

Reducing time-lag between onset of chest pain that could be due to a heart attack and seeking professional medical help

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Contents

Acknowledgements	3
Glossary	3
Summary.....	4
Main text	7
Aim.....	7
Background	7
Methods.....	9
Results	11
Intervention studies (9).....	12
Non-intervention quantitative studies (32).....	12
Non-intervention qualitative studies (12)	16
Discussion.....	18
Conclusion and recommendations	21
What is already known about this topic	23
Figure 1: Search flow chart.....	25
Table 1: Statistically significant socio-demographic factors associated or not associated with delay.....	26
Table 2: Statistically significant clinical factors associated or not associated with delay.....	27
Table 3: Statistically significant emotional factors associated with delay	28
Table 4: Statistically significant cognitive factors associated or not associated with delay.....	29
Table 5: Statistically significant other factors associated or not associated with delay.....	30
Table 6: Factors associated with delay reported in qualitative papers	31
References	33

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Glossary

Acute Coronary Syndrome - one of three conditions where the coronary arteries are either narrowed or blocked: STEMI, non-STEMI and unstable angina.

ECG - Electrocardiogram

Non-STEMI - see STEMI

PCI - Percutaneous Coronary Intervention - the treatment for a heart attack where a catheter is inserted into the coronary artery that is blocked; the blockage is removed and a stent is inserted to keep the artery open.

STEMI - ST elevation myocardial infarction: this refers to the look of the ECG for a patient following an MI. Those who have STEMIs are the most obvious on the ECG and tend to be worse than the other type, non-STEMIs.

Thrombolysis - the treatment for a heart attack where a drug is given that dissolves the blood clot that has blocked the coronary artery.

Unstable angina - a condition in which a narrowed coronary artery threatens to block leading to a STEMI or non-STEMI.

Summary

Aim

The work reported here is a systematic review of evidence that aims to answer two questions: why do patients having a heart attack delay seeking professional medical help and what interventions if any can reduce this delay.

Background

Many people having a heart attack delay calling emergency professional help. As a result they either cannot receive the best treatments at all, or do not benefit as fully as they might. For this reason, delay in seeking professional medical help is an important risk factor for poor outcome (1). Furthermore, there is some evidence that the delay is distributed unevenly across the population with, for example, women delaying longer than men. It follows that public health benefits could be achieved by effective campaigns to reduce the time-lag and these benefits might include a reduction in health inequality.

Method

See main text.

Results

Action taken

Five papers report that less than 10% requested an ambulance or called the Emergency Department as a first response. The most common action seems to be to consult a lay person; that person would then call emergency services. Others self-medicated, tried to relax, wished or prayed for symptoms to go, or drove to hospital.

Factors associated with delay

The factors associated with delay can be categorised as: socio-demographic, clinical, emotional, cognitive and other.

i) Socio-demographic

The strongest findings for socio-demographic factors associated with delay related to age, gender and ethnicity. There is weaker evidence relating to income. Little of the evidence is from the UK.

ii) Clinical

Clinical indicators can be divided into medical history and presenting condition. In relation to medical history, statistically significant correlations with delay are found in relation to those with a history of diabetes, hypertension, heart failure, family history of heart disease, and smokers. The findings relating to those with a history of angina and heart disease are conflicting.

In terms of presenting condition, the key finding is that severe symptoms are associated with less delay. By contrast, those who have no chest pain and who self-medicate are more likely to delay. The finding that STEMI is associated with less delay compared to non-STEMI is likely to be a product of the same phenomenon, that is, STEMIs have more severe symptoms. Prodromal symptoms were associated with delay. These findings are supported in qualitative data; those with severe symptoms report far less doubt about what to do. Furthermore, niggling prodromal symptoms in the period leading up to a heart attack added to the likelihood of doubt and delay.

iii) Emotional

Broadly-defined 'depression' (i.e. not necessarily clinically diagnosed) is associated with delay. There is one paper that suggests so-called emotion-focused coping is associated with delay - roughly this seems to be where people try to ignore or distract themselves from unpleasant reality. In the qualitative research, embarrassment and a desire not to trouble medics unnecessarily emerged as important for those who had delayed.

iv) Cognitive

The most important cognitive factor related to delay is the failure to recognise the presenting condition as cardiac or potentially cardiac. This is supported in the qualitative data. To this extent, it is probably linked to the clinical factors mentioned above. There is also evidence that those who lack trust in others and who lack general medical knowledge delay more. In the qualitative studies some who delayed reported that they did not believe they were at risk of a heart attack

and so did not interpret their symptoms as such; this belief was related to being female, young or a non-smoker.

v) Other

There is some evidence that being at home, and being alone are associated with delay; conversely, those who consulted someone rather than not were less likely to delay.

Discussion

See main text

Recommendations

Delay in reporting symptoms remains the main cause of overall delay in treatment of heart attack. There are patterns of delay within the population: age, gender and ethnicity are implicated; but the most important factor might be presentation with ambiguous symptoms. The small number of interventional trials that have been performed have produced little evidence of success in reducing delay. At present, there are no interventions that can be recommended.

Before developing and trialling new interventions, we should test the hypothesis that symptom differences are clinical differences at the heart of differences in presentation time both of individuals and of groups based on gender, ethnicity, class, depression and so forth. This might be possible using existing data from, for example, MINAP.

On the basis of the results of that study, we would have a good idea of which groups to target and how to do so. For example, it might be that women can be alerted to ambiguous and prodromal symptoms. Other groups that might be more likely to have ambiguous symptoms leading to delay could include diabetics, those with hypertension and older people. The key problem for any intervention would be whether it leads to a large increase in false alarms and, therefore, of a burden to the emergency services.

Reducing time-lag between onset of chest pain that could be due to a heart attack and seeking professional medical help

Main text

Aim

The work reported here is a systematic review of evidence that aims to answer two questions: why do patients having a heart attack delay seeking professional medical help and what interventions if any can reduce this delay.

Background

Coronary arteries are the blood vessels or tubes that deliver blood to the heart muscle. A heart attack or myocardial infarction (MI) is caused when one of these tubes blocks. The treatment regime for heart attack has changed since the early 1980s. At one time, the main treatment was to monitor and rest the person. In the 1980s, drugs called thrombolytics began to be used; these dissolved the clot that was causing the blockage and, combined with aspirin, these drugs greatly reduced mortality. Since around the mid-2000s, the treatment of choice in many cases has become percutaneous coronary intervention (PCI). This involves taking the person suffering the heart attack to a specialised theatre and inserting catheters into the coronary arteries in order to remove the blockage. Both thrombolysis and PCI are best performed as soon as possible after symptoms begin. Unfortunately, many patients delay calling emergency professional help with the result that they either cannot receive the treatment at all, or do not benefit as fully as they might. For this reason, delay in seeking professional medical help is an important risk factor for poor outcome (1).

