International migrants or CALD groups living abroad worldwide have reached a total of 232 million people, accounting for 3.2% of the world's population.⁵⁰ A CALD migrant is defined as any person who changes his or her country of usual residence.⁵¹ Their journeys inevitably end with a change of lifestyle, including food, activities, jobs, fashion, socialization, and health care.^{52, 53} 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.⁵⁴

CALD groups are prone to face settlement hardships including education, employment, taxation system and a different health care system.⁵⁵ 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.⁵⁶

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.⁵⁷⁻⁵⁹ 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.^{55, 60-61} In recognition of this issue, it is important to understand medical care seeking behavior 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.⁶² The aim of this review was to establish if there is an association between ethnicity and delay time 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.⁶³

Definition of concepts

This systematic review defines delay time as the interval between time of symptom onset and hospital arrival.^{64, 65} 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.⁶⁵ 'Time of symptom onset' is defined as the time during which the patient reported becoming acutely or severely ill, prompting the patient to seek medical care.⁶⁶

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 time 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 time in seeking medical care for chest pain among CALD populations compared to the delay in majority populations. The current review places the emphasis on the delay time 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.

Types of outcomes

This 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.⁶⁴ 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 II.

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, 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 III). Any disagreements that arose between the reviewers (KW and HG) were resolved through discussion, or with a third reviewer (RC).

Data collection

Data was extracted from papers included in the review using the standardized data extraction tool from JBI-MAStARI (Appendix IV). 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 V.

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.⁶⁷

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 1).*

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 1). The list of excluded studies and reasons for exclusion are provided in Appendix VI.

Table 1 Results of database, grey literature, and web searches

Resources searched	No. results
Medline (<i>In Process & Other Non-Indexed Citations</i> and <i>Ovid Medline</i>)	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)^{68, 69, 71-75}, two studies were conducted in the UK^{76, 77} and one study was performed in Canada.⁷⁰ Of all ten included studies, males were the dominant gender ranging from 53.6%⁷² to 75.6%.⁷⁷ The mean age of participants of the ten reviewed studies varied from 59⁷³ to 76.5⁷² years.

The ten studies included seven ethnic groups; Caucasian/White⁶⁸⁻⁷⁷, Black^{69, 71-75}, Hispanic^{68, 69, 74, 75}, Asian^{68, 69, 74, 75}, South Asian^{70, 76, 77}, Southeast Asian⁷⁰, and Chinese⁷⁰ (see Appendix VII). The proportions of ethnic groups varied between studies. Caucasian/White was the majority group for all included studies ranging from 28.8%⁷⁰ to 90.9% of the total population of individual studies.⁷² Six studies^{69, 71-75} included Black people ranging from 5.1%⁷⁴ to 33.0% of the total population of individual studies.⁷³ Hispanics were included in four studies^{68, 69, 74, 75}, the proportions ranged from 2.9%⁷⁴ to 3.5% of the total population of individual studies.⁷⁵ Asian was the smallest group in four studies^{68, 69, 74, 75} ranging from 1.0%^{68, 69} to 1.4%⁷⁴ of the total population of individual studies. Two studies in the UK collected data from South Asian groups which ranged from 3.4%⁷⁶ to 23.2% of the total population of individual studies.⁷⁷ A Canadian study⁷⁰ included South Asian, Chinese and Southeast Asian groups with proportions of 24.9%, 22.7% and 14% respectively.

