PREHOSPITAL CARE

Systematic review of interventions to reduce delay in patients with suspected heart attack

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Emerg Med J 2004;**21**:506–508. doi: 10.1136/emj.2003.013276

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Accepted for publication 23 February 2004

Objectives: To evaluate the effectiveness of interventions aiming to reduce time from onset of signs and symptoms of an acute myocardial infarction (AMI) to seeking medical help/arrival at hospital.

Methods: A systematic review was conducted. Fifteen electronic databases, the internet, and bibliographies of included studies were searched, and experts in the field of cardiac care were contacted. Randomised controlled trials (RCTs), controlled trials, and before and after studies conducted in any setting that assessed an intervention aimed at reducing time from onset of signs and symptoms of an AMI to seeking medical help and/or arrival in hospital were eligible for inclusion.

Results: Eleven media/public education intervention studies met the inclusion criteria. Five (one controlled and four before and after studies) reported the intervention to have a statistically positive effect on delay time and six (two RCTs and four before and after studies) reported no statistically significant effect. Three (one RCT and two before and after studies) of five studies evaluating the effect of the intervention on emergency department visits reported an increase in this outcome as a result of the intervention, and both studies (one RCT and one before and after study) examining calls made to emergency switchboards reported an increase in this outcome after the intervention.

Conclusions: There was little evidence that media/public education interventions reduced delay. There is some evidence that they may result in an increase in emergency switchboard calls and emergency department visits. Despite substantial expenditure of time and effort, methodological deficiencies of the studies mean that it is not possible to make definitive recommendations.

Acute myocardial infarction (AMI) is the major cause of premature mortality in the UK and other western countries.[1 2] The importance of prompt administration of thrombolytic therapy has lead to public education programmes to reduce time between onset of symptoms and treatment. This period consists of patient delay, transport time, and hospital time from admission to treatment.[3] Patient delay is defined as time from onset of signs and symptoms of an AMI to when medical assistance is sought.[4] Patient delay combined with transport time is referred to as prehospital delay.

The UK National Service Framework recommends public education programmes encouraging people to call an ambulance in the event of symptoms suggestive of myocardial infarction.[1] We conducted a systematic review to investigate the effectiveness of interventions aiming to reduce patient and/or prehospital delay.

METHODS

The review was undertaken according to the Centre for Reviews and Dissemination's (CRD) systematic review guidelines.[5] Fifteen electronic databases, the internet, and bibliographies of included studies were searched, and experts in the field of cardiac care were contacted. Studies were included if they assessed an intervention aimed at reducing patient and/or prehospital delay, reported either patient and/or prehospital delay as the outcome, and were randomised controlled trials (RCTs), controlled trials, or before and after studies. Articles were assessed for inclusion independently by two reviewers, and data extraction and quality assessment were carried out by one reviewer and checked by a second reviewer. Disagreements were resolved through discussion and, if necessary, by recourse to a third reviewer. Study validity was assessed using a checklist adapted from CRD's guidelines,[5] and a previous systematic review.[6] Studies were synthesised in a narrative format along with appropriate summary tables.

RESULTS

Eleven studies, evaluating media/public education campaigns, met inclusion criteria.[7–17] One of these also examined one to one education.[17] Two were RCTs,[16 17] one was a controlled trial,[15] and eight were before and after studies.[7–14] Table 1 summarises duration of the intervention and outcome measurement of studies.

Table 2 summarises the content of interventions. The primary outcome examined in all studies was patient and/or prehospital delay. Other outcomes were mortality rates and the use of health resources.

Prehospital and patient delay time

Two RCTs[16 17] and six before and after studies[8 9 11–14] examined prehospital delay. Three before and after studies reported a statistically significant reduction in delay after the intervention.[8 9 11] In one of these studies there were also statistically significant increases in percentage of persons delaying less than one hour and less than six hours.[11] Another before and after study reported a statistically significant increase in percentage of persons delaying two hours or less.[12] Neither RCT reported any statistically significant effects of the intervention. This was also the case for two of the before and after studies.[13 14]

The controlled trial[15] and three before and after studies[7 9 10] examined patient delay. The controlled trial reported a statistically significant increase in percentage of patients in the intervention group calling their general practitioner after compared with before the intervention. However, these findings were not compared with the control group. One before and after study found a statistically significant reduction in median delay.[9] The other two found no statistically

Abbreviations: RCT, randomised controlled trial; AMI, acute myocardial infarction

Table 1 Duration of the intervention and outcome measurement of included studies

Reference, country	Intervention period	Pre-intervention measurement period	Intervention measurement period	Post-intervention measurement period (time to commencement after intervention ceased)
RCTs				
Meischke *et al*, 1997,[16] USA	7 wk+10 m	None	10 m	14 m
Luepker *et al*, 2000,[17] USA	18 m	4 m	18 m	None
Controlled trial				
Rowley *et al*, 1982,[15] England	32 m	3 m	32 m	None
Before and after studies				
Mitic and Perkins, 1984,[12] Canada	8 wk	4 wk	8 wk	1 wk (3 m)
Ho *et al*, 1989,[10] USA	2 m	4.5 m	None	4.5 m
Moses *et al*, 1991,[13] USA	24 m	12 m	24 m	None
Rustige *et al*, 1992,[14] Germany	9 m (1st period) 18 m (2nd period)	6 m	9 m	6 m (after 1st period) 18 m (ongoing with 2nd period)
Bett *et al*, 1993,[7] Australia	1 wk	2 m	None	1 m (1 m)
Blohm *et al*, 1994,[8] Sweden	14 m	21 m	14 m	36 m
Gaspoz *et al*, 1996,[9] Switzerland	12 m	12 m	12 m	None
Maeso-Madronero *et al*, 2000,[11] Germany	6 m	6 m	6 m	None

m, month(s); wk, week(s).

significant difference in the percentage of people seeking help within different time periods[7 10] or in median delay.[7]

Use of health resources

Two RCTs[16 17] and three before and after studies[8 9 13] examined the effect of the intervention on emergency department visits. One RCT reported a statistically significant increase in the overall number of visits for chest pain throughout the campaign period,[16] one before and after study reported a statistically significant increase in mean number of visits per day,[8] and another before and after study showed a statistically significant increase in the mean number of visits per week.[9]

One RCT[16] and one before and after study[9] examined calls made to emergency switchboards. Both found statistically significant increases in the number of calls made after the intervention.

None of the three before and after studies examining use of ambulance/medic transport reported a statistically significant difference in this outcome from before to after the intervention.[8–10]

Table 2 Summary of the key factors of the intervention content of included studies

Reference, country	Importance of quick/immediate action	Emphasis of signs and symptoms of AMI	Importance of calling emergency services	Emphasis of treatment such as lysis	Use of a specific slogan
RCTs					
Meischke *et al*, 1997,[16] USA	Y	Y	Y	Y	Y
Luepker *et al*, 2000,[17] USA	Y	Y	Y	Y	N
Controlled trial					
Rowley *et al*, 1982,[15] England*	Y	N	Y	N	Y
Before and after studies					
Mitic and Perkins, 1984,[12] Canada	Y	Y	Y	N	N
Ho *et al*, 1989,[10] USA	Y	Y	Y	N	Y
Moses *et al*, 1991,[13] USA	Y	Y	N	N	N
Rustige *et al*, 1992,[14] Germany	Y	Y	N	N	N
Bett *et al*, 1993,[7] Australia	Y	N	N	Y	Y
Blohm *et al*, 1994,[8] Sweden	Y	N	Y	N	Y
Gaspoz *et al*, 1996,[9] Switzerland	Y	N	Y	Y	Y

The before and after study of Maeso-Madronero *et al*, 2000,[11] Germany, did not provide any details on intervention content. Y, yes; N, no. *Signs and symptoms of an AMI was not a key factor, but intervention content did emphasise chest pain.

Mortality rate

One RCT[17] and one before and after study[8] examined mortality rates. Neither reported any statistically significant effects of the intervention on mortality.

Study quality

Methodological quality of studies was generally poor. Studies were flawed with regard to issues concerning the sample, inclusion criteria, statistical analyses, outcome assessment, and reporting of information relating to intervention content and participants.

DISCUSSION

There is limited evidence that community wide media based or one to one educational interventions were successful in reducing delay time and they may have resulted in an increase in calls made to emergency switchboards and emergency department visits. However, because of the types of study designs used and methodological deficiencies of studies, it is unclear how much weight can be given to these findings. Evidence for the effectiveness of interventions came mainly from before and after studies suggesting a need for caution in attributing any reported effects to the actual intervention.

Studies that were effective in reducing delay appeared similar to those that were ineffective in terms of population, duration of intervention, main outcome measured, baseline delay, and year in which conducted. Few studies provided information relating to frequency and intensity of interventions for a similar assessment of these factors.

Implications for future research

It may be beneficial for interventions to emphasise importance of thrombolytic therapy in preventing death or disability, and make it acceptable for people to access emergency services without fear that they are wasting NHS resources or that their symptoms are not serious enough.[18 19] It might be useful to evaluate how patients (and their partners/family) make the decision to call for help before advocating interventions. It may also be appropriate to target education at high risk groups, including family members. However, there is a need to educate the public at large to call an ambulance if they witness what could be an AMI.

Future research requires an appropriate design with baseline measurement of delay time, a reasonable follow up period, and specification of frequency, intensity, and content of the intervention. As the ultimate aim of such interventions is to save lives, mortality should be measured. Such studies are needed before any firm conclusion can be drawn.

ACKNOWLEDGEMENTS

We thank Dr Robert Clark, Dr Gary Latchford, Neil Stanford, Julie Glanville, Dr Jeffrie Strang, Barbara Gurney, Clare Valentine, Geoff Peacock, and Tom Quinn for their comments throughout the review process. We would also like to thank Dr Seokyung Hahn for her advice on reporting of statistics.

CONTRIBUTORS

RL suggested the need for the review. JP obtained the funding. All authors contributed to the execution of the review and content of the paper. AS supervised the review. SD carried out the electronic search strategies. AH, AK, and JP carried out study selection, data extraction and quality assessment, and AS and IW arbitrated when necessary. AS, AH, AK, JP, IW, RL, and DT contributed to the study design, interpretation of the results and critical revisions to the manuscript.

A table giving full study details for RCTs and a longer version of the paper are available on the journal web site (http://www.emjonline.com/supplemental).

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Funding: this review was funded by a grant from the Research Directorate of the Northern and Yorkshire Regional Office of the NHS.

Competing interests: none declared.

REFERENCES

1 **Department of Health**. *National service framework for coronary heart disease: modern standards and service models*. London: Department of Health, 2000.
2 **National Center for Chronic Disease Prevention and Health Promotion**. *The burden of chronic diseases and their risk factors: national and state perspectives*. Atlanta: US Department of Health and Human Services, Centers for Disease Control and Prevention, 2002.
3 **Blohm MB**, Hartford M, Karlson BW, *et al*. An evaluation of the results of media and educational campaigns designed to shorten the time taken by patients with acute myocardial infarction to decide to go to hospital. *Heart* 1996;**76**:430–4.
4 **Ashton KC**. How men and women with heart disease seek care: the delay experience. *Prog Cardiovasc Nurs* 1999;**14**:53–60.
5 **Khan KS**, Ter Riet G, Glanville J, *et al*. *Undertaking systematic reviews of research on effectiveness: CRD's guidance for carrying out or commissioning reviews: CRD Report 4*. 2nd edn. York: NHS Centre for Reviews and Dissemination, 2001.
6 **Jepson R**, Clegg A, Forbes C, *et al*. The determinants of screening uptake and interventions for increasing uptake: a systematic review. *Health Technol Assess* 2000;**4**.
7 **Bett N**, Aroney G, Thompson P. Impact of a national educational campaign to reduce patient delay in possible heart attack. *Aust N Z J Med* 1993;**23**:157–61.
8 **Blohm M**, Hartford M, Karlson BW, *et al*. A media campaign aiming at reducing delay times and increasing the use of ambulance in AMI. *Am J Emerg Med* 1994;**12**:315–18.
9 **Gaspoz JM**, Unger PF, Urban P, *et al*. Impact of a public campaign on pre-hospital delay in patients reporting chest pain. *Heart* 1996;**76**:150–5.
10 **Ho MT**, Eisenberg MS, Litwin PE, *et al*. Delay between onset of chest pain and seeking medical care: the effect of public education. *Ann Emerg Med* 1989;**18**:727–31.
11 **Maeso Madronero JL**, Bergbauer M, Mensing M, *et al*. HEUH ''Recognition of myocardial infarction and correct acting'': a project aiming at reducing the prehospital delay time in acute myocardial infarction. *Herz Kreisl* 2000;**32**:257–62.
12 **Mitic WR**, Perkins J. The effect of a media campaign on heart attack delay and decision times. *Can J Public Health* 1984;**75**:414–18.
13 **Moses HW**, Engelking N, Taylor GJ, *et al*. Effect of a two-year public education campaign on reducing response time of patients with symptoms of acute myocardial infarction. *Am J Cardiol* 1991;**68**:249–51.
14 **Rustige J**, Schiele R, Schneider J, *et al*. Intravenous thrombolysis in acute myocardial infarct: optimization of the therapeutic strategy by informing the patients and physicians. *Anasthesiol Intensivmed Notfallmed* 1992;**27**:205–8.
15 **Rowley JM**, Hill JD, Hampton JR, *et al*. Early reporting of myocardial infarction: impact of an experiment in patient education. *BMJ* 1982;**284**:1741–6.
16 **Meischke H**, Dulberg EM, Schaeffer SS, *et al*. ''Call fast, Call 911'': a direct mail campaign to reduce patient delay in acute myocardial infarction. *Am J Public Health* 1997;**87**:1705–9.
17 **Luepker RV**, Raczynski JM, Osganian S, *et al*. Effect of a community intervention on patient delay and emergency medical service use in acute coronary heart disease: the rapid early action for coronary treatment (REACT) trial. *JAMA* 2000;**284**:60–7.
18 **Ruston A**. Accessing emergency care at the time of a heart attack: why people do not dial 999 for an ambulance. *J R Soc Health* 2001;**121**:243–7.
19 **Pattenden J**, Watt I, Lewin RJ, *et al*. Decision making processes in people with symptoms of acute myocardial infarction: qualitative study. *BMJ* 2002;**324**:1006–9.