Patient and Public Involvement (PPI) services within North Trent are forums through which lay people set their priorities in order to advise health policy. They have expressed concern about the number of people admitted with a heart attack who are ineligible for the best treatment because of this delay in reporting symptoms. There is also wider concern at the relative difference in coronary heart disease mortality between manual and non-manual social class groups in Britain; this has persisted and may have increased in the period 1978-2006, when the overall hazard ratio was 1.56 [95% CI: 1.45 to 1.69] (2). Furthermore, delay itself seems to be class-related such that this is likely to be a factor contributing to

inequality (1,3). There are other socio-demographic factors that have been reported as predictive of delay, including sex (women) and age (older people) (4,5).

This review is thus concerned with two questions: first, what are the predictors of delay and, second, what interventions succeed in reducing delay. There has been one previous review tackling both questions (8). This was published in 2004 and dealt with reports published up to 2001. This found a lack of convincing data in terms of either predictors or interventions. Since then, the increased availability of PCI makes this an urgent area of inquiry so that inequalities in access to the new treatment can be addressed. Furthermore, social marketing has emerged as a strategy to influence health behaviours (6). It has been used successfully in other areas such as cancer. It can be targeted at particular groups based, for example, on socio-demographic features. There is thus capacity to develop social marketing interventions to reduce delay, informed by this literature review.

Public health benefits could be achieved, including a reduction in health inequality, if the service could devise effective campaigns to reduce the symptom to professional time lag. Many such campaigns have been run and evaluated, without much evidence of success (1,7).

Since 2006 there have been four systematic reviews on topics of relevance to this report (9-12) plus an important comprehensive review published as part of a statement from the American Heart Association (1). Khraim 2009 reports predictors of delay from papers reported up to 2008 (9). We have drawn upon it for categorisation of predictors and for citation checking. The authors conclude that there are a number of predictors that could be used to target future publicity campaigns to those at-risk of delay. Our own conclusions concur with these although we shall suggest that clinical differences are at the heart of delay rather than, for example, gender in itself.

Finn et al's paper includes a systematic review focused on whether mass media campaigns are effective in reducing patient delay in response to chest pain (10). It finds 16 papers, all prior to 2001, and a Cochrane review published in 2002 (13) on the wider topic of the effect of mass media interventions on health service use. It concludes that there are no convincing data of a beneficial effect.

Canto is described as a review rather than systematic review. Its focus is gender differences in symptoms of Acute Coronary Syndrome (11). It reports six quantitative papers, five from large cohort studies. Its conclusions are modest: that data have been reported in inconsistent ways, making comparison difficult. However, age seems to be a stronger indicator of differences in symptoms than gender; gender differences might be a result of the average older age of women with ACS.

Dubayova et al is a systematic review of the effect of fear on delay in seeking help: cancer and heart disease are the two areas chosen for review (12). They find four papers relating to heart disease, all published before 2005. These showed that patients delayed seeking assistance when worried about troubling others and when fearful of financial consequences (the latter, in two US-based studies). Non-specific fear was associated with delay, but fear of death was associated with more rapid response.

Moser et al includes a comprehensive review of studies published from January 1981 to March 2000 (1). As such, the findings are by now dated. Nonetheless we shall refer to it in our discussion; we have also drawn upon the categories used in this paper in the section below discussion non-intervention qualitative studies.

Methods

Data sources and search strategy

The search was completed on 2nd February 2011. Keywords were developed through initial examination of relevant literature we already knew followed by trial-and-error scoping.

The databases searched were, in chronological order: Medline (via EBSCO searched 26 Jan 2011), CINAHL plus (via EBSCO searched 1 Feb 2011), PsycINFO (via CSA searched 1 Feb 2011), ASSIA (via CSA searched 1 Feb 2011), Web of Science (ISI Web of Knowledge searched 1 Feb 2011), Scopus (Elsevier SciVerse searched 1 Feb 2011), Science Direct (Elsevier SciVerse searched 1 Feb 2011), DARE (searched 1 Feb 2011), Cochrane Library (searched 2 Feb 2011), Google Scholar (searched 18th Feb 2011). We included papers published from 2006 as this marks the time from

which PCI becomes widely used as treatment for MI. The other inclusion criteria were: publication in peer-reviewed journal, empirical study, published in English from 2006 to the date of the search.

We searched for the keywords in title and abstract. They were clustered around three themes: myocardial infarction, seeking help, and delay. These themes were linked using the Boolean operator 'and'. In each theme synonyms and related terms were used, as follows:

Myocardial Infarction: (myocardial infarction OR chest pain OR heart attack OR angina OR acute coronary syndrome, OR ACS, [+ relevant associated database subject headings e.g. angina pectoris])

Seeking help: (seek* n4 (help OR healthcare OR advice OR assistance)

Delay: delay* OR reduc* delay

The full search strategy is available from the author and the process is set out in [Figure 1](#).

Study selection

After discarding papers obviously irrelevant by title, we had 118 papers. The abstracts of these and, where necessary, full text, were examined: 74 were discarded as not relevant, leaving 44 as relevant. Backward citation tracking was performed on these leading to 9 further papers of relevance. The resulting 53 papers were entered onto a Mendeley database where they were tagged by themes such as systematic review, qualitative or quantitative, intervention or observation, and country of origin. We then obtained full text of all papers and extracted data onto one of three tools: quantitative intervention studies, quantitative non-intervention studies or qualitative studies.

The following data were extracted from all studies: Author; date; type of study; location; population and sample. In addition, the following data were extracted from intervention studies:

- Delay time
- Predictors of delay
- Intervention to reduce delay
- Outcomes of intervention
- Link to inequality

The following data were extracted from non-intervention quantitative studies:

- Delay time
- Predictors of delay
- Action taken by patient
- Link to inequality

And the following data were extracted from non-intervention qualitative studies

- Reasons for delay
- Who to call and why
- Link to inequality

We did not limit the papers included on the basis of quality other than that they were published in peer-reviewed journals. However, we did score or comment on the quality of papers and factored this into our interpretation. For the non-intervention quantitative studies we created a star-rating system on the basis of whether or not i) the sample size was greater than 500 and ii) the data analysis had included multivariate analysis. One-star papers met neither criteria; two-star papers met one; and three-star met both. For the qualitative papers we commented informally about quality on the extraction table. For the intervention studies, we found only four and of these, only two specifically looked at effect on delay. Thus we included all four, plus related papers, but comment on the quality as relevant below.

Results

We shall present our results under the three headings based on the tools described above, thus: Intervention studies; Quantitative non-intervention; Qualitative non-intervention.

Intervention studies (9)

The search found two interventional studies reported in nine papers: both randomised trials from the USA (14,15); there were none from the UK.

The largest RCT was Dracup 2009 (14) with several associated reports (16-22). 3522 people with a history of AMI or invasive cardiac procedure were randomized 50/50 to receive or not the experimental intervention. This was a single face-to-face educational session conducted by a nurse with expertise in cardiology, followed by a telephone reinforcement session at 1 month. Each person was followed up for two years. In that period, 317 of the experimental group and 278 of the control group went to hospital with further symptoms. However, there was no significant difference in time-to-call: median was 2.2 hours for the experimental group and 2.25 hours for the control. There was no difference in the use of Emergency Medical Services (equivalent to A&E) except in the first 6 months, when the experimental group was slightly more likely to call; and similarly there was no increase in ambulance use. In a linked study there was evidence of increased knowledge about the condition in the experimental group.(21)

The other RCT did not follow up actual time-to-call (15). Instead the researchers assumed that increased knowledge and changed attitudes in the group receiving the intervention would portend shorter times-to-call. The Dracup study shows that this cannot be assumed; despite improved knowledge in the intervention group of that randomised trial there was no effect on delay.

