

Circulation

JOURNAL OF THE AMERICAN HEART ASSOCIATION



Demographic, Belief, and Situational Factors Influencing the Decision to Utilize Emergency Medical Services Among Chest Pain Patients

Adam L. Brown, N. Clay Mann, Mohamud Daya, Robert Goldberg, Hendrika Meischke, Judy Taylor, Kevin Smith, Stavroula Osganian and Lawton Cooper

Circulation 2000;102:173-178

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 72514

Copyright © 2000 American Heart Association. All rights reserved. Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://circ.ahajournals.org/cgi/content/full/102/2/173>

Subscriptions: Information about subscribing to *Circulation* is online at
<http://circ.ahajournals.org/subscriptions/>

Permissions: Permissions & Rights Desk, Lippincott Williams & Wilkins, a division of Wolters Kluwer Health, 351 West Camden Street, Baltimore, MD 21202-2436. Phone: 410-528-4050. Fax: 410-528-8550. E-mail:
journalpermissions@lww.com

Reprints: Information about reprints can be found online at
<http://www.lww.com/reprints>

Demographic, Belief, and Situational Factors Influencing the Decision to Utilize Emergency Medical Services Among Chest Pain Patients

Adam L. Brown, BS; N. Clay Mann, PhD, MS; Mohamud Daya, MD, MS; Robert Goldberg, PhD; Hendrika Meischke, PhD; Judy Taylor, EDD; Kevin Smith, MA; Stavroula Osganian, MD; Lawton Cooper, MD; for the Rapid Early Action for Coronary Treatment (REACT) Study

Background—Empirical evidence suggests that people value emergency medical services (EMS) but that they may not use the service when experiencing chest pain. This study evaluates this phenomenon and the factors associated with the failure to use EMS during a potential cardiac event.

Methods and Results—Baseline data were gathered from a randomized, controlled community trial (REACT) that was conducted in 20 US communities. A random-digit-dial survey documented bystander intentions to use EMS for cardiac symptoms in each community. An emergency department surveillance system documented the mode of transport among chest pain patients in each community and collected ancillary data, including situational factors surrounding the chest pain event. Logistic regression identified factors associated with failure to use EMS. A total of 962 community members responded to the phone survey, and data were collected on 875 chest pain emergency department arrivals. The mean proportion of community members intending to use EMS during a witnessed cardiac event was 89%; the mean proportion of patients observed using the service was 23%, with significant geographic differences (range, 10% to 48% use). After controlling for covariates, non-EMS users were more likely to try antacids/ aspirin and call a doctor and were less likely to subscribe to (or participate in) an EMS prepayment plan.

Conclusions—The results of this study indicate that indecision, self-treatment, physician contact, and financial concerns may undermine a chest pain patient's intention to use EMS. (*Circulation*. 2000;102:173-178.)

Key Words: coronary disease ■ epidemiology ■ public policy

Every year, ≈1 250 000 persons in the United States experience an acute myocardial infarction (AMI).¹ Of these, >50% die before reaching a medical facility. A majority of these deaths occur within 1 hour of the onset of acute symptoms.^{1,2} Thrombolytic therapy and other coronary reperfusion strategies are critical in altering the course of an AMI; they can reduce mortality by 25% if initiated within 1 hour of the onset of acute symptoms.³ Unfortunately, only a fraction of patients who are eligible for thrombolytic therapy receive treatment; this is due, in large part, to the time delay between the onset of acute symptoms and arrival at the hospital.⁴⁻¹⁰

Little is known about a patient's decision to use the emergency medical service (EMS) system during a chest pain event. EMS system use can be crucial to receiving prompt therapy for a possible AMI. Benefits include early diagnosis and treatment, emergency department (ED) forewarning of

patient arrival, and the ability to address life-threatening complications, such as dysrhythmias, during transport.^{11,12} However, studies indicate that only 50% to 60% of patients with chest pain use the EMS system.^{13,14}

Factors associated with EMS use among chest pain patients presenting to EDs were previously investigated in 2 concurrent studies in King County, Washington.^{9,15} The first study focused on the association between EMS use and demographic, situational, and clinical factors; the authors of this study reported that greater education and being physically active at the time of symptom onset were related to decreased EMS system use.⁹ The second study evaluated knowledge and belief issues surrounding EMS use and found that chest pain patients fail to use EMS because they do not perceive their symptoms as being life-threatening, they did not think of calling 911, or they thought self-transport would be faster.¹⁵ An important limitation in the current literature is that all

Received November 22, 1999; revision received January 28, 2000; accepted February 8, 2000.