Study details for RCTs

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
Reference, country Meischke et al, 1997,[18] USA **Language** English **Authors' objectives** To increase use of emergency medical services via 911 calls, and to reduce pre-hospital delay for individuals experiencing AMI.	**Intervention content and setting** A mass media 'sensitisation' campaign entitled 'Call Fast, Call 911' which consisted of public service announcements (PSA's) was followed by a direct mailing campaign. PSA's: the PSA's consisted of television and radio advertisements. The advertisement messages outlined the symptoms of AMI, listed reasons why patients should quickly call 911 after the initiation of AMI symptoms, and countered excuses patients commonly use to postpone seeking professional treatment. The basis and general content of the campaign were derived from a theoretic model of delay in health care behaviour. The PSA's provided information and included emotional messages designed to decrease delay by attenuating fear and/or denial about AMI and by bolstering belief in the success of current therapies. Mailing campaign: there were three intervention groups receiving brochures with informational, emotional or social messages. The mail campaign drew upon the theoretical model of Safer and colleagues. The informational and emotional brochures were targeted at the potential AMI victim him or herself. The informational described the signs and symptoms of AMI and the role of the paramedics in rapid treatment. The emotional strategy focused on the psychological barriers to calling 911 for chest pain. The social brochures were targeted at the "bystander" (mostly the spouse) of an AMI patient. The setting was King County. **Frequency/duration** The mass-media campaign lasted 7 weeks (10/91 to 11/91). The television PSA's ran for 4 weeks, and the radio PSA's ran for 6 weeks. Both the	**Inclusion criteria: total sample** The direct mail campaign was targeted at households in King County in which the head of household was 50 years of age or older. A list of 65% such households was obtained from a commercial direct mail address firm. The list contained 130,000 names. **Inclusion criteria: suspected AMI** Events (one per household) referred to patients in the coronary care unit admissions registry whose addresses linked to an address on the mailing registry. The case definition of an event was admission to the coronary care unit with a diagnosis on the unit log of "rule out myocardial infarction" (including acute myocardial infarction, angina, chest pain, cardiac arrest before arrival at hospital, and congestive heart failure). Patients who were admitted for scheduled procedures or who developed acute myocardial infarction symptoms after hospital admission were excluded. **Sample size** **Control** 1343 **Intervention** 4101 **Total** 5444 **Participant details** **Control** Age: 20-49 yr.: 3.3% 50-59 yr.: 9.9% 60-69 yr.: 28.4% 70-79 yr.: 36.7% 80+ yr.: 21.8% Gender: 55.4% men	**Statistical analyses used** The transformation ln (ln[delay time]), which was approximately normally distributed, was used to test mean differences between groups. Z-tests were used to test for differences between proportions, t-tests for differences between means, and chi-squared tests to compare distributions. To maintain statistical significance at an alpha level of 0.05 for each outcome measure, the difference between each intervention group and the control group was tested at $p<0.017$. Monthly totals of 911 calls, ED visits and hospital admissions were compared using student's t-test. A value of 0.05 was chosen as an arbitrary measure of statistical significance. Data were plotted against 95% confidence intervals based on Student's t-test to compare them with the 95% confidence intervals for additional observations in a regression. Analyses were restricted to the relatively homogeneous group of patients (90% of events) who were white and who reported having private medical insurance or medicare or being a member of a health maintenance organisation (HMO). **Power calculation** The authors considered an increase of 10 percentage	**Delay time measured** Pre-hospital delay time- defined as time from acute symptom onset to emergency department arrival. **Method of outcome evaluation** The registry contained patient data abstracted from hospital records. Two outcome measures were abstracted from the medical chart: method of transport (emergency vehicle vs. self-transport) and delay time from acute symptom onset to emergency department arrival. Media campaign only: ED records and EMS incident reports provided data to determine the effects of the media campaign. Medical record abstractors made monthly visits to all 17 hospitals in the study community, compiling data on ED visits for chest pain and whether these patients were admitted to the hospital's CCU or sent home. All patients admitted to CCU's with an admitting diagnosis of "rule-out MI" had their charts abstracted to determine whether an AMI had occurred. The EMS system in Seattle and King County supplied information on the number of 911 responses for AMI symptoms for the entire population and for individuals 50 years of age or older. The following sources provided monthly data from January 1990 on: Seattle and King County hospital ED visits and hospital admission records, Seattle and King County 911 call logs, and Seattle and King County hospital and CCU and ICU admission logs. Process Outcomes: Individuals in the study were interviewed via telephone to determine process outcomes. Six trained interviewers conducted the interviews. If the person on the list was deceased, very ill, or otherwise permanently unavailable, interviewers interviewed another available household member over the age of 50. Interviewers were blind to the research hypothesis as well as to the randomly assigned group designation of each interviewee. To get an indication of how many people remembered receiving printed materials on the topic, respondents were asked (a) if they remembered receiving a mailing or brochure in the past year on how to respond to a heart attack, and if so (b) if they had read one or more of these brochures. For those individuals who reported they remembered and had read such a brochure, respondents were asked what they remembered best about the brochure and what they thought the main message was. **Delay time** **Baseline delay time control** Not stated **Baseline delay time intervention** Not stated **Trial end delay time control** Total n (control + intervention groups)=4704 Pre-hospital delay time:

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
	television and the radio PSA's were scheduled to air during programmes most likely to reach the target audience. The PSA's were aired on six radio stations for a total of 567 spots and on three network television stations for a total of 98 times. The mailing intervention lasted 10 months (12/91 to 10/92). Brochures were mailed once every two months. **Duration of outcome measure** Outcome data were collected for a period of 2 years (17/12/91 to 31/12/93). There was 2 months of data collection after each mailing and a year of follow up. **Method of randomisation or control group selection** The mailing list was used to randomise individuals. This list was linked to a registry accumulating coronary care unit admissions from all 16 King County hospitals having such units. The authors randomised households on the mailing list, pre-sorted for zip code for equal representation across King County, into four groups; three intervention, one control.	Race: 91.6% White, 5.2% African-American, 2.9% Asian/Pacific Islander, 0.2 % Hispanic. Marital status: 65.3% married, 8.1% single, 26.5% divorced/widowed/separated. Income: <20 000$: 31.0% 20 000-39 999$: 22.9% 40 000-49 999$: 19.2% >or=50 000$: 26.9% Medical insurance: 22.8% private/group/HMO, 73.6% medicare, 2.1% medicaid, 1.4% none AMI: 25.8% Prior history of AMI: 28.9% New onset/unstable angina: 21.7% Prior history of angina: 39.4% **Intervention** Age: 20-49 yr.: 3.0% 50-59 yr.: 9.0% 60-69 yr.: 28.4% 70-79 yr.: 36.9% 80+ yr.: 22.7% Gender: 54.9% men Race: 92.3% White, 4.1% African-American, 3.2% Asian/Pacific Islander, 0.1% Native American/Alaskan, 0.4% Hispanic. Marital status: 65.0% married, 8.7% single, 26.3% divorced/widowed/separated. Income: <20 000$: 35.4% 20 000-39 999$: 21.9% 40 000-49 999$: 20.2% >or=50 000$: 22.6% Medical insurance: 23.2% private/group/HMO, 73.8% medicare, 1.8% medicaid, 1.1% none. AMI: 26.2% Prior history of AMI: 29.1% New onset/unstable angina: 20.8% Prior history of angina: 41.0% **Total** Not stated	points in the rate of 911 calls and a decrease of 30 minutes in delay to be meaningful intervention effects. Percentage of patients calling 911: With approximately 1150 cases per group, the power to detect a change of 10 percentage points in 911 calls between each intervention group and the control group was more than 99% (two-sided z-test, alpha=0.05/3). Delay time from acute symptom onset to emergency department arrival: With approximately 800 cases per group of quantifiable delay time data, the power to detect a 30-minute change between each intervention group and the control group was 70% (two-sided t-test, alpha=0.05/3). **Missing data** Three people were excluded because their medical charts could not be located. Percentages of missing data for covariates were as follows: marital status, 2%; medical insurance, 1%; other variables <1%. Concerning analysis of percentage of patients calling 911, 3% of events had missing data for the outcome variable and 3 events had missing data for prior history of AMI. Concerning delay time from symptom onset to emergency department arrival, quantifiable delay time was present in 69% of events	median 146 min., mean 173 min. ln(ln [delay time]): mean 1.6391 (SD=0.2559), n=790. **Trial end delay time intervention** Pre-hospital delay time: Informational intervention: median 160 min., mean 183 min., ln(ln [delay time]): mean 1.6509 (SD=0.2626), n=894. (NS, p<0.4). Emotional intervention: median 150 min., mean 167 min., ln(ln [delay time]): mean 1.6331 (SD=0.2766), n=795. (NS, p<0.7) Social intervention: median 140 min., mean 173 min., ln(ln [delay time]): mean 1.6401 (SD=0.2738), n=780. (NS, p>0.9) **<u>Medical services</u>** **Baseline use of medical services control** Outcomes on number of 911 calls, number of ED visits, and CCU admissions with admitting diagnosis of rule-out MI are reported for control and intervention groups together **Baseline use of medical services intervention** The following outcomes on number of 911 calls, number of ED visits, and CCU admissions with admitting diagnosis of rule-out MI are reported for control and intervention groups together: Number of 911 calls: an average of 450 calls per month for AMI symptoms during the pre-campaign period. Number of ED visits for chest pain: an average of 1375 patients per month for chest pain during the pre-campaign period.. CCU admissions with admitting diagnosis of rule-out MI: an average of 660 per month during the pre-campaign period. Number of AMIs: an average of 155 confirmed AMIs per month in persons over 50 years of age during the pre-campaign period. **Trial end use of medical services control** % (number) of patients calling 911: Total control group: 60.4 % (1112). No prior history of AMI and No AMI discharge diagnosis: 56.5% (554) No prior history of AMI with AMI discharge diagnosis: 64.8% (227) No prior history of AMI with No AMI discharge diagnosis: 64.6% (257) No prior history of AMI and No AMI discharge diagnosis: 61.6% (73) **Trial end use of medical services intervention** The following outcomes on number of 911 calls, number of ED visits, and CCU admissions with admitting diagnosis of rule-out MI are reported for control and intervention groups together: The number of 911 calls: this rose significantly during the campaign and remained high for 3 months after the campaign. Number of ED visits for chest pain: statistically significant increases occurred throughout the campaign period of October through December 1991. ED visits decreased below the upper 95% confidence interval (while remaining above the mean) 1-month after the media campaign and

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
				remained below this level. CCU admissions with admitting diagnosis of rule-out MI: This increased significantly during the campaign month of November 1991. Although not significantly higher, the number remained above the mean for 2 months after the campaign. Number of AMIs: For the 3 months overlapping the media campaign, there was an average of 153 AMIs per month (NS). % (number) of patients calling 911: Information: 63.3% (1190), NS, p<0.2. Emotional: 64.2% (1166), NS, p<0.06. Social: 61.8% (1099), NS, p<0.6. No prior history of AMI and No AMI discharge diagnosis: Informational: 58.6% (616), NS Emotional: 58.3% (592), NS Social: 55.8% (545), NS No prior history of AMI with AMI discharge diagnosis: Informational: 66.9% (236), NS Emotional: 66.1% (218), NS Social: 67.4% (227), NS Prior history of AMI with no AMI discharge diagnosis: Informational: 68.4% (266), NS Emotional: 70.7% (273), NS Social: 64.7% (258), NS Prior history of AMI with AMI discharge diagnosis: Informational: 72.2% (72), NS Emotional: 80.5% (82), p<0.01 Social: 79.4% (68), p<0.03 (tests of significance compare each intervention group with the control.) **Other outcomes** **Baseline for other outcomes control** Not stated **Baseline for other outcomes intervention** Not stated **Trial end for other outcomes control** Not stated **Trial end for other outcomes intervention** Not stated **Process outcomes** There were no significant differences between intervention groups in the number of people who remembered or who had read at least one of the brochures. Overall, 67 people (22%) in the intervention group remembered receiving a brochure and 55 (18%) had read one of them. Ten individuals in the control group (10%) reported remembering a brochure dealing with how to respond to chest pain. However, only half of those people (n=5) said they had read the brochure and/or could remember anything about the

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
				brochure. Only two people who reported having read the brochure remembered aspects of the brochure that did not seem to fit the brochure content of the intervention brochures (i.e. diet and smoking). **Cost information** Total cost of the campaign: $245 250.
Reference, country Luepker et al, 2000,[19] USA **Language** English **Authors' objectives** To evaluate a community intervention to reduce patient delay from symptom onset to hospital presentation and increase emergency medical services use.	**Intervention content and setting** The study was known as the rapid Early action for Coronary Treatment (REACT) trial. The intervention was a multi-component strategy based on social cognitive theory, self-regulatory theory, diffusion theory, social marketing, and community organisation principles. There were two central themes; symptom recognition, and the need to act fast by calling 911. Public messages emphasised chest pain or discomfort along with other AMI symptoms including shortness of breath, radiating pain, sweating, nausea, or weakness. The advice given instructed patients to call 911 for ambulance transport to hospital if any of these symptoms persisted for 15 minutes or longer. Intervention strategies were developed incorporating both interpersonal channels, such as mass media, and interpersonal methods, such as one-on-one interactions. The core symptom message used in interpersonal strategies emphasised chest pain as the primary symptom of AMI along with shortness of breath as another common symptom but stressed that other symptoms might also be present. The 4 intervention strategies included: (1) community organisation, in which health professionals and leaders of other relevant organisations in each community constituted a local advisory group; (2) public education, which targeted all residents of the intervention communities, with an 18-month programme that included the 6 themes of general awareness of AMI symptoms and appropriate action; MI survival plan, women and MI; MI symptom	**Inclusion criteria: total sample** Criteria for selecting communities included: proximity within 250 miles of a study field centre; clear geographic boundaries; population of more than 50 000; 911 emergency telephone service; willingness of the medical community and hospitals to participate; non-overlapping media and hospital use with other study communities; and similarity in demographics, medical services, and media characteristics within each community pair. The five field centres were: Universities of Alabama (Birmingham), Massachusetts (Worcester), Minnesota (Minneapolis - St Paul) and Texas (Houston) and a combined unit at the University of Washington (Seattle) and Oregon Health Services University (Portland). To capture the majority of acute CHD patients, all hospitals that provided emergency care to patients with acute CHD from the study communities were included. Hospitals treating small numbers of community CHD patients were excluded if minority representation would not be adversely affected and if the expected number of cases at the hospital was so low (<10%) that it would make data collection and quality control difficult. One hospital near a study community was included because the hospital saw a large percentage of AMI patients from the study community. **Inclusion criteria: suspected AMI** All adults who presented to a hospital ED with a chief complaint of chest pain were included. Characteristics of the primary population for the study	**Statistical analyses used** Baseline data were analysed to determine comparability of delay times between intervention and comparison communities using a paired t-test on the observed delay times (log-transformed to reduce skew) as well as using a 2-stage analysis where the first stage adjusted log-transformed delay time for age, race, and history of MI by regression analysis and the second stage compared the adjusted community medians by a paired t-test. Geometric mean was used as the estimate of the median. Delay times were log-transformed to make the distribution more nearly gausian. The analysis was conducted in 2 stages. First the trend in delay time was calculated for each community by linear regression of log delay against calendar time. All baseline data were attributed to time zero. Regression modelling was adjusted for 3 individual patient level covariates: age, sex, and history of AMI or CHD. Second, trends (slopes) in the 10 intervention communities were compared pair-wise with trends in the 10 matched control communities using the paired t test with 9 df. Trends in EMS use were analysed by a similar 2-stage	**Delay time measured** Pre-hospital delay time- defined as the time from self-reported acute symptom onset to arrival at the ED. **Method of outcome evaluation** Delay time was obtained from medical charts. A two-stage process was used to assess patient eligibility and collect delay time data. First, ED staff in study hospitals were trained in standardised questioning of patients regarding the nature and time of onset of acute symptoms. Follow-up training reinforced these practices. Study staff monitored ED logs to ensure that all presenting patients were considered and identified those that satisfied the inclusion criteria. Second, trained abstractors reviewed the hospital records of patients who were admitted with suspected acute CHD and collected demographic data, mode of transportation, procedures, clinical outcomes, and discharge diagnoses. Data collection protocols were reviewed and approved by the institutional review boards of each academic institution and hospital. measurement staff abstracted the symptoms and onset time, as well as the time of arrival at the ED, from hospital medical records using standardised medical record abstraction forms. The primary source of data on time of onset of symptoms was the ED nurse notes. Secondary sources, in priority order, were the ED physician notes, the inpatient nurse notes, and the inpatient physician notes. The difference between symptom onset time and ED arrival time is the primary outcome of delay time. Time of taking action (i.e. calling 911 or getting into the car to drive to the ED) and time of contact with the emergency personnel (either EMS or ED) were obtained from patient telephone interviews on a random subset of cases. Time of receipt of reperfusion treatment in patients receiving such treatment was obtained from the medical record. Measures of other secondary clinical outcomes and utilisation of medical services was obtained from EMS data, hospital ED logs, and medical record abstraction of key data elements. Data on knowledge, attitudes, intentions, and other impact measures were obtained from telephone interviews: 1) 4 cross-sectional random-digit dialling community surveys, 2) post hospital discharge telephone interviews of a sample of patients with diagnosed acute cardiac ischemia, and 3) post-ED telephone interviews of a sample of chest pain patients released from the ED. **<u>Delay time</u>** **Baseline delay time control** Mean pre-hospital delay time: 140.3 min. **Baseline delay time intervention** Mean pre-hospital delay time: 140.0 min.