In summary, these studies show that interventions targeted at individuals with heart disease can increase knowledge but as yet no such intervention has been shown to reduce time-to-call. The wider media campaigns examined in pre-2005 reviews showed that they too had no impact (13,23).

Non-intervention quantitative studies (32)

There were 32 relevant papers. 12 reported statistical analysis of pre-existing or new datasets that could be used to establish links to delay (24-35). 15 reported questionnaire data (36-50) and five were mixed method (5,51-54). One paper reported multinational data (26); 10, the USA; three were from the UK (5,24,53)

and then a variety of European, Australasian and Middle-Eastern countries. The sample size ranged from 48 to nearly half-a-million; the large samples were of pre-existing national datasets. Characteristics of participants reported in the papers were, most commonly, gender, age and ethnicity; other characteristics included socioeconomic status and morbidity. The setting for the main topic of interest was the community, where the symptoms of the acute cardiac event commenced. The delay was taken to be time to summoning appropriate medical help, although the form that took varied internationally. One area of vagueness here is whether the family practitioner or general practitioner is an appropriate person. In some studies, calling this person is viewed as a cause of delay; in others, it is reported as the end of delay. We return to this point in the discussion.

Length of delay

In most cases, the average delay is reported as a median rather than mean. The distribution is skewed, with a few very long delays that would render the mean deceptively high. For the United States, the data from a national registry show an (adjusted) mean delay time in time to hospital presentation of 114 minutes in 2004, down from 123 minutes in 1995 (55). Most other USA papers are in line with this, although the existence of outliers is also noteworthy. The international paper found delay to be shortest in Australasia (median 2.2 hours) and longest in Argentina and Brazil (4 hours). The USA was slightly higher than Australasia; Europe noticeably higher, with a median delay of 2.3 hours for STEMIs and 2.7 hours for non-STEMI Acute Coronary Syndrome (26). In the three UK studies, the mean delay is reported as between 3.1 and 6.27 hours, although the measures used are different. However, the median delay of 120 minutes reported in Perkins-Porras (5) is consistent with the international data reported in Goldberg (26).

Action taken

The primary concern in the papers is with factors associated with delay. However, there are some data on the specific actions taken by people in response to their symptoms. Three papers report that less than 10% requested an ambulance or called the Emergency Department as a first response (36,38,42). The most common action seems to be to consult a lay person; and that person would then call emergency services (26,38,42-44). Others self-medicated, tried to relax, wished or prayed for symptoms to go, or drove to hospital.

Factors associated with delay

The factors associated with delay can be categorised as: socio-demographic, clinical, emotional, cognitive and other.

i) Socio-demographic

Table 1 shows the papers finding statistically significant factors associated or not with delay alongside the star-ratings of the papers. The three-star papers show a number of sociodemographic factors associated with delay: older age, being female, inadequate health insurance, low neighbourhood income, ethnicity, country, and combinations of these. The only important contrary finding to any of these relates to a three-star paper using whole-population longitudinal data from Sweden (29). This found that gender was not significant in relation to pre-hospital delay or type of symptoms. By contrast, two three-star papers and two two-star papers find a link between gender and delay. The two three-star papers reports American longitudinal data and the authors note a reduction in the gender gap over time. Nonetheless, the gap still persists to 2008. The authors of one paper speculate that this might be due to so-called atypical symptoms in women; this is something the Swedish paper does not find, however.

The other important factors noted in three-star papers are ethnicity and class. Most of these are US-based papers and the findings are probably not generalisable unless ethnicity or class are associated with different or atypical symptoms. No such finding or claim exists on this in relation to class; but in an earlier paper McGinn et al speculate that there may be differences based on what they term, race (56).

ii) Clinical

[Table 2](#) shows the papers finding statistically significant clinical factors associated or not with delay. The square brackets indicate papers that find a statistically significant factor associated with less delay. Thus, for example, patients who present with systolic blood pressure below 90 are found to present more quickly.

The table has two main sections, one relating to past medical history, the other to the acute episode of heart disease. In relation to the first, several factors are associated with delay in three-star papers, with Ting et al's paper being central (33): those with a history of angina and coronary heart disease delayed less; those with a history of diabetes, hypertension, heart failure, family history of heart disease, and smokers, delayed more. One curious conflict is in relation to whether a past history of heart disease and angina is positively associated with delay, with two and three star papers reporting contradictory findings. A possible explanation of this is that the patients will have different experiences of heart disease that could result in different responses to symptoms of a heart attack. For example, someone with a long history of chronic angina might be less likely to respond quickly than someone with a short history of angina that is usually well controlled. Thus this categorisation of patients on the basis of history of heart disease might be too broad to be informative.

In terms of presenting condition, the key finding is that severe symptoms are associated with less delay. By contrast, those who have no chest pain and who self-medicate are more likely to delay. The finding that STEMI is associated with less delay compared to non-STEMI is likely to be a product of the same phenomenon, that is, STEMIs have more severe symptoms. Prodromal symptoms were associated with delay.

iii) Emotional

[Table 3](#) shows the papers finding statistically significant emotional factors associated with delay. Depression could be reported as a clinical factor; however, the papers reporting this did not use a formal diagnosis of depression and, as such, we have reported it under the heading of 'emotional' here. So-called emotion-focused coping refers to behaviour where someone tries ignores, distracts from and attempts to redefine the reality of a situation. In the case of cardiac disease an example would be someone with known cardiac disease who nonetheless puts

down clear angina symptoms to musculoskeletal pain. Fox-Wasylyshyn is the only paper to look for and report it, but unsurprisingly such behaviour is associated with delay (39). Similarly Khraim is the only quantitative paper to look for and report anxiety and embarrassment as factors associated with delay (42).

iv) Cognitive

[Table 4](#) shows the papers finding statistically significant cognitive factors associated or not with delay. In four two-star papers, the patient's belief that the symptoms are of cardiac origin was associated with less delay. Conversely, the belief pain is non-cardiac is associated with delay although the two papers that report this were only one-star. Some of the cognitive factors mentioned are variations on this realization theme; thus, not realizing severity, belief not at risk, not painful enough and incongruence of symptoms all seem associated. The problem-solving and cognitive avoidance style is mentioned as a risk factor for delay in one paper. The researchers here used a psychological test not used in any other study. Those in the problem-solving/cognitive avoidance strategy appear to use a problem-solving approach to avoid thinking about the consequences of their current position. Lacking trust in others is picked out as a delay risk factor in a three-star paper.

v) Other

[Table 5](#) shows the papers finding statistically significant other factors associated or not with delay. There are conflicting findings in relation to whether or not someone is alone correlates with delay. The paper that finds a correlation is UK, London, based; the two that do not are Turkish and USA, although the latter is statistically weak. Those who consult another, non-professional, person delay less than those who do not.