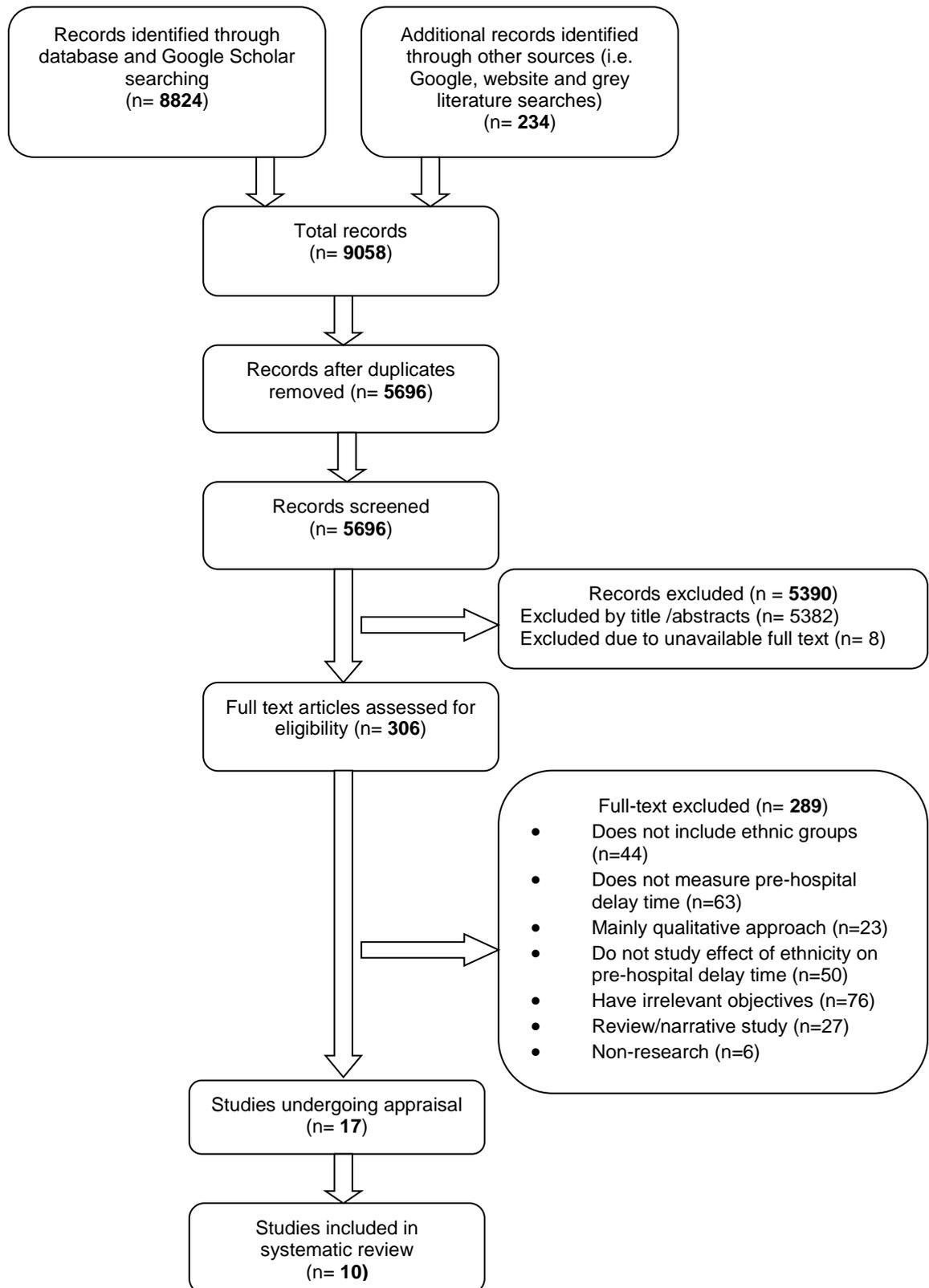


Figure 1 Study Selection flowchart

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)⁷⁶, National Registry of Myocardial Infarction (NRM)^{68, 69, 74}, British Cardiovascular Intervention Society (BCIS)⁷⁷, Atherosclerosis Risk in Community (ARIC)⁷¹, the Cooperative Cardiovascular Project⁷² and Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes with Early Implementation (CRUSADE).⁷⁵ The remaining two studies^{70, 73} included participant from local hospitals. The selected studies had sample sizes varying from 395⁷³ to 482 327⁷⁴ participants.

Methodological quality

All ten included studies were observational studies including five prospective cohort studies^{68, 73-76}, and five retrospective cross-sectional studies.^{69,70, 71, 72, 77} The descriptive summary of all included studies is available as Appendix V. 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 VIII).

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) (see Appendix III). 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 (see Table 2).