From the Department of Emergency Medicine, Oregon Health Sciences University, Portland (A.L.B., N.C.M., M.D.); the Intermountain Injury Control Research Center, University of Utah School of Medicine, Salt Lake City (N.C.M.); the Department of Cardiology, University of Massachusetts School of Medicine, Worcester (R.G.); the Department of Health Services, University of Washington, Seattle (H.M.); the Division of Health and Kinesiology, Mississippi University for Women, Columbus (J.T.); New England Research Institutes, Watertown, Mass (K.S., S.O.); and the National Heart, Lung, and Blood Institute, Bethesda, Md (L.C.).

Correspondence to N. Clay Mann, PhD, MS, Intermountain Injury Control Research Center, 410 Chipeta Way, Suite 222, Salt Lake City, UT 84108-1226. E-mail: clay.mann@hsc.utah.edu

© 2000 American Heart Association, Inc.

Circulation is available at <http://www.circulationaha.org>

published studies evaluating EMS use among chest pain patients originate from one state with a tax-based, prepaid EMS system.^{9,13,15–18} Thus, geographic differences and the impact of cost concerns on EMS use remain uninvestigated.

The objective of the current study was to determine if community members recognize the benefit of the EMS system in a cardiac emergency and to compare these findings to actual EMS usage. This study documented geographic variations in bystander intention to use EMS services among 20 diverse communities in the United States and compared these findings to actual EMS utilization rates among chest pain patients in each community. In addition, survey data provided by chest pain patients presenting to participating EDs were used to determine how demographic factors, situational attributes, and patient perceptions influence the decision to access the EMS system.

Methods

Study Design

The data for this study were drawn from a subgroup of all patients included in the REACT trial.¹⁹ REACT was a multicenter, randomized, controlled community trial designed to evaluate the effects of a community intervention on the time interval between onset of AMI symptoms to contact with hospital-based emergency medical care.^{19,20} In brief, 20 communities were pair-matched by demographic characteristics in 5 regions throughout the United States. One community of each pair was randomly assigned as the intervention site and the other served as a control site. Four months of baseline data were collected in all communities; this was followed by an 18-month, multifaceted education program in the intervention communities. Data used in this study were collected from all 20 communities during the baseline period (December 1995 through March 1996) before the intervention was initiated. In the REACT trial, patient consent requirements were reviewed and approved by all participating hospitals.

Sample Characteristics

For this study, data were provided by 2 sample sources: a random-digit-dial (RDD) community telephone survey and a telephone follow-up survey of chest pain patients presenting to participating EDs and either released or admitted to the hospital with a possible or confirmed coronary event. A review of the medical records for patients participating in the telephone follow-up survey was also conducted.

The RDD community survey was administered among ≈ 60 adults who were ≥ 18 years of age in each of the 20 communities. Telephone exchanges and a count of households with listed phone numbers were obtained for specific zip code areas designating the geographic boundaries of each community. Counts of listed households were supplemented with estimates of unlisted households. Disproportionate stratified sampling was used to increase the overall household rate. To adjust for the complex sample design, survey responses were weighted by the reciprocal of the probability of selection. For purposes of this study, only community respondents ≥ 30 years of age were included in the analysis to facilitate comparison with the follow-up survey.