Non-intervention qualitative studies (12)

There were 12 papers reporting qualitative studies of factors linked to delay. Three were of UK origin (57-60); 3, Canada (61-63); 1, USA (64); 1, Australia (65); 1, Sweden (66); 1, Denmark (67); and 1, Hong Kong (68). 11 used semi-structured interviews and one used focus groups (66). The analysis of data was thematic in 10 papers, narrative in one (64). And the overall framework was described as

phenomenological or grounded theory, or not described. In most cases the interviews were performed whilst the participant was still in hospital following the event; one paper did longitudinal interviews at 3 and 9 months in the participants' homes (65). The sample sizes were commensurate with qualitative research, varying from 10 to 56. Nine of the papers reported women-only studies. Ethnicity was a focus of two papers (58,64). Relatives were included in the focus group study.

[Table 6](#) shows the major factors associated with delay reported in qualitative papers. The categories are broadly similar to those in the quantitative papers. Socio-demographic factors feature little, perhaps because people do not view themselves or their behaviour in terms of, say, class or ethnicity when discussing heart attacks. There are some data relating to who people chose to contact in the first instance. There are few reports of people directly contacting emergency services; most either call a GP (or equivalent) or a lay person, usually a relative. There are no data comparing the response of these, although one paper reports that calling a lay person always resulted in that person calling emergency services (67). By contrast, an Australian paper reports occasional bad advice from GPs, including advising the person drive to A&E (65).

The qualitative data add depth to some of the quantitative findings. There are repeated examples of patients whose symptoms did not match their expectations of a heart attack and were instead taken for gastric reflux or asthma. Self-medication was also a common theme and is perhaps linked; those who felt their problems to be related to non-cardiac would turn to anti-indigestion remedies, hot baths and the like. Another theme was a belief that you were not at risk of a heart attack; in some cases this was related to an expectation that heart disease was mainly a male problem; in others, youth and being a non-smoker. Finally, embarrassment came through as quite a strong theme even though it is reported only once in quantitative data. People were worried that the symptoms they were having were not cardiac and that they would feel foolish or that they had wasted doctors' time.

Discussion

Some patients delay longer than others in seeking professional help following the onset of cardiac symptoms; and they do so in discernible patterns that can be broadly categorised under the headings, socio-demographic, clinical, emotional, cognitive and other. The strongest socio-demographic predictor is age. Gender and ethnicity are also predictors in some studies although the effect of gender could be either due to or compounded by age and non-classic symptoms. The latter seems to be the key clinical predictor of delay; patients with severe, classic symptoms of crushing central chest pain radiating down the arm, sweating, hypotension and tachycardia respond quickest. The evidence also suggests that a history of heart disease correlates with more rapid response, although the data are less clear and there are some contradictory reports. The strongest emotional predictor is depression, although data from qualitative papers suggest that embarrassment or fear of embarrassment are strong features in delay for those whose symptoms are not straightforward. And of cognitive predictors, the most important seems to be that the person recognises the symptoms as cardiac. Clearly, these predictors are interrelated; someone with severe symptoms is more likely to recognise their cardiac origin.

It is tempting to look at the times of the fastest responders and judge that this should be the response time of all. Thus is created a public health problem causing avoidable deaths; but this is probably illusory. A heart attack is not an incident with immediate unambiguous symptoms, unlike a cardiac arrest or a car crash. Finn et al (10) report a major US study that showed that one-third of over 430,000 patients with confirmed myocardial infarction did not have chest pain on presentation to hospital (69). They note also that within this group are disproportionately high numbers of women, older people, diabetics and those with heart failure. It is perhaps unreasonable to expect a person with, say, history of gastric reflux, who over two days prior to a heart attack experiences prodromal symptoms of increasing severity, to respond as quickly as someone with classic symptoms and no relevant comorbidity.

The important issue in relation to delay is, therefore, not the existence of a gap so much as the existence of a gap between people with similar symptoms. Thus far the research question has not been asked in this way; we suggest it should be. In other words, we should ask whether, for example, women delay longer than men

when experiencing similar symptoms. The best evidence that such a gap exists lies in the different response times of groups who are likely to experience similar symptoms. A good example is the under-insured group in the USA whose response time is slower than others but whose lack of insurance is unlikely to affect symptoms of heart attack. The same is likely to be true of country: the gap is longer in some countries rather than others and, again, this seems unlikely to affect symptoms.

The non-clinical categories that come through strongest in the studies, however, are age, gender and ethnicity. There is evidence from the experimental study that age affects symptom presentation in older people (70) as well as the epidemiological evidence mentioned above relating to older people, women, diabetics and those with heart failure. It follows that the difference in response times between older and younger people, men and women, could be explained on this basis. This is supported by qualitative data that suggest women experience different non-classic symptoms. No such data exist in relation to ethnicity; furthermore the plausibility of an ethnicity-related difference in presenting symptoms seems doubtful given the lack of clear and consistent physiological and genetic difference across ethnic groups (71).

The first question of this literature review is what factors are associated with delay. The answer seems to be that clinical factors are the strongest predictor; some of the non-clinical factors linked with delay might also be the result of clinical factors. However, in support of the idea that there is avoidable delay are a) the existence of non-clinical factors, such as insurance-status and ethnicity, that are associated with delay but which are unlikely to work via clinical factors and b) data from qualitative research showing that people were hesitant in calling for help because of embarrassment or a similar concern.

The second question of the review is what interventions work in reducing delay. There has been little research in this area in the period of this review and the results echo earlier projects; people's knowledge can be increased but this does not necessarily manifest in shorter response times. Given the lack of interventions reported, none from the UK, it seems reasonable for further work to be done. Those undertaking such projects should reflect upon the importance of ambiguous symptoms and perhaps focus on groups at risk of delay such as women, older

people, ethnic minorities, those with depression and those who lack trust in the system.

We note also the finding that those who consult another person rather than not experience less delay. This could be related to severity of symptoms but is worth further examination. For example, people with heart disease might form networks of support or buddies they can call if they are, for example, experiencing puzzling symptoms but are worried they could be wasting medical time were they to call a professional. It is worth noting that an intervention that successfully reduces delay could increase inequality as an unwanted side effect if it leads to the relatively quick responders responding more quickly but has not effect on the slowest.

This leads to a final issue, the question of what constitutes an appropriate response. There is some evidence that those who consult a lay-person rather than a GP might get to treatment quicker because a lay-person is likely immediately to call emergency services. However, the message, "Call a friend, not your doctor" would be counterintuitive and confusing. Arguably, any delay between calling a GP and receiving treatment is best seen as system-created and should be addressed as such. In the UK, the current algorithms for chest pain mean it is unlikely that calling your GP with plausible symptoms of a heart attack will result in much delay compared to calling an ambulance direct; however, this is a question worth addressing in future study.