The outcomes were measured in two ways: quantitative time measured in hour units^{68, 69, 73-77} (Table 3) and categories of time⁷⁰⁻⁷² (Table 4). 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^{68, 69, 71, 72, 74-76} had a large sample size at a national level, only three studies^{70, 73, 77} enrolled less than 1000 participants. The ten studies were performed over periods of time ranging from one year⁷⁶ to ten years.⁷⁴ The heterogeneity of the outcome measures of included studies prevented statistical pooling for meta-analysis. Therefore, as meta-analysis could not be performed⁶⁷ 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.

Table 2 Summary of quality assessment using the JBI-MAStARI appraisal tool

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	%
Ben-Shlomo et al. 2008 ⁷⁶	Y	Y	Y	Y	Y	N	U	Y	Y	77.8
Canto et al. 1998 ⁶⁸	Y	Y	U	Y	Y	N	N	Y	Y	66.7
Goldberg et al. 1999 ⁶⁹	N	Y	Y	Y	Y	Y	U	Y	Y	77.8
Kendall et al. 2013 ⁷⁷	Y	Y	Y	Y	Y	Y	N	Y	Y	88.9
King et al. 2009 ⁷⁰	Y	Y	Y	Y	Y	U	Y	Y	Y	88.9
McGinn et al. 2005 ⁷¹	Y	Y	U	U	Y	N	N	Y	Y	66.7
Sheifer et al. 2000 ⁷²	N	Y	Y	Y	Y	N	N	Y	Y	66.7
Syed et al. 2000 ⁷³	N	Y	Y	Y	Y	N	N	Y	Y	66.7
Ting et al. 2008 ⁷⁴	Y	Y	Y	Y	Y	N	Y	Y	Y	88.9
Ting et al. 2010 ⁷⁵	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

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' method⁷⁶ and self-reported method.⁷⁷ One study in the USA classified ethnicity by country of origin⁶⁸ and another one study in Canada used the surname method.⁷⁰ 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.⁷⁴ included all Asians, while King et al.⁷⁰ stratified Asian into three sub groups and as such these two studies cannot be compared.

Results of meta-synthesis of quantitative research findings

Delay time 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 time as the interval between time from symptom onset to hospital arrival. Seven studies^{68, 69, 73-77} reported the delay time as quantitative time in hour units ranged from 1.90 hours⁷⁴ to 3.10 hours.⁷⁶ (Table 3) whilst the other three studies⁷⁰⁻⁷² reported delay time in time different categories ranging from < 1 hour to within 24 hours (Table 4). Nine studies^{68-75, 77} concluded that there was a statistically significant difference in delay time between ethnic groups and the majority group. Only one study⁷⁶ in the UK reported a similarity in delay time between Caucasian and South Asian groups (Table 3-4).

Six studies^{69, 71-75} reported longer delay times in Black compared to Caucasian/White. Hispanics arrived at hospital later than Caucasian/White in four studies^{68, 69, 74, 75} in the USA. Asians suffering from chest pain also presented to the ED later than Caucasian/White in four studies.^{68, 69, 74, 75} The other three studies^{70, 76, 77} compared delay time between Caucasian/White and South Asian; only two studies^{70, 76} reported longer delay time in South Asians than the majority group. The Canadian study⁷⁰ noted slower ED presentations in Southeast Asian and Chinese groups compared to the majority groups.

Proportions of delayer groups differed significantly ($p < 0.05$) between majority group (White) and ethnic groups (Table 4). Ethnic groups were more likely to wait longer than majority group to seek medical care for chest pain.

Table 3 Delay time in seeking care for chest pain (hours)

Authors Country/year	Median delay time (hours)					p
	White	Black	Hispanic	Asian	South Asian	
Ben-Shlomo et al [¶] UK (2008) ⁷⁶	3.1				3.1	NS
Canto et al USA (1998) ⁶⁸	2.0		2.3	2.1		≤0.001
Goldberg et al USA (1999) ⁶⁹	2.1	2.4	2.3	2.2		NA
Kendall et al UK (2013) ⁷⁷	2.1				2.6	0.15
Syed et al USA (2000) ⁷³	2.1	3.2				0.003
Ting et al [¶] USA (2008) ⁷⁴	2.0	2.4	2.3	2.1 [#]		<0.001
Ting et al USA (2010) ⁷⁵	2.6	2.9	2.8	3.0		<0.001