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
	recognition; bystander response to MI; and importance of contacting emergency medical services (EMS); (3) professional education, which included physicians, nurses, rehabilitation staff, emergency department (ED) staff, and ambulance staff who were involved in continuing education meetings, special seminars, and academic detailing; and (4) patient education for those with a history of CHD or CHD risk factors who were taught at clinics by physicians **Frequency/duration** The intervention lasted for 18 months (4/96 to 8/97). Mass media: 1459 TV and newspaper stories about heart disease; 235 TV and newspaper stories about the project or its message; a circulation of 1220650 for special newspaper inserts; 4657 public service announcements and paid advertisements played on commercial TV broadcast outlets in 10, 20, 30 and 60 second formats; 2932 public service announcements and paid advertisements played on cable TV channels; 385 public service announcements and paid advertisements played on commercial radio broadcast outlets. Small Media: 1175676 pieces of direct mail targeted at general public and Medicare-eligible persons; 607 displays with brochures for use mainly at pharmacy prescription and check-out counters; 210 billboards appeared for at least 30 days at a time in high-traffic public areas; 3094 posters were distributed in clinics, work sites, and other public areas; 1340704 brochures and newsletters for general public or target distribution audiences; presentation of messages on slides preceding movies in 6 communities. Community and patient groups: presentations to a combined total of 361 cardiac rehabilitation groups, risk factor patient management classes, and other in-person presentations or brief	included age of 30 years and older, admission for evaluation of suspected acute CHD, and discharge with a CHD-related diagnosis. Institutionalised individuals, those transferred from hospitals outside of the study areas, and those presenting with other causes of chest pain were not included. **Sample size** **Control** 5051 baseline, 24347 at 18 months **Intervention** 4582 baseline, 27063 at 18 months **Total** Not stated **Participant details** **Control** Numbers in brackets are average numbers per month. Baseline: Total presenting to ED: 5051 (1684) Released from ED: 3520 (1173) Hospitalised with non-cardiac diagnosis: 183 (46) Hospitalised with cardiac diagnosis (primary population): 2175 (544) Diagnoses of those hospitalised with cardiac diagnoses: Acute MI: 502 (126) Ischemic heart disease: 502 (126) Prior MI, angina pectoris, and other forms of chronic ischemic heart disease: 505 (126) Cardiac dysrhythmias, heart failure, ill defined descriptions, and complications of heart disease and atheroschlerosis: 194 (49) Chest pain: 479 (11) Age: mean 65 yr., SD 14. Gender: 52.7% men. 18 months: Total presenting to ED: 24347 (1353) Released from ED: 13749 (764)	procedure using logistic regression in the first stage. **Power calculation** A 30-minute net reduction in median delay time was considered to be a clinically relevant intervention effect. In the 10 community pairs, 15000 primary cases were estimated to occur over the 22 months of data collection. A sample size of 10 community pairs and 15000 cases provides 80% power for detecting a 30-minute net reduction in median delay time between intervention and comparison communities. **Missing data** Delay time information at baseline was available on 71.7% to 72.8% and did not differ by community assignment. Absence of delay times was primarily the result of a vague patient symptom history or inadequate recording by hospital staff.	**Trial end delay time control** During: Mean pre-hospital delay time: 126.2 min. Mean delay trend in control communities: 6.8% per year (95% CI: -14.5% to 1.6%). Six control areas had decreasing delay times. **Trial end delay time intervention** During: Mean pre-hospital delay time: 130.3 min. Mean delay time trend in intervention communities declined significantly at 4.7% per year (95% CI: -8.6% to -0.6%) but this did not differ significantly from the trend in control communities. Eight intervention groups had negative slopes indicating decreasing delay times. **Medical services** **Baseline use of medical services control** Average rate of EMS use: 33% Average ED presentations per month: 1684 **Baseline use of medical services intervention** Average rate of EMS use: 33%. Average ED presentations per month: 1527 **Trial end use of medical services control** During: EMS use in the control communities did not change (3% per year, 95% CI: -13% , 7%). Average ED presentations per month: 1353 **Trial end use of medical services intervention** During: The odds of EMS use increased steadily and significantly in intervention communities (16% per year, 95% CI: 2%, 32%). The net effect was a 20% increase in EMS use in intervention communities compared with control communities (odds ratio, 1.20; 95% CI: 1.07, 1.34, $p<0.005$). Average ED presentations per month:1504 **Other outcomes** **Baseline for other outcomes control** Case fatality rates: 2.66%. The odds of reperfusion therapy use during the first six hours of symptom onset declined slightly during the follow-up period in the intervention community group (OR=0.92), but not in the control group (OR=1.11). Thus the net change favoured the control group (OR=0.83). As a function of time period, the odds ratio for receiving reperfusion therapy within 6 hours of symptom onset was most favourable during the first six months of the intervention. Reperfusion <or= 1 hr. from ED arrival (n=3013): Baseline control: 19.3%

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
	counselling sessions of high-risk patients; distribution of 468 printed and video materials to high-risk patients and their families; presentations to a combined total of 915 senior and civic organisations, work sites, and social service agencies; 145 visible public events, such as health fairs or brief presentations of the message as part of some other public event. **Duration of outcome measure** Baseline measurements were taken for 4 months (12/95 to 3/96) and then measurements were taken for 18 months while the intervention was ongoing. **Method of randomisation or control group selection** One city in each matched pair was assigned to the intervention and the other city in each pair was randomly assigned to status. The matched pairs were comparable in age distribution, education level, ethnic distribution, household income, and median delay time. All communities accepted their randomised assignments and participated until the end of the intervention programme. Randomisation of communities was conducted by the co-ordinating centre at the beginning of baseline data collection and revealed to those printing the intervention materials. Randomisation status was revealed to investigators to hire and train intervention staff 2 months after baseline data collection began, and was made public at the beginning of the intervention (4/96).	Hospitalised with non-cardiac diagnosis: 797 (44) Hospitalised with cardiac diagnosis (primary population): 9801 (545) Diagnoses of those hospitalised with cardiac diagnoses: Acute MI: 1892 (105) Ischemic heart disease: 2214 (123) Prior MI, angina pectoris, and other forms of chronic ischemic heart disease: 2755 (153) Cardiac dysrhythmias, heart failure, ill defined descriptions, and complications of heart disease and atheroschlerosis: 902 (50) Chest pain: 2038 (113) Age: mean 65 yr., SD 14 Gender: 54.0% men **Intervention** Numbers in brackets are average numbers per month. <u>Baseline:</u> Total presenting to ED: 4582 (1527) Released from ED: 2809 (936) Hospitalised with non-cardiac diagnosis: 269 (67) Hospitalised with cardiac diagnosis (primary population): 2876 (719) Diagnoses of those hospitalised with cardiac diagnoses: Acute MI: 700 (175) Ischemic heart disease: 704 (176) Prior MI, angina pectoris, and other forms of chronic ischemic heart disease: 683 (171) Cardiac dysrhythmias, heart failure, ill defined descriptions, and complications of heart disease and atheroschlerosis: 256 (64) Chest pain: 533 (133) Age: mean 65yr., SD 14 Gender: 56.0% men <u>18 months:</u> Total presenting to ED: 27063 (1504) Released from ED: 15688 (872) Hospitalised with non-cardiac		Reperfusion <or= 6 hr. from ED arrival (n=3013): Baseline control: 27.5 Angioplasty, those reperfused (n=1207): Baseline control: 19.3% Survival (n=3013): Baseline control: 95.0% Reperfusion, no exclusions (n=4483): Baseline control: 45.5% (baseline rates adjusted for age, sex, ethnicity, cohabitation status, coronary heart disease history, insurance status, presenting blood pressure, and transfer status). **Baseline for other outcomes intervention** Case fatality rates: 3.23% Reperfusion <or= 1 hr. from ED arrival (n=3013): Baseline intervention: 13.8% The odds of reperfusion therapy use during the first 6 hours of symptom onset declined in the intervention group (OR=0.92) Reperfusion <or= 6 hr. from ED arrival (n=3013): Baseline intervention: 28.3% Angioplasty, those reperfused (n=1207): Baseline intervention: 53.1% Survival (n=3013): Baseline intervention: 94.9% Reperfusion, no exclusions (n=4483): Baseline intervention: 49.6% (baseline rates adjusted for age, sex, ethnicity, cohabitation status, coronary heart disease history, insurance status, presenting blood pressure, and transfer status). **Trial end for other outcomes control** <u>During:</u> Case fatality rates 1.78% (NS) The proportion of patients who were hospitalised and subsequently discharged with a non-cardiac diagnosis did not differ significantly between control and intervention communities during the intervention (p=0.61). The proportion of patients admitted with suspected CHD increased in both intervention and control communities from baseline to intervention, but the differences were not significant (p=0.13). Reperfusion <or= 1 hr. from ED arrival (n=3013): odds ratio at 1.5 years for control group: 0.78 (95% CI: 0.47, 1.30). Reperfusion <or= 6 hr. from ED arrival (n=3013): odds ratio at 1.5 years for control group: 1.11 (95% CI: 0.70, 1.76). Angioplasty, those reperfused (n=1207): odds ratio at 1.5 years for control group: 1.86 (95% CI: 0.81, 4.30). Survival (n=3013): odds ratio at 1.5 years for control group: 1.06 (95% CI: 0.49, 2.29). Reperfusion (n=4483): odds ratio at 1.5 years for control group: 0.83 (95% CI: 0.57, 1.21). **Trial end for other outcomes intervention** <u>During:</u> Case fatality rates: 2.43% (NS) The proportion of patients who were hospitalised and subsequently discharged with a non-cardiac diagnosis did not differ significantly between

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
		diagnosis: 813 (45) Hospitalised with cardiac diagnosis (primary population): 10563 (587) Diagnoses of those hospitalised with cardiac diagnoses: Acute MI: 2200 (122) Ischemic heart disease: 2512 (140) Prior MI, angina pectoris, and other forms of chronic ischemic heart disease: 2587 (144) Cardiac dysrhythmias, heart failure, ill defined descriptions, and complications of heart disease and atheroschlerosis: 984 (55) Chest pain: 2280 (127) Age: mean 66 yr., SD 14 Gender: 52.5% men **Total** Not stated		control and intervention communities during the intervention (p=0.61). The proportion of patients admitted with suspected CHD increased in both intervention and control communities from baseline to intervention, but the differences were not significant (p=0.13), Reperfusion <or= 1 hr. from ED arrival (n=3013): odds ratio at 1.5 years for intervention group: 0.90 (95% CI: 0.55, 1.47). OR trend ratio (I:C): 1.15 (95% CI: 0.57, 3.33, p=0.69). Reperfusion <or= 6 hr. from ED arrival (n=3013): odds ratio at 1.5 years for intervention group: 0.92 (95% CI: 0.61, 1.40). OR trend ratio (I:C): 0.83 (95% CI: 0.45, 1.55, p =1.55). Angioplasty, those reperfused (n=1207): odds ratio at 1.5 years for control group: 3.09 (95% CI: 1.45, 6.57). OR trend ratio (I:C): 1.66 (95% CI: 0.54, 5.09, p =0.36). Survival (n=3013): odds ratio at 1.5 years for control group: 1.06 (95% CI: 0.54, 2.08). OR trend ratio (I:C): 1.00 (95% CI: 0.36, 2.76, p =0.99). Reperfusion (n=4483): odds ratio at 1.5 years for control group: 0.96 (95% CI: 0.69, 1.34). OR trend ratio (I:C): 1.16 (95% CI: 0.70, 1.91, p =0.55). **Process outcomes** The co-ordinating centre conducted random digit dial telephone surveys of 30 to 60 adults aged 21 years and older in each study community at 4 time-points- baseline, early, mid and late in the study- to obtain measures of knowledge, attitudes, and behaviours relevant to seeking care for AMI symptoms. A total of 4389 adults were contracted in 4 surveys. Participation rates were approximately 60%. In a group with a mean age of 43.1 years, there was a progressive increase in unaided recall of the REACT name with 6% (n=643) of respondents in intervention communities providing unaided recall at the last survey compared with 0% (n=541) in the control communities (p<0.001). At the end of the intervention, 44% (n=602) of the surveyed population in the intervention communities recognised the REACT name when it was presented whereas 15.1% (n=561) recognised it in the control areas (p<0.002). There was a low but increasing level of received messages about MI symptoms (p<0.03) and a higher percentage of correct answers to appropriate action for AMI (p<0.006) among persons residing in the intervention communities compared with control sites. No significant differences in these additional factors were observed between intervention and control communities. A survey of admitted patients showed similar results. **Cost information** For a typical town with 100 000 residents, the annual cost of the REACT intervention would be $156 000 to $294 000. The cost includes local staff, supplies, and media distribution. Differences between cities were a function of local labour, rent, media and distribution costs.

Study details for controlled trial

Study details	Intervention details	Participant details	Statistical analysis/Missing data	Outcome measurements and results
Reference, country Rowley et al, 1982,[17] England **Language** English **Authors' objectives** To investigate whether health education influences the behaviour of individuals suffering from chest pain, by persuading them to call for help at an early stage.	**Intervention content and setting** 'Nottingham Heartwatch' campaign: the value of early attention to patients with chest pain was outlined and the recipients were asked to ring a special telephone number if they had chest pain for more than 10 minutes. A letter outlining the value of early help in suspected heart attack drew attention to the possible importance of chest pain lasting for longer than 10 minutes and focused attention on this by means of a logo or campaign symbol: it described the availability of a hospital-based team to visit any patient with persistent chest pain and invited the patient to contact this team on an easy-to-remember number, which served a direct telephone line to the hospital coronary care unit. With the letter, the patient received self-adhesive stickers to apply to the telephone or first-aid cabinet and a card to carry in the handbag or the wallet. The telephone number was prominent in all these. The blue envelope and enclosed information was designed to avoid alarm and to provide a positive approach. The setting was 3 group practices in Nottingham (two situated in suburban Nottingham and one in an independent small town on the edge of metropolitan Nottingham). **Frequency/duration** The first letter was sent 6/77 and the second letter was sent 6/78. The intervention lasted 2 years and 8 months. **Duration of outcome measure** Not specifically stated. From 3/77 to 1/80 242 calls were received and since the first mailing occurred 6/77, baseline measures presumably lasted 3 months (3/77 to 5/77). It appears that measures were then taken for 2 years and 8	**Inclusion criteria: total sample** Patients aged over 40 and who were registered with either one of 3 group practices in Nottingham. **Inclusion criteria: suspected AMI** Patients over 40 with chest pain lasting longer than 10 minutes. **Sample size** **Control** Unclear **Intervention** Unclear **Total** Unclear **Participant details** **Control** Gender: 73% men Age: mean 56 yr. (men), 59 yr. (women). Suspected infarcts: 85%. Deaths by 6 weeks: 10%. **Intervention** Calling direct line Gender: 73% men. Age: mean 61yr. (men), 62 yr. (women). Suspected infarcts: 52%. Deaths by 6 weeks: 12%. Calling own doctor: Gender: 62% men. Age: mean 60 yr. (men), 67 yr. (women). Suspected infarcts: 82%. Deaths by 6 weeks: 11%. **Total** Not stated	**Statistical analyses used** Not stated **Power calculation** Not stated **Missing data** 578 were deleted from the original mailing list because of inaccuracies in the age/sex register.	**Delay time measured** Patient decision time- defined as interval between onset of symptoms and first call for help. **Method of outcome evaluation** Incoming calls were received by members of the nursing staff of the CCU, who had been provided with a message pad bearing a written protocol requiring them to establish where the caller was, whether the patient was suffering chest pain or other symptoms, and whether the patient was registered with one of the study practices. **Delay time** **Baseline delay time control** 24% of patients with definite and probable infarcts had called by 30 minutes from onset of symptoms before Heartwatch. **Baseline delay time intervention** 24% of patients in the study practices called their general practitioner by 30 minutes from onset of symptoms before Heartwatch. **Trial end delay time control** During: Patients with definite and probable infarcts from the control practices had not changed their behaviour during the study: 23% had called by 30 minutes from onset of symptoms during Heartwatch. **Trial end delay time intervention** During: Patients in the study practices called their general practitioner earlier after receiving Heartwatch information: 37% had called by 30 minutes from onset of symptoms ($p<0.05$). Patients with definite and probable infarction in the intervention group were calling their own general practitioners significantly earlier as a result of Heartwatch: 22% had called by 30 minutes from onset of symptoms before Heartwatch and 44% during ($p<0.05$). **Medical services** **Baseline use of medical services control** Not stated **Baseline use of medical services intervention** Not stated **Trial end use of medical services control** Not stated **Trial end use of medical services intervention** Not stated

	months (6/77 to 1/80) during the intervention. **Method of randomisation or control group selection** 3 of 13 practices that had participated in an earlier study were chosen as the intervention practices, and the remaining 10 practices were used as controls.			**<u>Other outcomes</u>** **Baseline for other outcomes control** Not stated **Baseline for other outcomes intervention** Not stated **Trial end for other outcomes control** Not stated **Trial end for other outcomes intervention** <u>During:</u> Of those patients in the study practices after the intervention in whom definite or probable infarction was not diagnosed 60% had called the direct line by one hour compared with 42% who called their own doctor ($p<0.05$). A similar analysis of patients in whom definite or probable infarction was the final diagnosis did not, however, show a significant difference between the time of calls to the direct line and to their general practitioner. A random sample of callers on the direct line were asked whether they had tried to contact their own doctor before dialling Heartwatch and of the 69 sampled, 22 (32%) indicated that they had. **Process outcomes** Not stated **Cost information** Not stated