Research thus far has focused on the experience of those who turn out to have had heart attacks. Some useful data might be gathered from the experience of those who have ambiguous symptoms that turn out not to be cardiac. In the first place, it would be useful to know the frequency of this phenomenon and whether an intervention to tackle delay results in an increase. Earlier research showed little evidence of such an increase but the projects had limited success anyway; a successful delay-reducing intervention could be undermined by a large increase in false alarms. The experience of the non-cardiac cases is of interest also as it might help us understand the embarrassment and hesitation of those who delay. For example, if non-cardiac cases frequently report feeling humiliated when they turn up at emergency centres then this could feed into a more widespread reluctance to use them if unsure.

We should be cautious in the use of the term 'ambiguous' and 'classic' in relation to chest pain. For example, some papers point to the fact that if women have different symptoms to men, calling men's symptoms 'classic' gives priority to these over women's symptoms. A similar point could be made in relation to the term we have preferred, 'ambiguous'; perhaps they are ambiguous because we have come to believe falsely that men's symptoms define heart disease. It might be desirable to develop the idea of typical-male, typical-female, typical-elderly, typical-White, and so forth; but at present, the data don't really support this idea. We therefore suggest that the term 'ambiguous' is reasonable as it conveys the sense of the difference between symptoms that are so severe people almost invariably call for help quickly and those that are less severe and leave them unsure what to do.

Finally we acknowledge limitations of this review. Chief amongst these is our limitation to publications in the English language. This presumably in part explains our bias towards Australasian and North American papers. We have also been inclusive in using small-scale and qualitative papers in our report. However, we have attempted only to draw conclusions justified by the strength of the data by, for example, using a star-based system for the quantitative non-intervention papers.

Conclusion and recommendations

Delay in reporting symptoms remains the main cause of overall delay in treatment of heart attack. There are patterns of delay within the population: age, gender and ethnicity are implicated; but the most important factor might be presentation with ambiguous symptoms. The small number of interventional trials that have been performed have produced little evidence of success in reducing delay. At present, there are no interventions that can be recommended.

Before developing and trialling new interventions, we should test the hypothesis that symptom differences are clinical differences at the heart of differences in presentation time both of individuals and of groups based on gender, ethnicity, class, depression and so forth. This might be possible using existing data from, for example, MINAP.

On the basis of the results of that study, we would have a good idea of which groups to target and how to do so. For example, it might be that women can be

alerted to ambiguous and prodromal symptoms. Other groups that might be more likely to have ambiguous symptoms leading to delay could include diabetics, those with hypertension and older people. The key problem for any intervention would be whether it leads to a large increase in false alarms and, therefore, of a burden to the emergency services.

What is already known about this topic

Early recognition of the symptoms of heart attack is associated with rapid treatment and therefore with better outcomes;

Many patients delay calling professional medical help once symptoms suggestive of a heart attack begin;

There are reports that certain groups of patients are more likely to delay longer, for example, older patients, women, ethnic minorities and the poor;

There have been a number of attempts to reduce the time delay but these have had disappointing results according to systematic reviews, the last of which was performed in 2004.

What this paper adds

Between 2006 and 2011 there have been 9 papers published in English in peer-reviewed journals reporting on two interventions aimed at reducing delay; as before, the results are disappointing;

There has been no research testing interventions aimed at reducing delay in the UK reported in the period we examined; the last such study involving the UK seems to be 1982;

Only a minority of symptomatic people call emergency services first; most call their GP or a lay person;

There are a number of factors reported as associated with delay; these can be categorised as socio-demographic, clinical, emotional, cognitive and other;

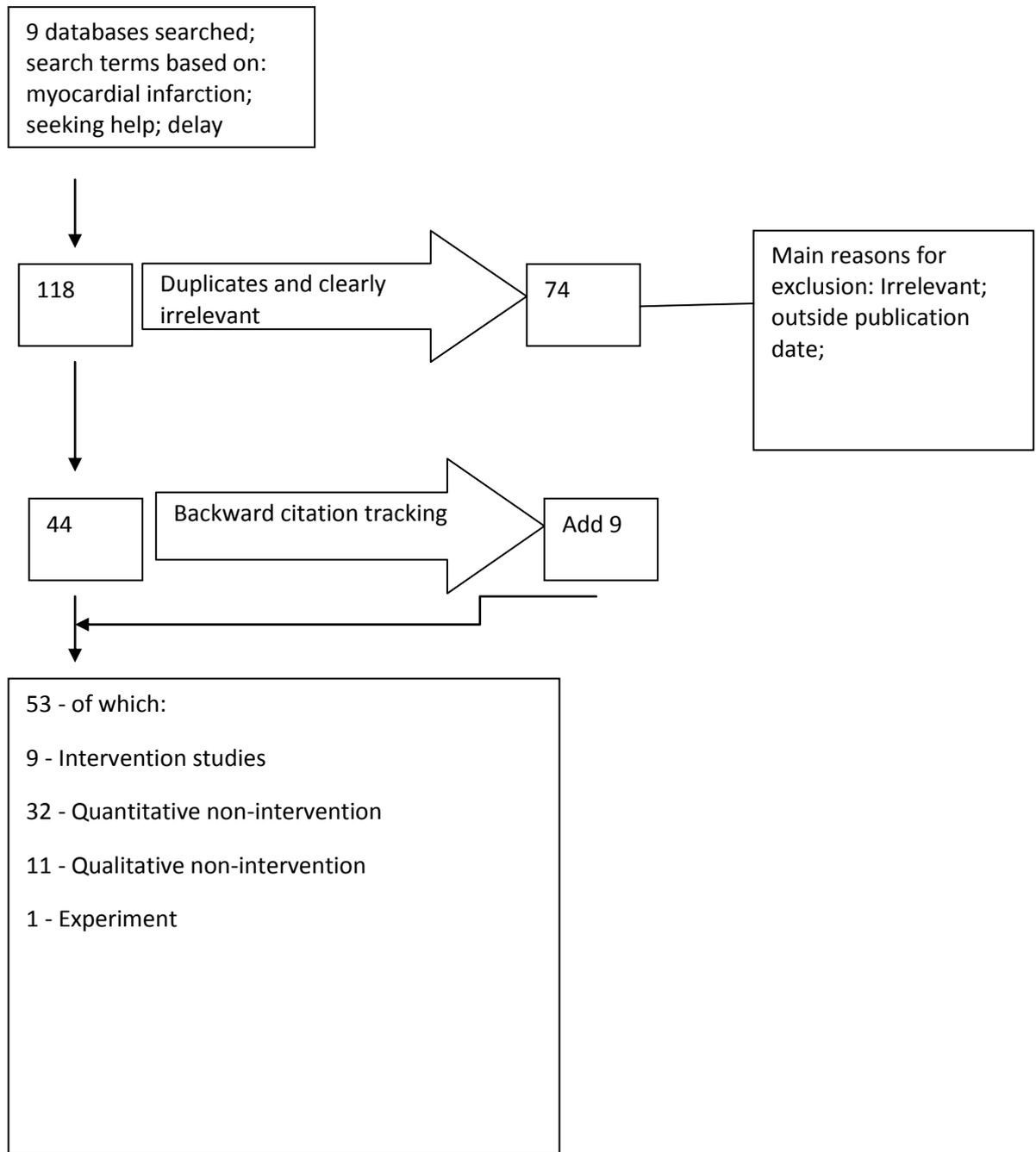
The most important factor seems to be the clinical/cognitive factor, which we have termed, ambiguity of symptoms;

Some of the socio-demographic factors associated with delay might be due to a higher level of ambiguity of symptoms in those groups, particularly women and older people;

In qualitative studies, the emotional factor, fear of embarrassment emerges as a reason for delay;

At present, no interventions can be recommended as likely to reduce delay.