Significant = $p \leq 0.05$, Significant analysis (p value) compares between majority group (White) and ethnic groups (Black, Hispanic, Asian, and South Asian). # Non-significant $p = .10$, [¶] = reported delay time as geometric mean, NS = non-significant, NA= statistical comparison was not performed

Table 4 Delay time in seeking care for chest pain presented in categories of time

Authors Country/year	Category of delay time (hours)	Proportion of patients (%)					<i>p</i>
		White	Black	South Asian	Southeast Asian	Chinese Other race	
King et al Canada (2009) ⁷⁰	<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 USA (2005) ⁷¹	< 4	52.3	43.4				<0.0001
	≥ 4	47.7	56.6				
Sheifer et al [#] USA (2000) ⁷²	< 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 = $p \leq 0.05$, Significant analysis (p value) compare between majority (white) and ethnic groups (Black, South Asian, Southeast Asian, Chinese and other race).

Factors associated with longer delay time

The factors relating to a longer delay time identified by the primary study authors are summarized in Table 5. Although factors associated with longer delay time were not part of the inclusion criteria, they are reported in this systematic review to emphasize the association between ethnicity and delay time.

Table 5 Summary of factors associated with longer delay time

Factors	Studies
Differences in seeking care behavior	Ben-Shlomo et al. 2008 ⁷⁶
Differences in symptoms presentation	Canto et al. 1998 ⁶⁸ King, K. M et al. 2009 ⁷⁰
Cultural and socioeconomic status	Ben-Shlomo et al. 2008 ⁷⁶ Canto et al. 1998 ⁶⁸ Sheifer et al. 2000 ⁷² Kendall et al. 2013 ⁷⁷
Atypical symptoms	Canto et al. 1998 ⁶⁸
Longer time to establish history of cardiac pain	Ben-Shlomo et al. 2008 ⁷⁶
Symptom perception and recognition	King et al. 2009 ⁷⁰ Sheifer et al. 2000 ⁷²
Culture and language barriers	Ben-Shlomo et al. 2008 ⁷⁶ Canto et al. 1998 ⁶⁸ King et al. 2009 ⁷⁰
Underuse of ambulance	Ben-Shlomo et al. 2008 ⁷⁶ Canto et al. 1998 ⁶⁸ King et al. 2009 ⁷⁰ McGinn et al. 2005 ⁷¹
High risk of heart disease	Ben-Shlomo et al. 2008 ⁷⁶ Canto et al. 1998 ⁶⁸ Kendall et al. 2013 ⁷⁷

Discussion

This systematic review aimed to synthesize the existing evidence on the association between ethnicity and delay time in seeking medical care for chest pain among culturally and linguistically diverse (CALD) populations. It revealed longer delay times among CALD populations and showed the association between ethnicity and time 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 recommended practice for these populations.

Ethnicity and longer delay time

Zerwic et al.⁷⁸ and Henderson et al.⁷⁹ noted a significantly longer delay time in ethnic groups compared to the majority group. The current review found a significantly longer delay time in ethnic groups such as Black, Hispanic, Asian, South Asian, Southeast Asian, and 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.¹⁰⁻¹²

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 VIII) 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 studies⁸⁰⁻⁸² demonstrated that ethnicity was associated with poorer symptom recognition, and protective health-related behaviors that lead to delay in seeking care. The findings of this systematic review confirm the association between ethnicity and longer delay time. Some significant influencing factors found in this review are related to sociocultural factors such as cultural and socioeconomic status, culture and language barriers, differences in seeking care behaviors and symptom perception. The review findings are consistent with the previous studies⁸³⁻⁸⁵ that showed that the differences in delay time between countries related to their unique sociocultural context.

The additional factors included lower utilization of ambulance and health insurance. Lozzi et al.⁸⁶ found a large number of ACS patients hesitated to call an ambulance and Brown et al.⁸⁷ 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 impact on how CALD populations might 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.⁵⁵ Consequently, their health behavior 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.⁶⁰⁻⁶¹ Cultural competence is a set of congruent behaviors, 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.⁸⁸

Many organizations such as the Heart Foundation in Australia have promoted chest pain action plans to the public in order to minimize the delay time. Disappointingly, patient delay times are still longer than the recommendation response time worldwide^{83, 89}, 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 VIII) 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 time 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. There is evidence of the association between ethnicity and time taken to reach hospital after experiencing chest pain among CALD populations. Reducing delay time in seeking care for chest pain is a critical issue for health agencies worldwide. Improving public awareness and implementing cultural competence might bring many benefits to CALD populations. Additionally, further quality research in multicultural countries is warranted to understand the pattern to seeking care among these non-majority populations.