Study details for before and after studies

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
Reference, country Mitic and Perkins, 1984,[14] Eastern Canada **Language** English **Authors' objectives** To investigate the effectiveness of a media campaign in reducing the delay and decision times of persons experiencing out-of-hospital heart attack symptoms.	**Intervention content and setting** Mass media campaign entitled 'Signals and Actions'. The campaign involved both purchased television and radio spots and public service announcements. Advertisements were placed during prime time. The content of the radio and television advertisements emphasised two basic concepts. First, the symptoms of a heart attack were clearly described, the most common being an uncomfortable pressure, squeezing or fullness in the centre of the chest behind the breastbone. Second, the viewer or listener was informed of the importance of seeking immediate professional assistance if these symptoms occur, by phoning an ambulance or going directly to hospital. The setting was a large hospital in Eastern Canada. **Frequency/duration** The media campaign was aired for eight weeks. The television advertisement lasted 30 seconds and the radio spot was 60 seconds in length. **Duration of outcome measure** Before measurements were collected for four weeks. Measurements were then collected for 8 weeks during the media campaign and for one week, three months after the media campaign had terminated.	**Inclusion criteria: total sample** Persons in Eastern Canada who are served by a large hospital **Inclusion criteria: suspected AMI** Persons who presented with chest pain or other heart attack symptoms. **Sample size** **Before** 101 **After** 329 during, 41 after. **Total** 471 **Participant details** **Before** Gender: 64% men. Age: mean 54 yr. (men), 61 yr. (women). **After** During: Gender: 56.5% men. Age: mean 54 yr. (men), 58 yr. (women). After: Gender: 48.8% men. Age: mean 55 yr. (men), 59 yr. (women). **Total** Not stated	**Statistical analyses used** Chi-square test **Power calculation** Not stated **Missing data** Not stated	**Delay time measured** Delay time- defined as time from symptom onset to arrival in the hospital emergency department. **Method of outcome evaluation** The medical records of persons who presented with chest pain or other heart attack symptoms were examined. During the eight-week media campaign, demographic information and delay times of persons presenting at the hospital emergency department were recorded by the admitting staff. A random selection of 44 persons who were seen by medical staff during the latter 4 weeks were contacted by phone. A standardised form was used to interview the subjects and record their responses. These persons were asked if they had seen or heard the Signals and Actions program and if they had, whether the program had influenced them to seek medical assistance more quickly. Decision times were also collected. **Delay time** **Delay time before** Mean delay time: men: 99.1 hr. women: 62.1 hr. delay time (hr.) Number (%) 0-2 16 (15.8) 2-6 19 (18.8) 6-12 15 (14.9) 12-24 15 (14.9) 24+ 36 (36.6) **Delay time after** During: mean delay time: men: 92.1 hr. women: 83.4 hr. delay time (hr.) Number (%) 0-2 103 (31.3) 2-6 72 (21.9) 6-12 35 (10.6) 12-24 22 (6.7) 24+ 97 (29.5) (for 0-2 hr., $p<0.05$, chi-square=9.23). After: mean delay time:

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
				men: 35.1 hr. women: 165.7 hr. delay time (hr.) Number (%) 0-2 12 (29.3) 2-6 7 (17.1) 6-12 5 (12.2) 12-24 4 (9.8) 24+ 13 (31.7) **<u>Medical services</u>** **Use of medical services before** Not stated **Use of medical services after** Not stated **<u>Other outcomes</u>** **Other outcomes before** Not stated **Other outcomes after** Not stated **Process outcomes** Telephone interviews of 44 (29 males, 15 females with a mean age of 57 yr.) persons randomly selected from those who had presented at the hospital emergency ward complaining of heart attack symptoms during the latter 4 weeks of the campaign: 30 (68.2%) of the 44 persons had and 14 (31.8%) had not seen or heard a radio or television advertisement that explained what to do if they thought they were experiencing a heart attack. Of those who had seen/heard the advertisement, 27 (90%) reported that they had viewed the advertisement on television, 2 (6.7%) had heard the message on the radio and 1 (3.3%) had been informed through a relative or friend. Of those who had seen/heard the advertisement, 28 (93.3%) were able to remember the two components of the media message and 2 (6.6%) were unable to remember one or both of the components. Of those who had seen/heard the advertisement, 20 (73.3%) reported decision times of <or= 2hr. Of those who had not seen/heard the advertisement, 7 (50%) reported decision times of <or= 2hr. ($p<0.05$, chi-square = 11.8). Of those who had seen/heard the advertisement, 12 (40%) reported that the message had persuaded them to act sooner than if they had not been exposed to the program, 9 (30%) reported that it had reinforced what they already knew and 9 (30%) reported that it had no effect on their behaviour. Of those who reported that the campaign had caused them to act, 10 (83.3%) reported decision times of <or= 2 hr. ($p<0.05$, chi-square = 21.5). Of those who reported that the campaign did not cause them to act, 3 (33.3%) reported decision times of <or= 2 hr. ($p<0.05$, chi-square =

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
				4.97). Of those who reported that the campaign had reinforced their previous knowledge, all 9 (100%) reported decision times of <or= 2hr. Of persons not exposed to the media campaign, 50% reported decision times of more than two hours and 50% reported decision times of less than two hours. **Cost information** Not stated
Reference, country Ho et al, 1989,[12] USA **Language** English **Authors' objectives** To investigate the effect of a public media education campaign to shorten patient delay and increase use of emergency medical services by patients with cardiac chest pain.	**Intervention content and setting** Public media education campaign in cooperation with the American Heart Association. The media campaign message emphasised the symptoms of an AMI, the importance of acting quickly ("saving time could save your life") and calling 911 to activate the EMS. The message was disseminated in two daily newspapers, three radio stations, and three network television stations targeted at the adult population living in King County and the greater metropolitan Seattle area. **Frequency/duration** There were 18 newspaper inserts and 216 radio spots during a six-week period and 66 television spots during a seven - week period. The radio announcements were spaced throughout the day, whereas the television announcements were clustered during the morning, evening and night news and during prime time. The intervention was presented for 2 months (it began Feb. 16th, 1987) **Duration of outcome measure** Before measurements were taken for 4.5 months (1/10/86 to 15/2/87). Data was collected for 4.5 months after the intervention ceased.	**Inclusion criteria: total sample** Hospitals in King County, Washington with intensive care beds. Eight hospitals were initially included (from October 1, 1986) and a ninth hospital began operation in May 1987, and was included in the surveillance system from that time. **Inclusion criteria: suspected AMI** Patients admitted to the intensive or cardiac care units of one of 9 King County hospitals with intensive care beds with diagnosis of rule-out AMI, chest pain or angina. Such patients were identified from unit logs every two weeks. Excluded from the surveillance were patients admitted for scheduled procedures (e.g. bypass surgery, angioplasty, cardiac catheterisation), patients transferred from non-participating hospitals, and patients transferred from other areas of the hospital (in-hospital rule-out AMI). Patients hospitalised during one time period (pre-message, message or post-message) and interviewed in another were excluded. **<u>Sample size</u>** **Before** 401 **After** 489 **Total** 890 **<u>Participant details</u>** **Before**	**Statistical analyses used** Student's t- (two-sided) and chi-squared tests were used, $p<0.05$ was considered statistically significant. The t-test was used for continuous variables (e.g. age), the chi-squared test was used for categorical variables (e.g. proportion who called 911). **Power calculation** Not stated **Missing data** The telephone interview rates were 48% and 45% respectively. 5% could not be reached despite multiple attempts. The refusal rate for interviews was approximately 25% for both before and after groups.	**Delay time measured** Patient delay time- defined as delay between onset of chest pain and definitive care. **Method of outcome evaluation** Hospital records of patients included in the survey were reviewed for patient demographics, previous cardiac history, symptoms, delay between symptoms and ED arrival, method of transportation, discharge diagnosis, and hospital outcome. (Patients with a discharge diagnosis of AMI had additional information abstracted, including hospital treatment, complications, results of cardiac enzymes, and interpretations of ECGs). A letter requesting permission for a telephone interview was sent to all surveillance patients who lived in King County and did not reside in a retirement home, nursing home, or other extended care facility. For deceased patients, the next of kin was contacted. A 10 minute interview was conducted with the patient or spouse (or significant other) at four to eight weeks after hospitalisation to determine circumstances related to the event leading to the hospitalisation (e.g. symptoms, actions taken, demographic information), whether the interviewee had heard any information on heart attacks and, if affirmative, the source and type of information. **<u>Delay time</u>** **Delay time before** Patient delay time (hr.) Number (%) 0-2 143 (35.7) 2-4 86 (21.4) 4-6 38 (9.5) 6 + 134 (33.4) Total no of patients with confirmed AMI (n=135 (33.7%)): Patient delay time (hr.) Number (%) 0<2 57 (42.2) 2<4 28 (20.7) 4<6 11 (8.1) 6 + 39 (28.9) Median patient delay time for confirmed AMI patients only: 2.6 hr. **Delay time after** Patient delay time (hr.) Number (%) 0<2 180 (36.8)

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
		Age: mean 63.2 yr. Gender: 57.1% men History of MI or angina: 51.9% Confirmed AMI: 33.7% **After** Age: mean 62.3 Gender: 58.7% men History of MI or angina: 43.1%* Confirmed AMI: 25.2%* (* indicate significant differences between before and after groups) **Total** Not stated		2<4 104 (21.3) 4<6 40 (8.2) 6 + 165 (33.7) Differences between pre and post groups were not significant. Total no of patients with confirmed AMI (n=123 (25.2%)): Patient delay time(hr.) Number (%) 0<2 52 (42.3) 2<4 21 (17.1) 4<6 9 (7.3) 6 + 41 (33.3) Median patient delay time for confirmed AMI patients only: 2.3 hr. When stratified by discharge diagnosis of AMI, patient delay time remained non-significant between the periods. **<u>Medical services</u>** **Use of medical services before** Number (%) using medic transport: 163 (42.0%) Number (%) with confirmed AMI using medic transport: 65 (49.6%) **Use of medical services after** Number (%) using medic transport: 196 (43.7%) Differences between pre and post groups were not significant. Number (%) with confirmed AMI using medic transport: 58 (50.4%) When stratified by discharge diagnosis of AMI, EMS use remained non-significant between the periods. **<u>Other outcomes</u>** **Other outcomes before** Not stated **Other outcomes after** Not stated **Process outcomes** Significantly more patients in the post-message period (n=358, 73.2%) than the pre-message period (n=204, 50.9%) had heard new information about AMI (p=0.0001). Of those who reported hearing new information, significantly more people in the post-message period (n=194, 54.2%) than the pre-message period (n=77; 37.7%) reported hearing one of the components of the message, symptoms of a heart attack (p=0.002). When limited to only patients hearing one of the key components of the message from one of the media sources used in the campaign, the difference remained significant. There was no significant difference between pre-message period and post-message period in the proportion of patients who reported hearing the importance of time or of calling 911. There was also no significant difference between the two periods in the reported source of new information (television, radio or newsprint).

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
				Cost information Total cost of the campaign: $139, 272.
Reference, country Moses et al, 1991,[15] USA **Language** English **Authors' objectives** To determine whether a public education campaign would improve the public's ability to recognise symptoms of an AMI and seek prompt medical attention, thereby reducing delay between onset of symptoms and hospital presentation.	**Intervention content and setting** Public education campaign consisting of patient education brochures, television advertisements, public talks, posters and radio spots. The program explained the warning signs of a heart attack and the need to seek prompt medical attention if they occurred. The setting was one hospital in Jacksonville, a town in rural central Illinois. **Frequency/duration** The intervention duration was 2 years. The program consisted of 800 brochures distributed, 15500 brochures mailed, 50 posters displayed at local businesses and in hospital lobbies, 23 television spots (2 television stations), 358 radio spots (4 radio stations), 426 public service announcements (3 radio stations), 42 newspaper spots (5 newspapers), 4 radio talk shows, 2 public speaking engagements and 1 article in senior citizen publication. Radio public service announcements were aired at low-priority listening times. Paid media spots were concentrated at high-priority times. After an initial heavy thrust during the first two months, the messages were staggered throughout the remainder of the campaign. **Duration of outcome measure** Before measurements were taken for 1 year and then measurements were taken for 2 years during the campaign, itself.	**Inclusion criteria: total sample** People living in Jacksonville with one hospital serving a population of 26000 in town and a total population of 55000. **Inclusion criteria: suspected AMI** Persons reporting to the emergency department with 1 or more of 80 selected complaints suggestive of AMI, for example, chest pain, angina, neck pain. **Sample size** **Before** 500 **After** 668 for1st yr., 625 for 2nd yr. **Total** 1793 **Participant details** **Before** Age: mean 57 yr. Gender: 45% men. **After** Age: mean 55 yr. During 1st year: Gender: 45% men. During 2nd year: Gender: 45% men. **Total** Diagnosis of angina: 24%. Diagnosis of MI: 11% Diagnosis of non-cardiac chest pain: 65%	**Statistical analyses used** Not stated **Power calculation** Not stated **Missing data** Not stated	**Delay time measured** Pre-hospital delay time- defined as delay between onset of symptoms to emergency room arrival. **Method of outcome evaluation** Baseline data were gathered from a retrospective review of emergency department charts. Emergency department patient charts were reviewed weekly during the two years of the campaign. **Delay time** **Delay time before** Pre-hospital delay time: discharge diagnosis angina (n=114): mean 204 min., median 103 min. discharge diagnosis MI (n=66): mean 217 min., median 103 min. discharge diagnosis non-cardiac chest pain (n=320): mean 248 min., median 125 min. **Delay time after** During: Pre hospital delay time: 1st year after: discharge diagnosis angina (n=168): mean 176 min., median 103 min. discharge diagnosis MI (n=67): mean 252 min., median 103 min. discharge diagnosis non-cardiac chest pain (n=433): mean 248 min., median 108 min 2nd year after: discharge diagnosis angina (n=144): mean 234 min., median 117 min. discharge diagnosis MI (n=66): mean 175 min., median 112 min. discharge diagnosis non-cardiac chest pain (n=415): mean 239 min., median 120 min Numerous subgroups of patients with angina or AMI were categorised by age, sex, or presentation to the emergency department in < or > 6 hours after onset of pain. No significant earlier presentation was found. **Medical services** **Use of medical services before** Not stated **Use of medical services after** During: The small increase in number of emergency department visits during the 3-year study was not statistically significant **Other outcomes**