Figure 1: Search flow chart



Click [here](#) to return to main document

i) Socio-demographic

Sociodemographic	Yes			No		
	3*	2*	1*	3*	2*	1*
Younger			(42,51)			
Older	(29,30)	(32,36)			(46)	
Women (%)	(30)	(32,35,45,46)	(38,43)	(29)		(44)
Education (less high)		(31)			(46)	
Inadequate health insurance	(33,39)					(37,38)
Low neighbourhood income	(39)					
South Asian (UK)	(24)					
Non-white (USA)	(39)					
Afro-Am (USA)	(33)		(37,38,51)			
Hispanic (USA)	(33)					
Married		(5)			(36)	
Not married!			(38)			
Country	(26)					
Combinations e.g. black and DM	(33)					

Table 1: Statistically significant socio-demographic factors associated or not associated with delay

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ii) Clinical

	Yes			No		
Clinical	3*	2*	1*	3*	2*	1*
MEDICAL HISTORY						
Poor self-rated health			(51)			
Angina/CHD	[[[(33,34)]] (48)!]	[[[(32)]] (31)!]				
Dyspnoea		(47)				
Diabetes	(33)25	(32)		(30)		
Heart failure	add Ting					
Hypertension	(33,34)	(32)				
Diuretics and calcium antagonists		(32)				
Family history	(33)					
Smoker	(33)					
CURRENT CONDITION						
STEMI	[[[(26,49)]]]	[[[(5,32)]]]				
No chest pain	(33)					
Low pain	(29)					
High Pain	[[[(49)]]]		(37)			
Severe sudden symptoms		[[[(45,47)]]]				
Cardiogenic shock	[[[(33)]]]					
Systolic below 90	[[[(33)]]]					
Pulse greater 100	[[[(33)]]]					
Current CHF	[[[(33)]]]					
Pain in shoulders			(44)			
SOB			(51)			
Feeling faint			(51)			
Prodromal symptom	(27)		(43,44,52)			
Intermittent symptoms		(47)	(42)			
Self-medication	(50,54)	16				
Night time presentation	(34)					

Table 2: Statistically significant clinical factors associated or not associated with delay

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iii) Emotional

	Yes		
EMOTIONAL	3*	2*	1*
Depression		(25,50)	
Emotion-focused coping		(39)	
Anxiety			(42)
Embarrassment			(42)

Table 3: Statistically significant emotional factors associated with delay

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iv) Cognitive

	Yes			No		
COGNITIVE	3*	2*	1*	3*	2*	1*
Not realize severity		(32)	(42)		(36)	
Specific cardiac knowledge			(42)			
Lack of knowledge	(41)					
Belief cardiac		[[5,48,50,53]]				
Belief non-cardiac			(38,44)		(36)	
Belief not at risk			(51)			
Not painful enough			(38)			
Waiting for symptoms to go			(42)			
Incongruence of symptoms	(49)	(40)				
Belief that stress caused their ACS		(53)				
High denial scores		(53)				
Problem solving and cognitive avoidance coping style		(46)				
Lack trust in others	(48)					

Table 4: Statistically significant cognitive factors associated or not associated with delay

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v) Other

	Yes			No		
OTHER	3*	2*	1*	3*	2*	1*
At home		(5)	(38)			
Alone		(5)			(36)	
Consult family		(45)	(43)		(53)	
Consult someone rather than not	[[[(49)]]				(53)	
Rural		(32)				

Table 5: Statistically significant other factors associated or not associated with delay

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Reason for delay	Papers	Examples
Clinical		
Self-medication	(59,60,62,67,68)	<p>Actions and strategies after onset; using old remedies e.g. for back pain; I had a plan; (67)</p> <p>Maintaining self control through medication</p> <ul style="list-style-type: none"> Aspirin, paracetamol, "hot bath", (59)
Emotional		
Embarrassment	(57,58,62,67)	<p>Worried doctors would diagnose indigestion, would feel a right fraud, (57)</p> <p>Ambivalence whether to call for help or cope; what if it's a false alarm; the importance of others I'm calling no matter what you say; I didn't want to cause trouble.(67)</p> <p>According to the accounts of the participants, avoiding embarrassment seemed to be more important than avoiding a serious outcome. (61)</p>
Cognitive		
Not realize severity; Incongruence of symptoms; waiting for symptoms to go	(57,59,60,62,65-68)	<p>Pain/symptoms not recognised as cardiac e.g. arthritis, heaviness, arm rather than chest, funny sensation rather than pain, nausea and vomiting associated with a bug, getting old.(57)</p> <p>Intermittent early-warning or prodromal symptoms (e.g. breathless or mild indigestion); Diversity of symptom experience (throat tension, tightness and ache, SOB, nausea, indigestion, tiredness); Ambiguity of symptoms - accompany other illnesses, particularly co-morbidity such as gastric reflux, asthma;(65)</p> <p>Not recognising symptoms</p> <ul style="list-style-type: none"> Not what expected Most thought it was indigestion(59) <p>The AMI patients experienced a variety of symptoms and both patients and relatives often felt uncertain about the origin of the symptoms, interpreted them as less serious conditions and tried to alleviate the discomfort in various ways.(66)</p>
Lack of knowledge	(67)	Knowledge and ideas: heart is on left side - pain in centre; not at risk; it's just flu; using GTN multiple times caused delay (67)
Belief not at risk	(57,59,65)	<p>Feeling too young and fit; Not a smoker or now ex-smoker,</p> <p>5. Belief in low vulnerability to CHD despite the fact that most women interviewed had multiple risk factors - only two rated low-risk; (65)</p> <p>8. Engendered perception</p> <ul style="list-style-type: none"> Stereotypical view of heart attack patient (overweight, smoker, male) Women not at risk one women mentions pre-menopause; (59)