Implications for practice

There was evidence of association between ethnicity and the delay time 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 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 is warranted to check its effectiveness, especially public awareness among CALD populations. Guidelines and Clinical care standard 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 time 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 subanalysis of ethnicity to explore the differences in delay time 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.⁹⁰ Also, research focusing on sociocultural factors influencing delay time 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 time, future studies should consider consideration of other confounding factor such as economic status, income and health insurance status of CALD populations.

Conflict of Interest

The reviewers 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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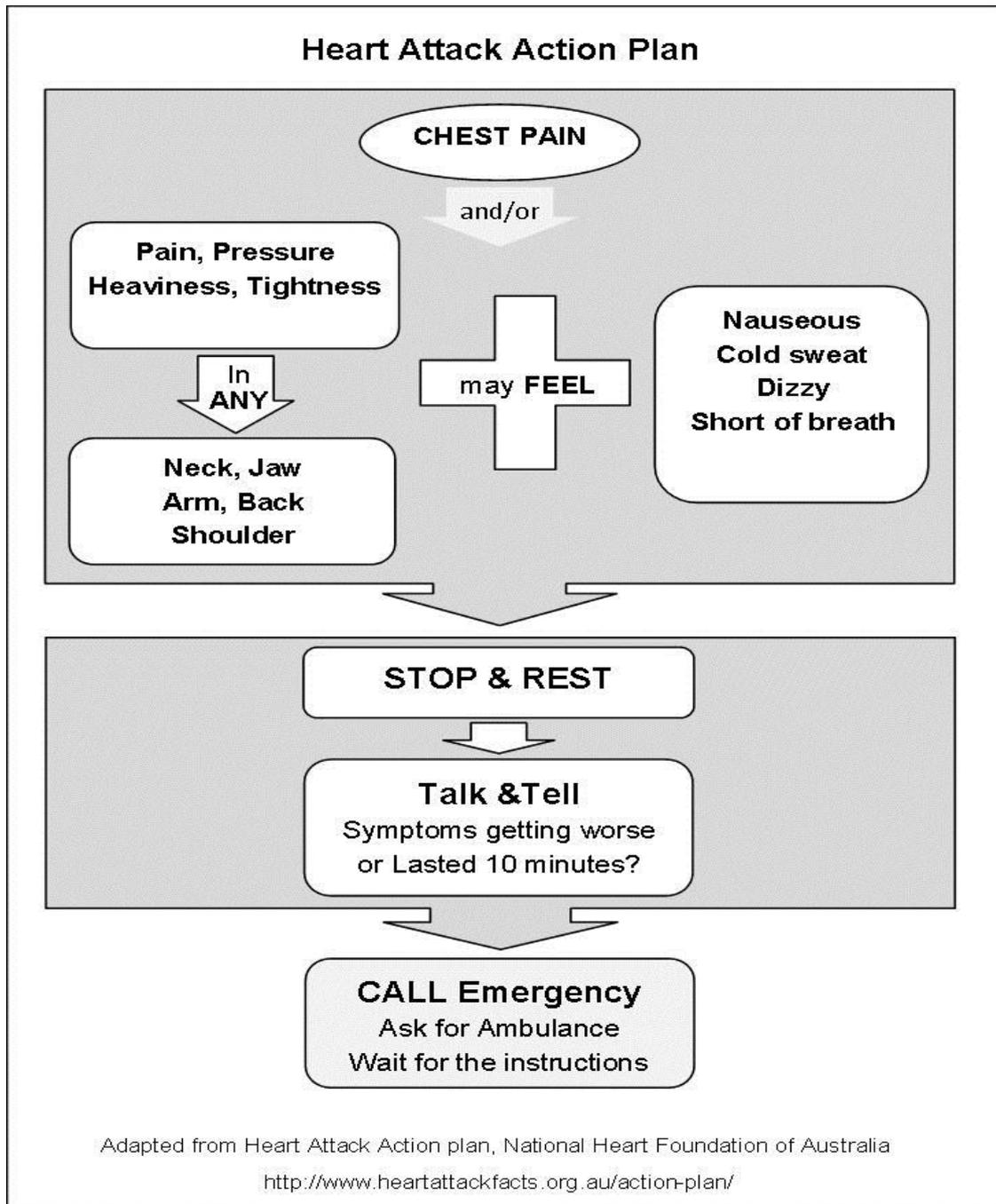
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Appendix I: Heart Attack Action Plan