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
				Other outcomes before Not stated **Other outcomes after** During: The percentage of the study population that resulted in non-cardiac complaints increased 26% from baseline during the study period. **Process outcomes** Not stated **Cost information** Total cost of the 1-year campaign: $10 000. The campaign continued for a second year using the same media avenues donated at no extra cost.
Reference, country Rustige et al, 1992,[16] Germany **Language** German **Authors' objectives** To reduce patient decision time by means of intensive education of patients and physicians.	**Intervention content and setting** Intensive educational programme using mass media. The main message of the media programme was: When experiencing heavy pains, tightness of the chest or severe pressure on the chest, don't wait but call the doctor immediately. A further educational programme focused on local and super-regional media (TV, radio and newspapers) and transmitting organisations (clubs, self help groups, primary care practices and businesses/companies). The intervention was set in Germany- Ludwigshafen (3 hospitals) and Frankenthal (1 hospital) **Frequency/duration** 9 months (7/89 to 3/90) for the intensive educational programme and 18 months (10/90 to 3/92) for the further programme. **Duration of outcome measure** Before measurements lasted 6 months (1/89 to 6/89). Measures were then taken during the 9 months of the intensive educational programme, after this programme had finished for 6 months, and during the 18 months of the further programme.	**Inclusion criteria: total sample** Not stated **Inclusion criteria: suspected AMI** Patients admitted to participating hospitals diagnosed with acute chest pain. Those diagnosed with cardiac infarction and available for an interview to establish the pre-hospital time and the time between hospital admission and thrombolysis were included in the study. **Sample size** **Before** 203 **After** 466 **Total** 669 **Participant details** **Before** Gender: 66% men (mean age 61 yr.), 34% women (mean age 68 yr.) Definite AMI: 38% **After** Not stated **Total** Not stated	**Statistical analyses used** Not stated **Power calculation** Not stated **Missing data** 669 patients with acute cardiac infarction were recorded. The pre-hospital time could be established for 619 (92.5%) of these.	**Delay time measured** Pre-hospital delay time- this was not defined. **Method of outcome evaluation** Pre-hospital delay was assessed by means of interview asking patients: start time of chest pains, time the doctor was notified, transport time, and start of treatment. No details on how interviewees were contacted were reported. **Delay time** **Delay time before** Median pre-hospital delay time: 4.2 hr. **Delay time after** Median pre-hospital time: 1990: 2.8 hr. 1991: 4.1 hr. 1992: 3.0 hr. **Medical services** **Use of medical services before** Not stated **Use of medical services after** Not stated **Other outcomes** **Other outcomes before** % of patients with cardiac infarction who received thrombolysis therapy: 27% (whole year 1989) **Other outcomes after** % of patients with cardiac infarction who received thrombolysis therapy: 1990: 38% 1991: 47%

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
				1992: 51% (first 3 months) **Process outcomes** Not stated **Cost information** Not stated
Reference, country Bett et al, 1993,[9] Australia **Language** English **Authors' objectives** To evaluate the effect of the National Heart Foundation (NHF) of Australia's Heart Week campaign, which was directed towards encouraging those with symptoms of possible myocardial infarction to seek help as promptly as possible.	**Intervention content and setting** Public education campaign and professional education. The NHF repeated messages about the importance of preventing sudden death by early transport to hospital following the onset of suspected myocardial infarction, and stressed recent developments such as the benefits of coronary thrombosis. They emphasised the findings of the GISSI and ISIS trials (that hospital mortality rate was reduced substantially in patients who were treated early after the onset of symptoms) and the Australasian studies on the preservation of left ventricular function with early thrombolysis. Media briefing: a paper on the need to respond urgently to symptoms of suspected heart attack and the positive experience with thrombolytic therapy was distributed to media representatives. Campaign launch: the campaign was launched by the Governor General of Australia at the Sydney Opera House. The event included the simulated rescue of a heart attack victim from an Island in Sydney Harbour. A helicopter, water police and ambulance services were used to transport the "victim" rapidly to hospital. Similar events took place in other states. Media coverage: the theme "when it's heart attack, every minute counts" was promoted in television news and current affairs shows, radio news bulletins and talk back shows. Newspapers carried approximately 100 stories including several full page features. Thirteen magazines included articles on the heart week theme and several of them ran competitions related to heart health. A	**Inclusion criteria: total sample** Not stated **Inclusion criteria: suspected AMI** Patients admitted to 22 CCU's with chest pain. **Sample size** **Before** 335 (1st survey), 221 (2nd survey) **After** 253 **Total** 809 **Participant details** **Before** Characteristics of survey 1 and 2 respectively: Age: mean (+/- SEM) 62.0 (+/- 0.6) yr., 60.4 (+/- 0.8) yr. Gender: 68% men, 62% men. Myocardial infarction: 45%, 41%. Angina: 47%, 48%. Previous CCU admission: 40%, 30%. Previous myocardial infarction: 37%, 24%. **After** Age: mean 62.3 yr. Gender: 64% men. Myocardial infarction: 52%. Angina: 38%. Previous CCU admission: 38%. Previous myocardial infarction: 29%. **Total** Diagnosis of angina: 44% Diagnosis of MI: 46% Previous MI: 31% Previous CCU admission: 37%	**Statistical analyses used** Graphs were drawn of the number of patients seeking help each half hour after the onset of symptoms (bars) and cumulative percentage (line plots) with 95% confidence intervals (dotted lines) of those who had sought help at these times. A graph was drawn for each of the following: all admissions, 1988 survey, first 1989 survey and second 1989 survey. **Power calculation** Not stated **Missing data** Data were collected on 1402 admissions and information on patient delay was available for 809 of these.	**Delay time measured** Patient delay time- defined as time from onset of symptoms to first seeking help. **Method of outcome evaluation** CCU nurses questioned patients admitted with chest pain and recorded age, sex, hospital diagnosis and any history of previous MI or of admission to a CCU. They also recorded the times of the onset of symptoms precipitating admission and the first attempt to get help. During the third survey patients in five of the hospitals (n= 253) were asked why they delayed, whether they were aware of the campaign, and whether this had influenced their decision to seek help when they did. **Delay time** **Delay time before** Median patient delay time: 1st survey: 1.6 hr. 2nd survey: 1.0 hr. Patient delay time (hr.) % 1st survey: <1 38 <2 54 <4 69 <6 77 2nd survey <1 42 <2 61 <4 73 <6 78 **Delay time after** Median patient delay time: 1.0 hr. Patient delay time (hr.) % <1 45 <2 62 <4 73 <6 81 **Medical services**

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
	popular television series (A Country Practice) included two episodes in which the heroine suffered a heart attack and required urgent thrombolytic therapy. Advertising: almost all commercial radio stations broadcast a commercial on the theme at peak times during the week. Advertising appeared on trams and buses, and banners were prominently displayed in most capital cities. A national supermarket chain reproduced the heart week message on 24 million shopping bags. One million leaflets, 50 000 car stickers, professional papers and posters for ambulance organisations, libraries, pharmacies, general practitioners and community health centers were distributed. Educational activities: community displays, usually in association with local ambulance services, were conducted in shopping centres and schools and during sporting events in each state. Professional Education: hospitals were notified that more patients with chest pain might present to emergency departments and place some strain on CCU beds. Ambulance services were given professional papers for their staff, which described the advances in the treatment of heart attack. In most states, seminars brought together ambulance officers, emergency department and CCU staff to help in the co-ordination of emergency treatment of heart attack. All general practitioners in Australia received posters and literature to display in their waiting rooms, professional papers on developments in the treatment of heart attack and guidelines for thrombolytic therapy and were invited to seminars in capital cities and regional centres. **Frequency/duration** The intervention lasted 1 week in 1989.			**Use of medical services before** Not stated **Use of medical services after** Not stated. **<u>Other outcomes</u>** **Other outcomes before** % of those with MI given fibrinolysis: 1st survey: 30.6% 2nd survey: 34.4% **Other outcomes after** % of those with MI given fibrinolysis: 53.1% ($p<0.0001$, chi-square=24.2) **Process outcomes** 72% had been aware of the campaign, but for them the median delay (one-hour) was the same as it was for those who had been unaware of it. 42% stated that they had been influenced by the campaign in their decision to seek help, but even for them the median delay was one hour, and for those with a past history of MI it was 1.3 hours. **Cost information** Not stated

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
	Duration of outcome measure Three surveys were conducted and each lasted one month. The first was in1988 (6 months before), the second preceded (1 month before) and the third followed (1 month after) Heart week			
Reference, country Blohm et al, 1994,[10] Sweden **Language** English **Authors' objectives** To reduce delay times and increase ambulance use in patients with acute chest pain in order to improve the prognosis in patients with AMI by instituting early treatment.	**Intervention content and setting** Media campaign, which started with a 3-week intensive phase, followed by a maintenance phase. The message stated that for chest pain lasting more than 15 minutes, immediately dial 90 000 for ambulance transport to hospital because it might indicate AMI. A slogan, 'Heart-pain-90 000' was used. (In Sweden, it translates as 'Hjarta-Smarta-90 000', which has a more emotional and rhythmic sound, often used in popular song lyrics.) During the initial intensive phase radio, newspaper, bus/tram, pillar, local district clinic, hospital, pharmacy, post office and bank were simultaneously used. During the maintenance phase, the message was repeated in the following months of the campaign period: radio- not repeated, newspaper- months 2, 3,4, 11, 12, bus/tram- months 2, 3, 4, 8, 9, 10, pillar- month 3, local district clinic- all months (i.e. 2-12), hospital- all months (i.e. 2-12), pharmacy- all months (i.e. 2-12), post office- months 2,11, bank- months 2, 5, 6, 12, and household distributed leaflet- months 4, 7, 11. Articles about AMI were written in the main local newspaper in Goteborg with 4-month intervals, but advertisements in the newspaper appeared more often. Television, the most effective media in Sweden, was not used, because of costs and lack of interest among the industry. There is no information on intervention content for the last two months of the campaign. The departments of medicine in the two city hospitals took an active part in the campaign. Thus all patients admitted to the coronary care unit were given a leaflet in which not only the 'Heart-	**Inclusion criteria: total sample** Individuals living in Goteborg, Sweden. **Inclusion criteria: suspected AMI** All patients arriving in the CCU of Sahlgrenska Hospital, Goteborg, Sweden between 2/86 and 12/91 who developed AMI during the first 3 days in hospital. At least two of the following three criteria had to be fulfilled for AMI: chest pain lasting for at least 15 minutes; appearance of Q-waves in at least two leads on a 12-lead standard electrocardiogram; or serum enzyme activity above the normal range in at least two consecutive samples of either aspartate aminotransferase or creatine kinase. **<u>Sample size</u>** **Before** 768 **After** 496 during, 1053 after **Total** 2317 **<u>Participant details</u>** **Before** Age: median 70 yr., range 24-101 yr. Gender: 70% men. History of cardiovascular diseases: MI: 29% Angina pectoris: 46% Hypertension: 36% Diabetes mellitus: 12% **After** <u>During:</u> Age: median 72 yr., range 35-97yr.	**Statistical analyses used** Fisher's permutation test was used to test for differences between the periods before and after the campaign. All p-values were 2-sided and not corrected for multiple comparisons. **Power calculation** Not stated **Missing data** Information on delay time was not available in 1% of the patients before the campaign, in 6% of the patients during the campaign, and in 16% of the patients after the campaign. Among AMI patients in the CCU, information on delay time was missing in 2% before, and 7% during the campaign.	**Delay time measured** Pre-hospital delay time- defined as delay time between onset of symptoms and arrival in hospital. **Method of outcome evaluation** Within 24 hours after arrival in the CCU, the patients were asked about the delay time between onset of pain and arrival in hospital, and whether they were transported to hospital by ambulance or not. Information about time of onset of symptoms was recorded by research personnel or doctors and nurses on duty. Information about the time of arrival in hospital was always available in hospital records. Information on survival was obtained from the Swedish National Registry of Deaths. In patients transported by ambulance during 1 year prior to, and during the campaign who developed AMI, the time between onset of symptoms and the call for the ambulance, as well as the ambulance transport time were retrospectively collected from the paramedic case record forms. **<u>Delay time</u>** **Delay time before** Median pre-hospital delay time: All patients: 3hr. Men: 2hr. 40min. Women: 3hr. 30min. <70 yr. old: 2hr. 30min. >70 yr. old: 3hr. 30min. Previous AMI or angina pectoris: 3hr. 0min. No previous AMI or angina pectoris: 3hr. 0min. % of patients with delay time <2 hr.: 40% Median pre-hospital delay time: all CCU patients only with suspected AMI: 3hr. (n=2142), all CCU patients with confirmed AMI: 3hr. (n=768) all hospital wards including CCU patients, with suspected AMI: 4.0hr. (n=3308) all hospital wards including CCU patients, with confirmed AMI: 3.10hr. (n=908) % of AMI patients in CCU arriving in hospital <or=3 hrs: 51% Median pre-hospital delay time in patients admitted to CCU: patients with previous history of MI or angina pectoris: 3.0hr. (n=1411)

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
	Pain-90 000' message was included, but also a careful description of AMI and the potential advantages of early intervention. **Frequency/duration** The intervention duration was 14 months (11/87 to 12/88). **Duration of outcome measure** Before measurements were taken for 21 months (2/86 to 10/87). Measurements were then taken for 14 months during the campaign (11/87 to 12/88) and 36 months after the campaign had ceased (1/89 to 12/91).	Gender: 64% men. History of cardiovascular diseases: MI: 31 Angina pectoris: 41% Hypertension: 30% Diabetes mellitus: 10% <u>After:</u> Age: median 72 yr., range 26-97 yr.* Gender: 67% men. History of cardiovascular diseases: MI: 32% Angina pectoris: 41%* Hypertension: 33% Diabetes mellitus: 17%* (*p-values indicate significant differences between before and after groups) **Total** Not stated		patients with no previous history of MI or angina pectoris: 3.0hr. (n=7310) patients with previous history of MI, angina pectoris, congestive heart failure, hypertension or diabetes mellitus: 3.0hr. (n=1687) patients with no previous history of MI, angina pectoris, congestive heart failure, hypertension or diabetes mellitus: 3.05hr. (n=455) age <or=60 yr.: 3.0hr. (n=581) age 60-75 yr.: 3.0hr. (n=971) age >75 yr.: 3.30hr. (n=560) gender male: 3.0hr. (n=1430) gender female: 3.10hr. (n=712) patients with large AMI: 2.43hr. (n=390) patients with small AMI: 3.20hr. (n=377) Patients with AMI admitted to Sahlgrenska Hospital through the emergency room: median pre-hospital delay: 3hr. pre-hospital delay time(hr.) % <3 50 <6 67 <12 80 <24 88 % of patients showing ST elevation in ECG on admission: pre-hospital delay time(hr.) % <3 22 <6 30 <12 34 <24 37 **Delay time after** <u>During:</u> Median pre-hospital delay time: All patients: 2hr. 20min. Men: 2hr. 15min. Women: 2hr. 45min. <70 yr. old: 2hr. 0min. >70 yr. old: 2hr. 50min. Previous AMI or angina pectoris: 2hr. 35min. No previous AMI or angina pectoris: 2hr. 18min. % of patients with delay time <2 hrs: 45% This percentage remained at a similar level during the 3 years thereafter. Median pre-hospital delay time: all CCU patients only with suspected AMI: 2.40hr. (n=1184), p<0.001. all CCU patients with confirmed AMI: 2.20hr. (n=496), p<0.001. all hospital wards including CCU patients, with suspected AMI: 2.45hr. (n=1511), p<0.001. all hospital wards including CCU patients, with confirmed AMI: 2.25hr. (n=554), p<0.001.