Table 6: Factors associated with delay reported in qualitative papers

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References

1. Moser DK, Kimble LP, Alberts MJ, Alonzo A, 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(2):168-182.
2. Ramsay SE, Morris RW, Lennon LT, Wannamethee SG, Whincup PH. Are social inequalities in mortality in Britain narrowing? Time trends from 1978 to 2005 in a population-based study of older men. *Journal of epidemiology and community health*. 2008;62(1):75-80.
3. Richards H. Victim-blaming revisited: a qualitative study of beliefs about illness causation, and responses to chest pain. *Family Practice*. 2003;20(6):711-716.
4. Albus C. Psychological and social factors in coronary heart disease. *Annals of Medicine*. 2010;42(7):487-494.
5. 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. *European Journal Of Cardiovascular Nursing: Journal Of The Working Group On Cardiovascular Nursing Of The European Society Of Cardiology*. 2009;8(1):26-33.
6. Grier S, Bryant C a. Social marketing in public health. *Annual review of public health*. 2005 26(9):319-39.
7. Luepker RV. Delay in acute myocardial infarction: why don't they come to the hospital more quickly and what can we do to reduce delay? *American Heart Journal* 2005;150(3):368-370.
8. Hewitt A, Kainth A, Pattenden J, Sowden A, Duffy S, et al. *Predictors of delay in seeking medical help in patients with suspected heart attack, and interventions to reduce delay: A systematic review*. 2004; Centre for Reviews and Dissemination, University of York.
9. Khraim FM, Carey MG. Predictors of pre-hospital delay among patients with acute myocardial infarction. *Patient education and counselling*. 2009;75(2):155-161.
10. Finn JC, Bett JHN, Shilton TR, Cunningham C, Thompson PL. Patient delay in responding to symptoms of possible heart attack: can we reduce time to care? *Medical journal of Australia*. 2007 187(5):293-298.
11. Canto JG. Symptom presentation of women with acute coronary syndromes: myth vs reality. *Archives of Internal Medicine*. 2007;167(22):2405.
12. Dubayova T, van Dijk P. J, Nagyova I, Rosenberger J, Havlikova E, Gdovinova Z, et al. The impact of the intensity of fear on patient's delay regarding health care seeking behavior: a systematic review. *International Journal Of Public Health* 2010;55(5):459-468.

13. Grilli R, Ramsay C, Minozzi S. Mass media interventions: effects on health services utilisation. *Cochrane database of systematic reviews* (Online) [Internet]. 2002 Jan [cited 2011 Aug 10];(1):CD000389. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/11869574>
14. 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. *Circulation. Cardiovascular Quality And Outcomes*. 2009;2(6):524-532.
15. Tullmann DF, Haugh KH, Dracup KA, Bourguignon C. A randomized controlled trial to reduce delay in older adults seeking help for symptoms of acute myocardial infarction. *Research in nursing & health*. 2007;30(5):485-497.
16. Dracup K, McKinley S, Riegel B, Mieschke H, Doering LV, Moser DK. A nursing intervention to reduce prehospital delay in acute coronary syndrome: a randomized clinical trial. *Journal of cardiovascular nursing*. 2006;21(3):186-193.
17. Buckley T. The effect of education and counselling on knowledge, attitudes and beliefs about responses to acute myocardial infarction symptoms. *European Journal of Cardiovascular Nursing*. 2007;6(2):105.
18. Dracup K, McKinley S, Riegel B, Meischke H, Doering LV, Moser D, et al. A randomized controlled trial to reduce prehospital delay to treatment in acute coronary syndrome. *Circulation*. 200;116(16):1821.
19. Dracup K. Acute coronary syndrome: what do patients know? *Archives of Internal Medicine*. 2008;168(10):1049.
20. Riegel B, Moser DK, McKinley S, Pelter M, Doering L, Meischke H, et al. Who Listens to Our Advice? Predicting who Responds to an Intervention Designed to Decrease Delay in Seeking Treatment for Acute Coronary Syndrome. *Circulation*. 2008;118(18):S825-S825.
21. McKinley S, Dracup K, Moser DK, Riegel B, Doering LV, Meischke H, et al. The effect of a short one-on-one nursing intervention on knowledge, attitudes and beliefs related to response to acute coronary syndrome in people with coronary heart disease: A randomized controlled trial. *International journal of nursing studies*. 2009;46(8):1037-1046.
22. Fox-Wasylyshyn S, El-Masri M, Artinian NT. Testing a model of delayed care-seeking for acute myocardial infarction. *Clinical nursing research*. 2010;19(1):38-54.
23. Bett JHN, Tonkin AM, Thompson PL, Aroney CN. Failure of current public educational campaigns to impact on the initial response of patients with possible heart attack. *Internal Medicine Journal*. 2005;35(5):279-282.
24. 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.

25. Foraker RE, Rose KM, McGinn AP, Suchindran CM, Goff , Jr DC, Whitsel EA, et al. Neighborhood income, health insurance, and prehospital delay for myocardial infarction: the atherosclerosis risk in communities study. *Archives of Internal Medicine*. 2008;168(17):1874-1879.
26. Goldberg RJ. Prehospital Delay in Patients With Acute Coronary Syndromes (from the Global Registry of Acute Coronary Events [GRACE]). *American Journal of Cardiology*. 2009;103(5):598-603.
27. Graham MM, Westerhout CM, Kaul P, Norris CM, Armstrong PW. Sex differences in patients seeking medical attention for prodromal symptoms before an acute coronary event. *American Heart Journal*. 2008;156(6):1210-1216.
28. Hwang SY. The influence of age on acute myocardial infarction symptoms and patient delay in seeking treatment. *Progress in cardiovascular nursing*. 2006;21(1):20-27.
29. Isaksson R. Time trends in symptoms and prehospital delay time in women vs. men with myocardial infarction over a 15-year period. The Northern Sweden MONICA Study. *European Journal of Cardiovascular Nursing*. 2008;7(2):152.
30. Kaul P, Armstrong PW, Sookram S, Leung BK, Brass N, Welsh RC. Temporal trends in patient and treatment delay among men and women presenting with ST-elevation myocardial infarction. *American Heart Journal*. 2011;161(1):91-97.
31. Nouredine S. Patterns of responses to cardiac events over time. *Journal of cardiovascular nursing*. 2009;24(5):390-397.
32. 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 Journal Of Cardiology*. 2006;47(6):329-336.
33. Ting HH, Bradley EH, Wang Y, Lichtman JH, Nallamothu BK, Sullivan MD, et al. Factors associated with longer time from symptom onset to hospital presentation for patients with ST-elevation myocardial infarction. *Archives of internal medicine*. 2008;168(9):959-68.
34. Turin TC, Kita Y, Rumana N, Nakamura Y, Takashima N, Sugihara H, et al. Time lag to hospitalisation and the associated determinants in patients with acute myocardial infarction: The Takashima AMI Registry, Japan. *Emergency Medicine Journal*. 2011;28:239-241.
35. Vavouranakis I, Fanioudaki A, Lamprogiannakis E, Baltzakis I, Sidiropoulou K, Porfiri E, et al. Delays incurred during acute myocardial infarction: a comparative study of rural and urban populations in Greece. *Rural And Remote Health*. 2010;10(2):1271.