Appendix II: Search strategy

Medline (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 stenosis* or thrombo*)).tw.
15	(ACS or STEACS or NSTEMACS 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	Limiters/Expanders
S36	S18 AND S29 AND S34	Limiters - English Language Search modes - Boolean/Phrase
S35	S18 AND S29 AND S34	Search modes - Boolean/Phrase
S34	S30 OR S31 OR S32 OR S33	Search modes - Boolean/Phrase
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*)))	Search modes - Boolean/Phrase
S32	TI ((Delay* or prompt* or rapid*)) OR AB ((Delay* or prompt* or rapid*))	Search modes - Boolean/Phrase
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)))	Search modes - Boolean/Phrase
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")	Search modes - Boolean/Phrase
S29	S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28	Search modes - Boolean/Phrase
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)	Search modes - Boolean/Phrase
S27	TI (Language N2 proficien*) OR AB (Language N2 proficien*)	Search modes - Boolean/Phrase
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")	Search modes - Boolean/Phrase
S25	(MW ethnology)	Search modes - Boolean/Phrase
S24	(MH "Special Populations") OR (MH "Vulnerability")	Search modes - Boolean/Phrase
S23	(MH "Cultural Competence")	Search modes - Boolean/Phrase
S22	(MH "Culture") OR (MH "Acculturation") OR (MH "Cultural Diversity") OR (MH "Cultural Values") OR (MH "Ethnology") OR (MH "Ethnological Research")	Search modes - Boolean/Phrase
S21	(MH "Refugees")	Search modes - Boolean/Phrase
S20	(MH "Ethnic Groups+")	Search modes - Boolean/Phrase
S19	(MH "Immigrants")	Search modes - Boolean/Phrase

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	Search modes - Boolean/Phrase
S17	TI (atherosclero* OR athero-sclero* OR atherothrombo* OR athero-thrombo*) OR AB (atherosclero* OR athero-sclero* OR atherothrombo* OR athero-thrombo*)	Search modes - Boolean/Phrase
S16	TI (unstable) N4 (angina) OR AB (unstable) N4 (angina)	Search modes - Boolean/Phrase
S15	TI (ACS OR STEACS OR NSTEMACS OR CAD OR CHD) OR AB (ACS OR STEACS OR NSTEMACS OR CAD OR CHD)	Search modes - Boolean/Phrase
S14	TI ((coronary) N2 (syndrome* OR disease* OR event* OR occlusion* OR stenosis* OR thrombo*)) OR AB ((coronary) N2 (syndrome* OR disease* OR event* OR occlusion* OR stenosis* OR thrombo*))	Search modes - Boolean/Phrase
S13	TI (heart) N2 (attack*) OR AB (heart) N2 (attack*)	Search modes - Boolean/Phrase
S12	TI ((ST) N2 (elevat* OR depress*)) OR AB ((ST) N2 (elevat* OR depress*))	Search modes - Boolean/Phrase
S11	TI (STEMI OR NSTEMI) OR AB (STEMI OR NSTEMI)	Search modes - Boolean/Phrase
S10	TI (AMI OR MI) OR AB (AMI OR MI)	Search modes - Boolean/Phrase
S9	TI (((myocardial or cardiac or heart) N2 (infarct* or isch#emi*))) OR AB (((myocardial or cardiac or heart) N2 (infarct* or isch#emi*)))	Search modes - Boolean/Phrase
S8	TI "chest pain" OR AB "chest pain"	Search modes - Boolean/Phrase
S7	(MH "Atherosclerosis")	Search modes - Boolean/Phrase
S6	(MH "Myocardial Infarction")	Search modes - Boolean/Phrase
S5	MH Coronary Disease OR MH Coronary Arteriosclerosis OR MH Coronary Stenosis OR MH Coronary Thrombosis	Search modes - Boolean/Phrase
S4	(MH "Angina Pectoris") OR (MH "Angina, Unstable")	Search modes - Boolean/Phrase
S3	(MH "Chest Pain")	Search modes - Boolean/Phrase
S2	(MH "Acute Coronary Syndrome")	Search modes - Boolean/Phrase
S1	(MH "Myocardial Ischemia")	Search modes - Boolean/Phrase