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
				(Pitman's non-parametric test was used.) % of AMI patients in CCU arriving in hospital <or=3 hrs: 58% (p<0.05) (Pitman's non-parametric test was used.) Median pre-hospital delay time in patients admitted to CCU: patients with previous history of MI or angina pectoris: 2.45hr. (n=702), p<0.001. patients with no previous history of MI or angina pectoris: 2.35hr. (n=482), p<0.05. patients with previous history of MI, angina pectoris, congestive heart failure, hypertension or diabetes mellitus: 2.45hr. (n=867), p<0.001. patients with no previous history of MI, angina pectoris, congestive heart failure, hypertension or diabetes mellitus: 2.20hr. (n=317), p<0.05. age <or=60 yr.: 2.42hr. (n=290), p<0.01. age 60-75 yr.: 2.40hr. (n=528), p<0.001. age >75 yr.: 3.0hr. (n=326), p<0.01. gender male: 2.40hr. (n=733), p<0.001. gender female: 2.40hr. (n=420), p<0.01. patients with large AMI: 2.0hr. (n=220), p<0.001. patients with small AMI: 2.40hr. (n=261), p<0.05. (Pitman's non-parametric test was used.) Patients with AMI admitted to Sahlgrenska Hospital through the emergency room: median pre-hospital delay: 2hr. 20min. (p<0.001). pre-hospital delay time(hr.) % <3 57 (p<0.01) <6 74 (p<0.01) <12 89 (p<0.001) <24 96 (p<0.001) % of patients showing ST elevation in ECG on admission: pre-hospital delay time(hr.) % <3 29 (p<0.01) <6 36 (p<0.05) <12 39 (p>0.05) <24 42 (p<0.05) (Pitman's non-parametric test was used.) Median pre-hospital delay time for all patients admitted to a CCU during the campaign who had heard of the campaign: 2hr. 28min. Median pre-hospital delay time for all patients admitted to a CCU during the campaign who had not heard of the campaign: 2hr. 48 min. (p<0.05) Median delay time for patients with confirmed AMI who had heard of the campaign: 2hr. 10min. Median delay time for patients with confirmed AMI who had not heard of the campaign: 2hr. 45min. (p<0.01) (Pitman's non-parametric test was used.)

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
				<u>After:</u> Median pre-hospital delay times: All patients: 2hr. 20min. (p<0.001). Men: 2hr. 10min. (p<0.001). Women: 2hr. 45min. (p<0.05). <70 yr. old: 2hr. 0min. (p<0.01). >70 yr. old: 2hr. 50min. (p<0.001). Previous AMI or angina pectoris: 2hr. 30min. (p<0.01). No previous AMI or angina pectoris: 2hr. 10min. (p<0.001). (p-values are for before versus after the campaign.) % of patients with delay time <2 hrs: this remained at a similar level to that during the campaign. **<u>Medical services</u>** **Use of medical services before** % of patients who developed MI and used an ambulance service: 61% Number of patients with chest pain per day in the emergency department: 10 +/- 0.1. **Use of medical services after** <u>During:</u> % of patients who developed MI and used an ambulance service: 64% (p>0.2) <u>After:</u> % of patients who developed MI and used an ambulance service: 60% **<u>Other outcomes</u>** **Other outcomes before** % (number) of patients with 1-year mortality rate: All patients: 25% (766). <70 yr. old: 15% (397). Pre-hospital delay time for all such patients: pre-hospital delay (hr.) % (number) <2 22 (306) 2-4 25 (148) >4 28 (302) Pre-hospital delay time of such patients <70 yr. old: pre-hospital delay (hr.) % (number) <2 12 (180) 2-4 17 (76) >4 17 (139) Number of patients with chest pain appearing in the emergency department: 4407 Patients with AMI admitted to Sahlgrenska Hospital through the emergency room:

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
				% (number) in-hospital mortality: all patients: 14% (919) patients <75 yr.: 10% (555) all CCU patients: 13% (777) CCU patients <75 yr.: 8% (513) % (number) 1-year mortality: all patients: 29% (905) patients <75 yr.: 19% (546) all CCU patients: 26% (766) CCU patients <75 yr.: 17% (505) **Other outcomes after** <u>During:</u> % (number) of patients with 1-year mortality rate: All patients 25% (525) <70 yr. old: 16% (242). Pre-hospital delay time for all such patients: pre-hospital delay (hr.) % (number) <2 20 (216) 2-4 28 (96) >4 26 (175) Pre-hospital delay time of such patients <70 yr. old: pre-hospital delay (hr.) % (number) <2 14 (118) 2-4 16 (38) >4 16 (68) Number of patients with chest pain appearing in the emergency department: 4805 Patients with AMI admitted to Sahlgrenska Hospital through the emergency room: % (number) in-hospital mortality: all patients: 13% (632) patients <75 yr.: 9% (352) all CCU patients: 11% (529) CCU patients <75 yr.: 8% (323) % (number) 1-year mortality: all patients: 28% (632) patients <75 yr.: 18% (352) all CCU patients: 25% (529) CCU patients <75 yr.: 18% (323) <u>After:</u> % (number) of patients with 1-year mortality rate: All patients: 25% (809). <70 yr. old: 13% (355). Pre-hospital delay time for all such patients: pre-hospital delay (hr.) % (number) <2 20 (313) 2-4 27 (153) >4 22(214)

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
				Pre-hospital delay time of such patients <70 yr. old: pre-hospital delay (hr.) % (number) <2 10 (153) 2-4 14 (65) >4 12 (96) When separately analysing patients who were less than 70 years of age, there was a weak tendency indicating at lower mortality during the 3 years after the campaign. This trend was not more marked among patients who arrived less than 2 hours after onset of pain. **Process outcomes** On two occasions (May 1988 and November 1988) 400 and 610 persons were interviewed by telephone via a telemarketing company. Persons were chosen at random via Goteborg's official telephone list according to a procedure routinely used in telemarketing evaluations. This evaluation was not planned before the start of the campaign. 60% and 71% of the persons, respectively, reported that they had heard of 'Heart_Pain_90 000'. The messages that reached the most people were those on the poster advertisements on buses and trams and the articles and advertisements in newspapers. Only 46% and 58%, respectively, thought that they could interpret the campaign. Of those who thought that they could interpret the message of the campaign, 31% and 33%, respectively, spontaneously remembered all parts of the message at the two evaluations. They comprised 15% and 19%, respectively, of all those who were interviewed. More than 80% of the persons who had heard of the message thought that the campaign was useful, whereas 1% were frightened by it or uninterested. On one occasion- October 1988- an advertisement in the main daily newspaper in Goteborg was evaluated 2 days after it appeared by interviewers from a special evaluation company. 180 persons chosen at random were interviewed on the street. This evaluation was not planned before the start of the campaign. Among the 180 persons who had read the newspaper, 52% had seen the advertisement. Of all persons 47% had read the headline, 27% had read some of the text under the headline, and 16% had read all the text. 95% thought it was good and 3% reacted negatively. During the campaign 1366 patients with suspected AMI were admitted to the coronary care unit in Sahlgrenska Hospital. 1065 (78%) of these were interviewed. This evaluation was designed before the start of the campaign. Of those interviewed 65% had heard of 'Heart_Pain_90 000' but only 31% of those who had heard of it thought that the campaign influenced them to come faster to the hospital. Of those interviewed, the percentage of patients being aware of the campaign via various media was as follows (Media type (%)): newspaper (46), bus/tram (45) , hospital (25), radio (11), pharmacy (11), post office (5), bank (4). The percentage of patients (N=1058) aware of the campaign during various periods of the campaign is as follows (Time quartile (%)): 1 (58), 2 (69), 3 (67), 4 (67). Among all patients admitted to a CCU during the campaign those who

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
				had heard of Heart-pain-90 000 had a median delay time of 2 hr. 28 min. as compared with 2 hr. 48 min. in those who had not heard of it ($p<0.05$). Among patients with confirmed AMI, the median delay time was 2hr. 10 min. for those having heard of the campaign versus 2 hr. 45 min. for those who had not ($p<0.01$) **Cost information** The costs for the campaign were as follows: total cost of printing advertisement material: $54 000, advertisements on buses and trams: $160 000, advertisements on pillars: $35 000, advertisements in newspapers: $105 000, household distributed leaflets: $40 000, salary for nurse: $18 000. Total cost of campaign: $ 412000. In summary $54 000 was spent on printing and $358 000 on distribution of material.
Reference, country Gaspoz et al, 1996,[11] Switzerland **Language** English **Authors' objectives** To decrease pre-hospital delay in patients with chest pain.	**Intervention content and setting** Multimedia public campaign with the slogan 'Heart attack? Every minute counts! Call 144!' The campaign focused on chest pain, AMI and thrombolysis, and importance of calling 144 to send physician staffed mobile intensive care unit. TV, radio, newspapers, posters and widely distributed leaflets (including to health and social care professionals) were used. The setting was in the Canton of Geneva, which is an urban area (282 km squared) of Switzerland. **Frequency/duration** The intervention lasted 12 months (5/92 to 4/93). Information on chest pain, AMI, and thrombolysis, was broadcast on the midday and evening news of the public speaking part of Switzerland on day 1 and six months later. Four 30 minute TV shows were also showed three and five months later, and a 30 second cartoon on chest pain, ending with a special logo for the campaign, was broadcast on TV 14 times per month for 12 months. The public radio of the French speaking part of Switzerland broadcasted information during the midday and evening news on day 1 and 6 months later, and there was a 45min programme on the campaign on day 1. Private radio broadcast 30 second messages six times a day during three separate weeks, six	**Inclusion criteria: total sample** People living in the Canton of Geneva. **Inclusion criteria: suspected AMI** People presenting with chest pain to the emergency department at the university hospital of canton. **Sample size** **Before** 1100 **After** 1295 **Total** 2395 **Participant details** **Before** Gender: 63% men. Age: mean 62 yr., SD 16. Hypertension: 38% Diabetes: 15% Previous MI: 24% Past history angina: 22% Past PTCA/CABG: 14% Typical chest pain: 66% **After** Gender: 61% men. Age: mean 64 yr.*, SD 16. Hypertension: 42%* Diabetes: 15% Previous MI: 22% Past history angina: 27%*	**Statistical analyses used** Chi square test was used to compare categorical variables and student's t-test for continuous variables. Time intervals were not normally distributed and were therefore analysed by Wilcoxon rank sum test. All tests were two-sided, and were regarded as significant if $p<0.05$. **Power calculation** Not stated **Missing data** Detailed information on pre-hospital delay was available for 96.5% of patients before the campaign and for 96.9% of patients during the campaign period.	**Delay time measured** Pre-hospital delay time- defined as time from onset of symptoms to arrival at hospital. Patient delay- defined as time from onset of symptoms to alert. **Method of outcome evaluation** Data were prospectively collected by research nurses through interviews with the patients or their relatives; review of the medical, nursing, and administrative records; review of the records of the central switchboard for medical emergencies and of ambulance companies; and through information obtained from the private services that dealt with emergency home medical visits. **Delay time** **Delay time before** Pre-hospital delay time: mean 7 hr. 50 min. (SEM=30), median 180 min. Patient delay time: mean 4 hr. 47 min. (SEM=21), median 86.5 min. Pre-hospital delay time: AMI (n=309): mean 9 hr. 10 min. (SEM=67), median 195 min. Unstable angina (n=257): mean 7 hr. 52 min. (SEM=51), median 200 min. Other cardiac diseases (n=164): mean 8 hr. 21 min. (SEM=116), median 150 min. Other non-cardiac services (n=370): mean 6 hr. 27 min. (SEM=34), median 169.5 min. Age <75 years: Men (n=574): mean 8 hr. 16 min.(SEM=50), median 168 min. Women (n=228): mean 6 hr. 26 min. (SEM=45), median 165 min. Age >or=75 years: Men (n=123): mean 6 hr. 58 min. (SEM=49), median 220 min. Women (n=175): mean 8 hr. 48 min. (SEM=71), median = 201 min. **Delay time after** During: Pre-hospital delay time:

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
	months after the beginning of the campaign. A press conference with the minister of health of the canton was held on day 1. This was widely reported in the newspapers. Advertisements carrying the logo of the campaign and its slogan appeared in the newspaper twice a week for 12 months. Posters were put up on the streets and on buses and trams for seven two week periods. Leaflets were distributed to households living outside the town, to all senior citizens, and to all state and town employees with one of their pay-cheques, to patients and visitors at the hospital for 12 months, in all post offices and pharmacies in the canton, and in the major supermarkets for two periods of two weeks. Leaflets were distributed to all patients admitted to the hospital for suspected AMI and to all patients following rehabilitation programmes after an AMI. They were mailed to all out-of-hospital public and private nursing services and to all medical practitioners, those who lecture to paramedics, policemen, and private hospital physicians. **Duration of outcome measure** Before measurements were taken for 12 months and then measurements were taken during the 12 months of the campaign.	Past PTCA/CABG: 15% Typical chest pain: 61%* (* indicate significant differences between before and after groups) **Total** Not stated		mean 4 hr. 54 min. (SEM=10), median 155 min. The mean and median pre-hospital delays were significantly reduced during the campaign by 2hr. 56min. and 25 min. respectively (p<0.001). Patient delay time: mean 3 hr. 02 min. (SEM=10 min), median 60 min. (p<0.001). Pre-hospital delay time: AMI (n=341): mean 5 hr. 10 min. (SEM=21), median 155 min. Unstable angina (n=327): mean 4 hr. 46 min. (SEM=20), median 160 min. Other cardiac diseases (n=225): mean 4 hr. 27 min. (SEM=21 min), median = 150 min. Other non-cardiac services (n=402): mean 5 hr. 01 min. (SEM=20), median 150 min. Age <75 years: Men (n=638): mean 4 hr. 49 min. (SEM=16), median = 139.5 min. Women (n=253): mean 5 hr. 14 min. (SEM=26), median = 165 min. Age >or=75 years: Men (n=157): mean 4 hr. 26 min (SEM=20), median = 150 min. Women (n=247): mean 5 hr. 04 min. (SEM=23), median = 189 min. **<u>Medical services</u>** **Use of medical services before** Number (%) calling switchboard for medical emergencies as the first alert: 138 (13%). Number (%) coming to hospital by ambulance: 563 (51%). Mean number of visits per week to the emergency department for chest pain: 22.2 **Use of medical services after** <u>During:</u> Number (%) calling switchboard for medical emergencies as the first alert: 256 (20%), p<0.001. Number (%) coming to hospital by ambulance: 684 (53%), NS. Mean number of visits per week to the emergency department for chest pain: 49, p<0.01. This increase in emergency department visits remained significant at six and 12 months. The increase of emergency department visits for chest pain during the first week was the result of a more that twofold increase in visits for AMI and unstable angina (p<0.01) and visits for chest pain of non-cardiac origin (p<0.05). Visits due to cardiac diseases other than AMI and unstable angina increased only slightly (NS). At six and 12 months the increase in emergency department visits per week for AMI and unstable angina was still significant, whereas it was not significant for visits owing to non-cardiac chest pain. **<u>Other outcomes</u>** **Other outcomes before** Not stated