36. 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. *Advances in Therapy*. 2006;23(2):244-255.
37. Banks AD, Dracup K. Are there gender differences in the reasons why African Americans delay in seeking medical help for symptoms of an acute myocardial infarction? *Ethnicity & disease*. 2007;17(2):221-227.
38. Banks AD, Dracup K. Factors associated with prolonged prehospital delay of African Americans with acute myocardial infarction. *American Journal of Critical Care*. 2006;15(2):149-157.
39. Fox-Wasylyshyn SM. Comparison of coping responses to symptoms between first-time sufferers and those with a previous history of acute myocardial infarction. *Journal of cardiovascular nursing*. 2007;22(2):145-151.
40. Fukuoka Y. Is severity of chest pain a cue for women and men to recognize acute myocardial infarction symptoms as cardiac in origin? *Progress in cardiovascular nursing*. 2007;22(3):132-137
41. 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 [Internet]*. 2007 Sep;7:284.
42. Khraim FM, Scherer YK, Dorn JM, Carey MG. Predictors of decision delay to seeking health care among Jordanians with acute myocardial infarction. *Journal Of Nursing Scholarship*. 2009;41(3):260-267.
43. Lovlien M. Are there gender differences related to symptoms of acute myocardial infarction? A Norwegian perspective. *Progress in cardiovascular nursing*. 2006;21(1):14-19.
44. Løvlien M, Schei B, Hole T. Prehospital delay, contributing aspects and responses to symptoms among Norwegian women and men with first time acute myocardial infarction. *European Journal Of Cardiovascular Nursing: Journal Of The Working Group On Cardiovascular Nursing Of The European Society Of Cardiology*. 2007;6(4):308-313.
45. Løvlien M, Schei B, Hole T. Myocardial infarction: psychosocial aspects, gender differences and impact on pre-hospital delay. *Journal of advanced nursing*. 2008;63(2):148-154.
46. Morgans AE, Archer F, Allen FCL. Patient decision making in prehospital health emergencies: Determinants and predictors of patient delay. *Journal of Emergency Primary Health Care*. 2008;6(3)
47. Nouredine 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. *Journal of Transcultural Nursing*. 2006 17(4):341-348.
48. Sullivan MD, Ciechanowski PS, Russo JE, Soine LA, Jordan-Keith K, Ting HH, et al. Understanding why patients delay seeking care for acute coronary

- syndromes. *Circulation. Cardiovascular Quality And Outcomes*. 2009;2(3):148-154.
49. Thuresson M. Thoughts, actions, and factors associated with prehospital delay in patients with acute coronary syndrome. *Heart & Lung*. 2007;36(6):398.
 50. Wong C-K, Tang EW, Herbison P, Birmingham B, Barclay L, Fu SYF. Pre-existent depression in the 2 weeks before an acute coronary syndrome can be associated with delayed presentation of the heart attack. *QJM: Monthly Journal Of The Association Of Physicians*. 2008;101(2):137-144.
 51. Harralson TL. Factors influencing delay in seeking treatment for acute ischemic symptoms among lower income, urban women. *Heart & Lung*. 2007;36(2):96-104.
 52. Hwang SY, Zerwic JJ, Jeong MH. Impact of prodromal symptoms on prehospital delay in patients with first-time acute myocardial infarction in Korea. *Journal of cardiovascular nursing*. 2010; 26(3):194-201
 53. Perkins-Porras L, Whitehead DL, Strike PC, Steptoe A. Causal beliefs, cardiac denial and pre-hospital delays following the onset of acute coronary syndromes. *Journal of Behavioral Medicine*. 2008;31(6):498-505.
 54. Zegrean M, Fox-Wasylyshyn S, El-Masri M. Alternative coping strategies and decision delay in seeking care for acute myocardial infarction. *Journal of cardiovascular nursing*. 2009;24(2):151-155.
 55. Ting HH, Bradley EH, Wang Y, Lichtman JH, Nallamothu BK, Sullivan MD, et al. Factors associated with longer time from symptom onset to hospital presentation for patients with ST-elevation myocardial infarction. *Archives of Internal Medicine*. 2008 168(9):959-968.
 56. McGinn AP. Trends in prehospital delay time and use of emergency medical services for acute myocardial infarction: experience in 4 US communities from 1987-2000. *American Heart Journal*. 2005;150(3):392-400.
 57. Albarran JW, Clarke BA, Crawford J. "It was not chest pain really, I can't explain it!" An exploratory study on the nature of symptoms experienced by women during their myocardial infarction. *Journal of clinical nursing*. 2007;16(7):1292-1301.
 58. Galdas P, Cheater F, Marshall P. What is the role of masculinity in white and South Asian men's decisions to seek medical help for cardiac chest pain? *Journal of health services research & policy*. 2007;12(4):223-229.
 59. Higginson R. Women's help-seeking behaviour at the onset of myocardial infarction. *British journal of nursing*. 2008;17(1):10-14.
 60. Ruston A. Women's interpretation of cardiac symptoms at the time of their cardiac event: the effect of co-occurring illness. *European Journal of Cardiovascular Nursing*. 2007;6(4):321-328.

61. Turriss SA. Maintaining integrity: women and treatment seeking for the symptoms of potential cardiac illness. *Qualitative health research*. 2008;18(11):1461-1476.
62. Turriss SA. Women's Decisions to Seek Treatment for the Symptoms of Potential Cardiac Illness. *Journal of Nursing Scholarship*. 2009;41(1):5-12.
63. Turriss SA, Finamore S. Reducing delay for women seeking treatment in the emergency department for symptoms of potential cardiac illness. *Journal Of Emergency Nursing*. 2008;34(6):509-515.
64. Bunde J. Depression and prehospital delay in the context of myocardial infarction. *Psychosomatic medicine*. 2006;68(1):51-57.
65. Gallagher R, Marshall AP, Fisher MJ. Symptoms and treatment-seeking responses in women experiencing acute coronary syndrome for the first time. *Heart & Lung*. 2010;39(6):477-484.
66. Henriksson C. Patients' and relatives' thoughts and actions during and after symptom presentation for an acute myocardial infarction. *European Journal of Cardiovascular Nursing*. 2007;6(4):280.
67. Herning M, Hansen PR, Bygbjerg B, Lindhardt T. Women's experiences and behaviour at onset of symptoms of ST segment elevation acute myocardial infarction. *European Journal of Cardiovascular Nursing*. 2010;
68. Kaur R, Lopez V, Thompson DR. Factors influencing Hong Kong Chinese patients' decision-making in seeking early treatment for acute myocardial infarction. *Research in nursing & health*. 2006;29(6):636-646.
69. Canto JG, Shlipak MG, Rogers WJ, Malmgren J a, Frederick PD, Lambrew CT, et al. Prevalence, clinical characteristics, and mortality among patients with myocardial infarction presenting without chest pain. *JAMA*. 2000;283(24):3223-9.
70. Rittger H, Rieber J, Breithardt OA, Dücker M, Schmidt M, Abbara S, et al. Influence of age on pain perception in acute myocardial ischemia: A possible cause for delayed treatment in elderly patients. *International journal of cardiology*. 2008;15:347-362.
71. Ellison, G. Smart, A. Tutton, R. Outram, S. Ashcroft, R. Martin P. Racial categories in medical practice: how useful are they? *PLoS medicine*. 2007;4(9):e287.