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 stenosis* or thrombo*)).tw.
15	(ACS or STEACS or NSTEMACS 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

Appendix III: Appraisal instruments

MAStARI Appraisal instruments

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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Are the patients at a similar point in the course of their condition/illness?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Has bias been minimised in relation to selection of cases and of controls?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Are confounding factors identified and strategies to deal with them stated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Are outcomes assessed using objective criteria?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Was follow up carried out over a sufficient time period?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Were the outcomes of people who withdrew described and included in the analysis?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Were outcomes measured in a reliable way?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Was appropriate statistical analysis used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Overall appraisal: Include Exclude Seek further info.

Comments (Including reason for exclusion)

Appendix IV: Data extraction instruments

MAStARI data extraction instrument

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: _____

Study results

Dichotomous data

Outcome	Intervention () number / total number	Intervention () number / total number

Continuous data

Outcome	Intervention () number / total number	Intervention () number / total number

Appendix V: List of included studies

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 for 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.

Appendix VI: List of excluded studies

1. 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

2. 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.

3. 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

4. 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

5. 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.

6. 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).

7. 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 VII: Summary of included studies

Authors	Country /year	Study design	Data source/ Sample size	Ethnic group (%)	Median DT (hour)	Key findings	Ethnicity associated with delay time
Ben-Shlomo et al ⁷⁶	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 behavior. Asian underuse of ambulance may reflect cultural differences.	Yes
Canto et al ⁶⁸ 1998	USA 1998	Prospective cohort study	NRMI 2 n = 275 046	White = 86 Hispanic= 3 Asian= 1 Native = <1	2.03	Times from symptom onset to hospital among ethnic groups were longer than white. Cultural and socioeconomic factors may influence symptom perception.	Yes
Goldberg et al ⁶⁹ 1999	USA 1999	Retrospective cross-sectional study	NRMI 2 n = 364 131	White = 86 Black = 6 Hispanic = 3 Asian = 1.0	2.10	Ethnicity was significantly associated with longer delay.	Yes
Kendall et al ⁷⁷ 2013	UK 2013	Retrospective analysis study	The BCIS n = 672	White= 76.8 South Asian =23.2	2.05	South Asians were more likely to have longer delay time and a longer post- hospital delay and entire delay (pre- and post-) than white.	Yes
King et al ⁷⁰	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	Ethnic patients were more likely to wait > 12 hours before seeking care. Ethnic groups were less likely to recognize cardiac symptoms. Language barrier was a potential barrier to identify symptoms and to reach definitive care.	Yes

DT= delay time, ACS= acute coronary syndromes, AMI= acute myocardial infarction, MINAP= Myocardial Ischaemic National Audit Project, NRMI= National Registry of Myocardial Infarction, BCIS= British Cardiovascular Intervention Society, ARIC = Atherosclerosis Risk in Community

Summary of included studies (continued)

Authors/ year	Country / Year	Study design	Data Source/ sample size	Ethnic group (%)	Median DT (hour)	Key findings in relation to association between ethnicity and delay	Ethnicity associated with delay time
McGinn et al ⁷¹	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 were likely to involve cultural as well as environmental issues.	Yes
Sheifer et al ⁷²	USA 2000	Retrospective cross-sectional study	The Cooperative Cardiovascular Project n = 102 339	White = 90.9 Black and other race = 9.1	NA	Black race was among associated factors of delay to present to ED and more likely to present later than 6 hours.	Yes
Syed et al ⁷³	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 significantly longer in Black compared with white.	Yes
Ting et al ⁷⁴ 2008	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 was associated with longer delay time.	Yes
Ting et al ⁷⁵ 2010	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

DT= 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

Appendix VIII: JBI Levels of Evidence for Effectiveness

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