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
				Other outcomes after Not stated **Process outcomes** Not stated **Cost information** Costs related to the campaign itself (TV, radio, newspaper advertisements, posters, and leaflets) totalled 300,000 Swiss Francs (£150,000).
Reference, country Maeso-Madronero et al, 2000,[13] Germany **Language** German **Authors' objectives** To initiate a media campaign to reduce pre-hospital delay time.	**Intervention content and setting** A media campaign was initiated with decentralised autonomy for the participation partners in communities and counties. Local press, local radio and television as well as telephone actions, local 'Emergency-Days' or 'Cardiovascular Days', seminars and lectures in schools, companies and sport clubs were used for information transmission. Also information brochures and posters in primary care practices, pharmacies and public places were used. No information on the content of the campaign was presented. The setting was 36 towns of the district of Arnsberg, Germany. The emergency units of 48 corresponding community hospitals took part. **Frequency/duration** The intervention lasted 6 months (1/7/94 to 31/12/94). **Duration of outcome measure** Between 1-1-1994 and 31-12-1997 patients with suspected AMI were recorded in 48 participating hospitals. Before measurements were taken for 6 months (1/1/94 to 30/6/94). Measurements were then taken for 6 months during the campaign.	**Inclusion criteria: total sample** Residents of the district of Arnsberg, Germany. **Inclusion criteria: suspected AMI** Patients with suspected AMI. **Sample size** **Before** 412 **After** 259 **Total** 671 **Participant details** **Before** Age: mean 67.2 yr., SD 12.4 yr. Gender: 35.55% women. Known coronary heart disease: 40.5% Past cardiac infarction: 27.2% Diagnosed with acute cardiac infarction: 60.9%. **After** Age: mean 67.3 yr., SD 12.2 yr. Gender: 37.0% women. Known coronary heart disease: 51.4%*. Past cardiac infarction: 27.0%. Diagnosed with acute cardiac infarction: 45.2%* (* indicate significant differences between before and after groups) **Total** Not stated	**Statistical analyses used** Pre-hospital times were compared for the before and after groups using the Mann-Whitney U-test (skewed data). T-tests for independent samples were used for other comparisons. Chi-square tests were used for categorical data. **Power calculation** Not stated **Missing data** Of the 5531 patients with suspected AMI, 5503 provided sufficient data.	**Delay time measured** Pre-hospital delay time- defined as time from onset of symptoms to arrival in hospital. **Method of outcome evaluation** Not stated. **Delay time** **Delay time before** Median pre-hospital delay time (25th%- 75th%- quartile): 4.0 hr. (1.7, 15.5). Pre-hospital delay time % <1 15.5 <6 58.5 6-12 10.9 **Delay time after** During: Median pre-hospital delay time (25th%- 75th%- quartile): 2.9 hr. (1.2, 11.0), p=0.007. Pre-hospital delay time % <1 23.2 (p=0.013) <6 66.0 (p=0.051) 6-12 10.0 **Medical services** **Use of medical services before** Not stated **Use of medical services after** Not stated **Other outcomes** **Other outcomes before** Not stated **Other outcomes after**

Study details	Intervention details	Participant details	Statistical analysis/ Missing data	Outcome measurements and results
				Not stated **Process outcomes** Not stated **Cost information** Not stated

PREHOSPITAL CARE

Systematic review of interventions to reduce delay in patients with suspected heart attack

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Emerg Med J 2004;**000**:1–6

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Accepted for publication 23 February 2004

Objectives: To evaluate the effectiveness of interventions aiming to reduce the time from the onset of signs and symptoms of an acute myocardial infarction (AMI) to seeking medical help/arrival at hospital.
Methods: A systematic review was carried out. Fifteen electronic databases, the internet, and the bibliographies of included studies were searched, and experts in the field of cardiac care were contacted. Randomised controlled trials (RCTs), controlled trials, and before and after studies conducted in any setting that assessed an intervention aimed at reducing the time from the onset of signs and symptoms of an AMI to seeking medical help and/or arrival in hospital were eligible for inclusion. Interventions could target people of any age at an increased risk of an AMI or the whole community.
Results: Eleven media/public education intervention studies met the inclusion criteria. Five (one controlled and four before and after studies) reported the interventions to have statistically positive effects on delay time, five (two RCTs and three before and after studies) reported no statistically significant effect, and the remaining before and after study did not conduct any statistical analysis. Three (one RCT and two before and after studies) of five studies evaluating the effect of the intervention on emergency department visits reported an increase in this outcome as a result of the intervention, and both studies (one RCT and one before and after study) examining calls made to emergency switchboards reported an increase in this outcome after the intervention.
Conclusions: There was little evidence that media campaigns and other public health interventions reduced delay. There is some evidence that they may result in an increase in emergency switchboard calls and emergency department visits. However, despite substantial expenditure of time and effort, methodological deficiencies of the studies mean that it is not possible to make definitive recommendations.

Acute myocardial infarction (AMI) is the major cause of premature mortality in the UK and other western countries.[1 2] Thrombolytic therapy provides considerable reduction in damage to the heart[3] but its effectiveness is dependent on prompt administration. There is a need for prompt action by people with symptoms of AMI or members of the public witnessing an AMI, and this has lead to widespread use of public education programmes designed to reduce the period between the onset of symptoms and treatment. This period consists of three different components: patient delay time, transport time, and hospital time from admission to treatment.[4] Patient delay time has been defined as the time from onset of signs and symptoms of an AMI to the time when medical assistance is sought[5] and is thought to account for most of the delay.[6] Patient delay time combined with transport time is referred to as prehospital delay time.

The UK National Service Framework (NSF) for coronary heart disease (CHD) reports that between a third and two thirds of deaths from AMI take place outside hospital.[1] There is an even greater problem with patients under 55 years of age where 90% of deaths from AMI occur before they arrive at hospital, with 40% delaying more than four hours.[7] Only about 25% of infarct patients receive thrombolytic therapy. This figure would increase if delays were shortened, with a corresponding increase in life expectancy.[8] Those who call an ambulance arrive at hospital, on average, one hour earlier than those who call their GP.[9] The NSF recommends local public education programmes encouraging people to call an ambulance in the event of symptoms suggestive of myocardial infarction. However, the effectiveness of interventions to reduce delay time is uncertain.[4] We conducted a systematic review to investigate the effectiveness of interventions aiming to reduce patient and/or prehospital delay time.

METHODS

The review was undertaken according to the Centre for Reviews and Dissemination's Guidance for those Carrying Out or Commissioning Reviews.[10]

Search strategy

We searched the following databases: Applied Social Sciences Index and Abstracts (1987–2001), Cochrane Controlled Trials Register (Cochrane Library, 2000 issue 4), Cumulative Index to Nursing and Allied Health Literature (CINAHL, 1982–2000), Database of Abstracts of Reviews of Effectiveness (Cochrane Library, 2000 issue 4), EMBASE (1980–2000), Educational Resources Information Center (ERIC, 1966–2001), Medline (1966–2000), Mental Health Abstracts (1969–2001), National Research Register (NRR, 2000 issue 4), NHS Economic Evaluation Database (Cochrane Library, 2000 issue 4), PsycINFO (1987–2001), Science Citation Index (1974–2001), System for Information on Grey Literature in Europe (SIGLE, 1976–2001), Social Science Citation Index (1972–2001), and Sociological Abstracts (1963–2000). The internet and the bibliographies of included studies were also searched and experts in the field of cardiac care were contacted to identify any other relevant trials. We considered studies in all languages regardless of publication status. Full details of the search strategy are available from the authors.

Abbreviations: RCT, randomised control file; AMI, acute myocardial infarction

Study selection
Studies were included if they assessed an intervention aimed at reducing the time from the onset of signs and symptoms of an AMI to seeking medical help and/or arrival in hospital, reported either patient and/or prehospital delay as the outcome, and were randomised controlled trials (RCTs), controlled trials, or before and after studies. Articles were assessed for inclusion independently by two reviewers. Disagreements were resolved through discussion and, if necessary, by recourse to a third reviewer.

Data extraction and quality assessment
Data extraction and quality assessment were carried out by one reviewer and checked by a second reviewer. Disagreements were resolved through discussion and, if necessary, by recourse to a third reviewer. Study validity was assessed using a checklist adapted from CRD's Guidance for those Carrying Out or Commissioning reviews[10] and a previous systematic review examining interventions for increasing screening uptake (box).[11] Where a study had multiple publications, all papers were examined to ensure that all relevant data were extracted. If necessary, we contacted study authors for additional information and data.

Data analysis
Studies were synthesised in a narrative format along with appropriate summary tables.

RESULTS
Eleven studies, all evaluating media/public education campaigns, met the inclusion criteria (full study details and findings can be found on line http://www.emjonline.com/supplemental).[12–22] One of these studies also examined one to one education.[22] Two were RCTs,[21 22] one was a controlled trial,[20] and eight were before and after studies.[12–19] One RCT[22] had nine associated publications,[23–31] the other RCT[21] had two associated publications,[32 33] and one before and after study[13] had seven associated publications.[34–40] Table 1 summarises the duration of the intervention and outcome measurement of the studies. Campaign length varied from one week to 32 months, and there was a large variation in the duration of the pre-intervention, intervention, and post-intervention measurement periods.

Table 2 summarises the content of the interventions. All interventions, except one that did not provide any information relating to intervention content,[16] emphasised the importance of quick action, but varied with regard to use of a specific slogan and emphasis of other factors, namely signs of an AMI, the importance of calling emergency services, and treatment. The primary outcome examined in all the studies was patient and/or prehospital delay. Other outcomes examined were mortality rates and the use of health resources including emergency department visits, calls to emergency switchboards, and the use of ambulance/medic transport.

Checklist for assessing study validity

RCTs

1 Random selection of intervention and control groups
2 Concealment of allocation

RCTs and controlled trials

1a Comparability at baseline

(If ''no'' go to 1b, otherwise go to 2a)

1b Adjustment for confounding factors
2a Identical treatment of groups other than intervention

(If ''no'' go to 2b, otherwise go to 3)

2b Adjustment for any confounding factors
3 Outcome assessors blinded to intervention allocation
4 Reporting of method for measuring delay time
5 Percentage of missing data
6 Power calculation
7 Appropriateness of statistical analysis

Before and after studies

1 Reporting of method for measuring delay time
2 Adjustment for confounding factors
3 Power calculation
4 Appropriateness of statistical analysis

Prehospital and patient delay time
Two RCTs[21 22] and six before and after studies[13 14 16–19] examined prehospital delay. Three of the before and after studies reported a reduction in delay after the intervention: median delay time decreased from 4 to 2.9 hours ($p = 0.007$) in one study,[16] from 3 hours to 2 hours and 20 minutes ($p<0.001$) in another study,[13] and by 25 minutes in the third study ($p<0.001$).[14] In one of these studies there was also an increase from 15.5% to 23.2% ($p = 0.01$) in the percentage of persons delaying less than one hour, and from 58.5% to 66.0% ($p = 0.05$) in those delaying less than six hours.[16] Another before and after study reported an increase from 15.8% to 31.3% ($p<0.05$) in the percentage of persons delaying two hours or less.[17] Neither of the RCTs reported any statistically significant effects of the intervention. This was also the case for two of the before and after studies.[18 19] However, one of these before and after studies did show a reduction in median delay from 4.2 to 2.8 hours, but no statistical analysis was conducted.[19]

The controlled trial[20] and three before and after studies[12 14 15] examined patient delay. The controlled trial reported an increase in the percentage of patients in the intervention group calling their general practitioner within 30 minutes after the intervention (37%) compared with before the intervention ((24%) $p<0.05$)). However, these findings were not compared with the control group—differences in delay time between pre-intervention and post-intervention periods were calculated separately for the control and intervention group. Only one of the before and after studies found a significant reduction in median delay from 86.5 to 60 minutes ($p<0.001$).[14] The other two before and after studies found no statistically significant difference in the percentage of people seeking help within different time periods[12 15] or in median delay.[12]

In summary; five studies (one controlled trial and four before and after studies) reported the interventions to have a statistically positive effect on delay time, and six studies showed no statistically significant effect of the intervention.

Use of health resources
Two RCTs[21 22] and three before and after studies[13 14 18] examined the effect of the intervention on emergency department visits. One RCT reported a statistically significant increase in the overall number of visits for chest pain throughout the campaign period (no figures given),[21] one before and after study reported an increase in mean number of visits per day from 10 to 25 ($p<0.001$),[13] and another before and after study showed an increase in the mean

Table 1 Duration of the intervention and outcome measurement of included studies

Reference, country	Intervention period	Pre-intervention measurement period	Intervention measurement period	Post-intervention measurement period (time to commencement after intervention ceased)
RCTs				
Meischke *et al*, 1997,[21] USA	7 wk+10 m	None	10 m	14 m
Luepker *et al*, 2000,[22] USA	18 m	4 m	18 m	None
Controlled trial				
Rowley *et al*, 1982,[20] England	32 m	3 m	32 m	None
Before and after studies				
Mitic and Perkins, 1984,[17] Canada	8 wk	4 wk	8 wk	1 wk (3 m)
Ho *et al*, 1989,[15] USA	2 m	4.5 m	None	4.5 m
Moses *et al*, 1991,[18] USA	24 m	12 m	24 m	None
Rustige *et al*, 1992,[19] Germany	9 m (1st period) 18 m (2nd period)	6 m	9 m	6 m (after 1st period) 18 m (ongoing with 2nd period)
Bett *et al*, 1993,[12] Australia	1 wk	2 m	None	1 m (1 m)
Blohm *et al*, 1994,[13] Sweden	14 m	21 m	14 m	36 m
Gaspoz *et al*, 1996,[14] Switzerland	12 m	12 m	12 m	None
Maeso-Madronero *et al*, 2000,[16] Germany	6 m	6 m	6 m	None

m, month(s); wk, week(s).

number of visits per week from 22.2 to 49 ($p<0.005$).[14] Not enough information was provided in the studies to determine the proportion of those presenting with chest pain that were confirmed to have AMI.

One RCT[21] and one before and after study[14] examined calls made to emergency switchboards. Both found significant increases in the number of calls made after the intervention, with the before and after study reporting an increase from 13% to 20% ($p<0.001$). No figures were given for the RCT.

None of the three before and after studies examining use of ambulance/medic transport reported a statistically significant difference in this outcome from before to after the intervention.[13–15]

Mortality rate

One RCT[22] and one before and after study[13] examined mortality rates. Neither reported any trends or significant effects of the intervention on mortality.

Table 2 Summary of the key factors of the intervention content of included studies

Reference, country	Importance of quick/immediate action	Emphasis of signs and symptoms of AMI	Importance of calling emergency services	Emphasis of treatment such as lysis	Use of a specific slogan
RCTs					
Meischke *et al*, 1997,[21] USA	Y	Y	Y	Y	Y
Luepker *et al*, 2000,[22] USA	Y	Y	Y	Y	N
Controlled trial					
Rowley *et al*, 1982,[20] England*	Y	N	Y	N	Y
Before and after studies					
Mitic and Perkins, 1984,[17] Canada	Y	Y	Y	N	N
Ho *et al*, 1989,[15] USA	Y	Y	Y	N	Y
Moses *et al*, 1991,[18] USA	Y	Y	N	N	N
Rustige *et al*, 1992,[19] Germany	Y	Y	N	N	N
Bett *et al*, 1993,[12] Australia	Y	N	N	Y	Y
Blohm *et al*, 1994,[13] Sweden	Y	N	Y	N	Y
Gaspoz *et al*, 1996,[14] Switzerland	Y	N	Y	Y	Y

The before and after study of Maeso-Madronero *et al*, 2000,[16] Germany, did not provide any details on intervention content. Y, yes; N, no. *Signs and symptoms of an AMI was not a key factor, but intervention content did emphasise chest pain.

Table 3 Quality assessment for the RCTs and the controlled trial

Reference, country	Random selection of groups	Concealment of allocation	Comparability at baseline	Identical treatment of groups	Blinding of outcome assessors	Reporting of method for measuring delay	% Missing data	Power calculation	Appropriate statistical analysis
RCTs									
Meischke *et al*, 1997,[21] USA	Y	NR	Y	Y	NR	Y	I+C: 31%	Y	Y
Luepker *et al*, 2000,[22] USA	Y	NR	Y	Y	NR	Y	I: 27.2% C: 28.3%	Y	Y
Controlled trial									
Rowley *et al*, 1982,[20] England	N/A	N/A	Y	Y	NR	N	NR	NR	NR

Y, yes; N, no; N/A, not applicable; NR, not reported or insufficient information; I, intervention, C, control.

Study quality

The methodological quality of the included studies was generally not high. Results of the quality assessment are shown in table 3 for the trials and in table 4 for the before and after studies.

Some studies were flawed with regard to the sample that was used. For example, in one study there were significantly more individuals in the pre-message period with a discharge diagnosis of AMI and a history of AMI or angina than in the post-message period.[15] In another study different coronary care units were used in pre-intervention and post-intervention surveys.[12] These potential confounders were not controlled for in the analysis.

Another limitation was the broad inclusion criteria used in some studies. For example, in one study participants were included if they reported to the emergency department with one or more of 80 possible complaints including symptoms such as neck pain, indigestion, jaw pain, and stomach pain.[18]

Some studies were inadequate with regard to the statistical analyses carried out. Three studies, for example, failed to report any statistical analysis with regard to the main outcome of interest, delay time.[12 18 19] In the controlled study, only within group comparisons were conducted with regard to delay time, therefore it is not possible to determine if there were any differences in delay time between the control and intervention groups.[20] As with the before and after studies, the observed reduction in delay time may have been attributable to some other confounding factor rather than the intervention itself.

Some studies were limited with regard to outcome assessment. Five studies measured delay time during the intervention as compared with after the intervention had ended.[14 16 18 20 22] Hence it was only possible to determine if the intervention was effective in the time period in which it was running. Any longer term effects of the intervention would have remained undetected in these studies. In one RCT no baseline measurements of delay time were taken.[21]

In addition, some studies reported little information about the content of the intervention or about the participants included.[16 19]

DISCUSSION

There is limited evidence that community wide media based or one to one educational interventions were successful in reducing delay time and they may have resulted in an increase in calls made to emergency switchboards and emergency department visits. However, because of the types of study designs used and the methodological deficiencies of these studies, it is unclear how much weight can be given to these findings. The evidence for the effectiveness of the interventions came mainly from before and after studies suggesting a need for caution in attributing any reported effects to the actual intervention. A recently published review of eight mass media interventions (all of which were also identified and included in our systematic review) reported similar findings with regard to delay time.[41]

Studies that were effective in reducing delay time appeared similar to those that were ineffective in terms of population, duration of the intervention, the main outcome measured, baseline delay time, and the year in which the study was conducted. Four of the six studies that reported the intervention to have no effect on delay concluded that a

Table 4 Quality assessment for the before and after studies

Reference, country	Reporting of method for measuring delay	Adjustment for confounding factors	Power calculation	Appropriate statistical analysis
Mitic and Perkins, 1984,[17] Canada	P	N/A	N/NR	Y
Ho *et al*, 1989,[15] USA	P	N/NR	N/NR	Y
Moses *et al*, 1991,[18] USA	P	N/NR	N/NR	N/A
Rustige *et al*, 1992,[19] Germany	Y	N/A	N/NR	N/A
Bett *et al*, 1993,[12] Australia	Y	N/NR	N/NR	N/A
Blohm *et al*, 1994,[13] Sweden	Y	N/NR	N/NR	Y
Gaspoz *et al*, 1996,[14] Switzerland	P	N/NR	N/NR	Y
Maeso-Madronero *et al*, 2000,[16] Germany	N	N/A	N/NR	Y

Y, yes; N, no; P, partial; N/A, not applicable; NR, not reported or insufficient information.

more prolonged campaign was probably required in order for the intervention to be effective.[12 15 18 22] Other factors, such as the frequency and intensity of exposure to the intervention are also likely to be important. Unfortunately, an insufficient number of studies provided information about frequency and intensity of the actual intervention for any conclusions to be drawn. Future studies should measure and report these factors.

Implications for future research

The effectiveness of media/public education campaigns in changing health behaviour is difficult to evaluate. Predictors of delay are complex and are likely to include more than just a good knowledge of the varied symptoms of AMI or a doctor's view of an ''appropriate'' reaction. Many people do not suffer from the well known symptom of chest pain when experiencing an AMI. Hence they may attribute their symptoms to non-cardiac causes, which can increase the delay in accessing medical services.[42] It may therefore be beneficial to use messages that do not include the word ''pain'',[43] emphasise the importance of thrombolytic therapy in preventing death or disability, and make it acceptable for people to access emergency services without fear that they are wasting NHS resources or that their symptoms are not serious enough.[44 45] Factors such as fear of wrongly ascribing symptoms to a heart attack, or fear of being hospitalised may be equally important.[46] It might be useful to gain a better understanding of how patients (and their partners/family) make the decision to call for help before advocating wide scale and expensive educational interventions. It may also be appropriate to target education at high risk groups, including family members. However, there is a need to educate the public at large to call an ambulance if they witness what could be an AMI as informed bystanders have a potentially important role in reducing delay. In addition, it is important to be aware of the impact that any media campaign may have on the number of emergency department visits for chest pain and calls made to emergency services.

Future research requires an appropriate design with baseline measurement of delay time, a reasonable follow up period, and specification of the frequency, intensity and content of the intervention. As the ultimate aim of such interventions is to save lives, mortality should be measured as part of the overall assessment. Our systematic review makes clear the need for such studies before any firm conclusion can be drawn.

ACKNOWLEDGEMENTS

We thank Dr Robert Clark, Dr Gary Latchford, Neil Stanford, Julie Glanville, Dr Jeffrie Strang, Barbara Gurney, Clare Valentine, Geoff Peacock, and Tom Quinn for their comments throughout the review process. We would also like to thank Dr Seokyung Hahn for her advice on reporting of statistics.

CONTRIBUTORS

RL suggested the need for the review. JP obtained the funding. All authors contributed to the execution of the review and content of the paper. AS supervised the review. SD carried out the electronic search strategies. AH, AK, and JP carried out study selection, data extraction and quality assessment, and AS and IW arbitrated when necessary. AS, AH, AK, JP, IW, RL, and DT contributed to the study design, interpretation of the results and critical revisions to the manuscript.

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Funding: this review was funded by a grant from the Research Directorate of the Northern and Yorkshire Regional Office of the NHS.

Competing interests: none declared.

REFERENCES

1 **Department of Health**. *National service framework for coronary heart disease: modern standards and service models*. London: Department of Health, 2000.
2 **National Center for Chronic Disease Prevention and Health Promotion**. *The burden of chronic diseases and their risk factors: national and state perspectives*. Atlanta: US Department of Health and Human Services, Centers for Disease Control and Prevention, 2002.
3 **Fibrinolytic Therapy Trialists' (FTT) Collaborative Group**. Indications for fibrinolytic therapy in suspected acute myocardial infarction: collaborative overview of early mortality and major morbidity results from all randomised trials of more than 1000 patients. [published erratum appears in *Lancet* 1994;**343**:742]. *Lancet* 1994;**343**:311–22.
4 **Blohm MB**, Hartford M, Karlson BW, *et al*. An evaluation of the results of media and educational campaigns designed to shorten the time taken by patients with acute myocardial infarction to decide to go to hospital. *Heart* 1996;**76**:430–4.
5 **Ashton KC**. How men and women with heart disease seek care: the delay experience. *Prog Cardiovasc Nurs* 1999;**14**:53–60.
6 **Dracup K**, Moser DK. Beyond sociodemographics: factors influencing the decision to seek treatment for symptoms of acute myocardial infarction. *Heart Lung* 1997;**26**:253–62.
7 **Norris RM**. Fatality outside hospital from acute coronary events in three British health districts, 1994–5. United Kingdom Heart Attack Study Collaborative Group. *BMJ* 1998;**316**:1065–70.
8 **Penny WJ**. Patient delay in calling for help: the weakest link in the chain of survival? *Heart* 2001;**85**:121–2.
9 **Birkhead JS**. Time delays in provision of thrombolytic treatment in six district hospitals. Joint Audit Committee of the British Cardiac Society and a Cardiology Committee of Royal College of Physicians of London. *BMJ* 1992;**305**:445–8.
10 **Khan KS**, Ter Riet G, Glanville J, *et al*. *Undertaking systematic reviews of research on effectiveness: CRD's guidance for carrying out or commissioning reviews: CRD Report 4*. 2nd ed. York: NHS Centre for Reviews and Dissemination, 2001.
11 **Jepson R**, Clegg A, Forbes C, *et al*. The determinants of screening uptake and interventions for increasing uptake: a systematic review. *Health Technol Assess* 2000;**4**.
12 **Bett N**, Aroney G, Thompson P. Impact of a national educational campaign to reduce patient delay in possible heart attack. *Aust N Z J Med* 1993;**23**:157–61.
13 **Blohm M**, Hartford M, Karlson BW, *et al*. A media campaign aiming at reducing delay times and increasing the use of ambulance in AMI. *Am J Emerg Med* 1994;**12**:315–18.
14 **Gaspoz JM**, Unger PF, Urban P, *et al*. Impact of a public campaign on pre-hospital delay in patients reporting chest pain. *Heart* 1996;**76**:150–5.
15 **Ho MT**, Eisenberg MS, Litwin PE, *et al*. Delay between onset of chest pain and seeking medical care: the effect of public education. *Ann Emerg Med* 1989;**18**:727–31.
16 **Maeso Madronero JL**, Bergbauer M, Mensing M, *et al*. HEUH 'Recognition of myocardial infarction and correct acting': a project aiming at reducing the prehospital delay time in acute myocardial infarction. *Herz Kreisl* 2000;**32**:257–62.
17 **Mitic WR**, Perkins J. The effect of a media campaign on heart attack delay and decision times. *Can J Public Health* 1984;**75**:414–18.
18 **Moses HW**, Engelking N, Taylor GJ, *et al*. Effect of a two-year public education campaign on reducing response time of patients with symptoms of acute myocardial infarction. *Am J Cardiol* 1991;**68**:249–51.
19 **Rustige J**, Schiele R, Schneider J, *et al*. Intravenous thrombolysis in acute myocardial infarct: optimization of the therapeutic strategy by informing the patients and physicians. *Anasthesiol Intensivmed Notfallmed* 1992;**27**:205–8.
20 **Rowley JM**, Hill JD, Hampton JR, *et al*. Early reporting of myocardial infarction: impact of an experiment in patient education. *BMJ* 1982;**284**:1741–6.
21 **Meischke H**, Dulberg EM, Schaeffer SS, *et al*. 'Call fast, Call 911': a direct mail campaign to reduce patient delay in acute myocardial infarction. *Am J Public Health* 1997;**87**:1705–9.
22 **Luepker RV**, Raczynski JM, Osganian S, *et al*. Effect of a community intervention on patient delay and emergency medical service use in acute coronary heart disease: The Rapid Early Action for Coronary Treatment (REACT) Trial. *JAMA* 2000;**284**:60–7.
23 **Brown AL**, Mann NC, Daya M, *et al*. Demographic, belief, and situational factors influencing the decision to utilize emergency medical services among chest pain patients: Rapid Early Action for Coronary Treatment (REACT) study. *Circulation* 2000;**102**:173–8.
24 **Nitzkin JL**. Barriers to patients seeking emergency care for acute coronary heart disease. *JAMA* 2000;**284**:2184.
25 **Goff DC Jr**, Sellers DE, McGovern PG, *et al*. Knowledge of heart attack symptoms in a population survey in the United States: the REACT Trial. Rapid Early Action for Coronary Treatment. *Arch Intern Med* 1998;**158**:2329–38.

26 **Feldman HA**, Proschan MA, Murray DM, *et al*. Statistical design of REACT (Rapid Early Action for Coronary Treatment), a multisite community trial with continual data collection. *Control Clin Trials* 1998;**19**:391–403.
27 **Goff DC**, Feldman HA, McGovern PG, *et al*. Prehospital delay in patients hospitalized with myocardial infarction symptoms in the US: REACT. *Circulation* 1997;**96**:874.
28 **Raczynski JM**, Finnegan JR Jr, Zapka JG, *et al*. REACT theory-based intervention to reduce treatment-seeking delay for acute myocardial infarction. Rapid Early Action for Coronary Treatment. *Am J Prev Med* 1999;**16**:325–34.
29 **Hedges JR**, Feldman HA, Bittner V, *et al*. Impact of community intervention to reduce patient delay time on use of reperfusion therapy for acute myocardial infarction: Rapid Early Action for Coronary Treatment (REACT) trial. *Acad Emerg Med* 2000;**7**:862–72.
30 **Goff DC Jr**, Feldman HA, McGovern PG, *et al*. Prehospital delay in patients hospitalized with heart attack symptoms in the United States: the REACT trial. Rapid Early Action for Coronary Treatment (REACT) Study Group. *Am Heart J* 1999;**138**:1046–57.
31 **Simons-Morton DG**, Goff DC, Osganian S, *et al*. Rapid early action for coronary treatment: rationale, design, and baseline characteristics. REACT Research Group. *Acad Emerg Med* 1998;**5**:726–38.
32 **Meischke H**, Eisenberg MS, Schaeffer SM, *et al*. Impact of direct mail intervention on knowledge, attitudes, and behavioral intentions regarding use of emergency medical services for symptoms of acute myocardial infarction. *Eval Health Prof* 1994;**17**:402–17.
33 **Eppler E**, Eisenberg MS, Schaeffer S, *et al*. 911 and emergency department use for chest pain: results of a media campaign. *Ann Emerg Med* 1994;**24**:202–8.
34 **Blohm M**, Herlitz J, Hartford M, *et al*. Consequences of a media campaign focusing on delay in acute myocardial infarction. *Am J Cardiol* 1992;**69**:411–13.
35 **Herlitz J**, Hartford M, Karlson BV, *et al*. Effect of a media campaign to reduce delay times for acute myocardial infarction on the burden of chest pain patients in the emergency department. *Cardiology* 1991;**79**:127–34.
36 **Blohm M**, Herlitz J, Schroder U, *et al*. Reaction to a media campaign focusing on delay in acute myocardial infarction. *Heart Lung* 1991;**20**:661–6.
37 **Herlitz J**, Hartford M, Blohm M, *et al*. Effect of a media campaign on delay times and ambulance use in suspected acute myocardial infarction. *Am J Cardiol* 1989;**64**:90–3.
38 **Herlitz J**, Hartford M, Blohm M, *et al*. Evaluation of the media campaign Heart-Pain-90,000: time delay in acute myocardial infarct can be reduced. *Lakartidningen* 1991;**88**:2973–7.
39 **Herlitz J**, Hartford M, Blohm M, *et al*. Delay between the onset of symptoms and treatment: a critical factor in acute myocardial infarction. *Lakartidningen* 1988;**85**:1997–8.
40 **Herlitz J**, Blohm M, Hartford M, *et al*. Follow-up of a 1-year media campaign on delay times and ambulance use in suspected acute myocardial infarction. *Eur Heart J* 1992;**13**:171–7.
41 **Caldwell MA**, Miaskowski C. Mass media interventions to reduce help-seeking delay in people with symptoms of acute myocardial infarction: time for a new approach? *Patient Educ Couns* 2002;**46**:1–9.
42 **Ruston A**, Clayton J, Calnan M. Patients' action during their cardiac event: qualitative study exploring differences and modifiable factors. *BMJ* 1998;**316**:1060–4.
43 **Treasure T**. Pain is not the only feature of heart attack. *BMJ* 1998;**317**:602–3.
44 **Ruston A**. Accessing emergency care at the time of a heart attack: why people do not dial 999 for an ambulance. *J R Soc Health* 2001;**121**:243–7.
45 **Pattenden J**, Watt I, Lewin RJ, *et al*. Decision making processes in people with symptoms of acute myocardial infarction: qualitative study. *BMJ* 2002;**324**:1006–9.
46 **Cobbe SM**, Redmond MJ, Watson JM, *et al*. ''Heartstart Scotland''—initial experience of a national scheme for out of hospital defibrillation. *BMJ* 1991;**302**:1517–20.