The telephone follow-up survey included both an ED telephone survey and a hospital inpatient telephone survey. The ED follow-up telephone survey was conducted 7 to 13 weeks after the ED visit for patients presenting to EDs with chest pain but who were subsequently released without a hospital admission. The inpatient follow-up telephone survey, which was conducted 7 to 13 weeks after hospital discharge, was administered to admitted patients with a confirmed *International Classification of Diseases*²¹ discharge code of AMI (410) or acute cardiac ischemia (411). Disproportionate stratified random sampling was applied with sampling fractions

adjusted for community size and patient response for both the ED survey and inpatient survey. Because patient sampling and survey response rates differed by community, responses were weighted by the number of eligible persons (released from the ED or admitted to the hospital) divided by the number of completed interviews.

The 2 follow-up telephone surveys were appended and merged with hospital medical chart data. This combined database, referred to as the patient follow-up survey, was limited to patients who were ≥ 30 years of age who presented to the hospital with non-traumatic chest pain.¹⁹ Patients were excluded if they were institutionalized or transferred from another hospital.

Additionally, each EMS and fire service agency in each REACT community was queried regarding the availability of a prepayment system. EMS prepayment systems indemnify citizens against the cost of EMS treatment and transport.¹³ Systems may be tax-based (publicly funded EMS) programs, which do not bill patients for services, or hybrid EMS programs that offer an optional prepayment service that, on the basis of an annual membership fee, indemnifies the patient against any charges not covered by health insurance.

Measurements

Data contained in the RDD community telephone survey were used to identify community perceptions regarding the value of EMS services during a cardiac event. Specifically, the following question addressed bystander intentions during a coronary emergency: "If you thought someone was having a heart attack, what would you do?" Two optional responses, among many, were the following: (1) call 911 or an ambulance and (2) drive the person to the hospital. By comparing the community telephone survey findings with the EMS utilization data contained in the patient follow-up survey, we could compare community perceptions regarding intended bystander EMS usage with actions taken by community members experiencing a suspected coronary event.

The patient follow-up survey also contained questions assessing demographic, situational, and belief factors associated with the chest pain event that led patients to seek medical attention. Thus, we could also associate EMS use with patient demographics, patient appraisals of their medical condition, actions taken before seeking medical attention, and various beliefs and perceptions that facilitated or hindered quick action when seeking medical care.

Data Analysis

Descriptive statistics were used to assess the similarity among the independent samples used in this study. In addition, an exploratory analysis was conducted with patient follow-up survey data to identify demographic, belief, and situational factors associated with the decision to activate (or not activate) the EMS system. Demographic factors and other variables associated with EMS activation in the exploratory analysis were included in a mixed-effects logistic regression model predicting the primary mode of transport (EMS versus other). Design effects associated with the REACT trial were incorporated into the model, in which "study pair" was nested within "geographic region," and "community" was nested within "pair" and "region" using the glimmix macro for the SAS system.²² Contributions to the model are reported as adjusted odds ratios. All analyses were conducted using SAS, version 6.12.

Results

Survey Response Rates

In the RDD community telephone survey, 36.9% of the randomly generated telephone numbers were for zip code-eligible households ($n=2067$). In addition, 55 calls to households resulted in no contact after 15 attempts. Among those contacted, 520 resulted in refusals, 62 were ineligible due to a language barrier (non-Spanish or English) or illness, and 136 provided incomplete interviews. The overall interview rate (completed interviews divided by potentially eligible

TABLE 1. Summary of Sample Characteristics for the 3 Telephone Surveys

Variable	Community Survey	ED Survey	In-Patient Survey	P
Age, y	49.2±13.8	52.0±15.4	64.9±13.0	<0.001
Male sex	379 (41.7)	243 (57.1)	161 (34.2)	<0.001
Ethnicity				<0.001
White	778 (82.0)	318 (76.3)	387 (87.9)	
Hispanic	86 (10.4)	38 (9.2)	27 (5.7)	
Black	68 (7.9)	56 (12.1)	21 (3.5)	
Education level				<0.001
<High school	88 (10.1)	122 (29.0)	128 (27.7)	
High school	255 (28.6)	111 (26.2)	144 (32.2)	
Some college	267 (25.8)	121 (28.1)	103 (23.7)	
Completed college	346 (35.4)	68 (16.7)	71 (16.4)	

Values are mean±SD or n (%). Calculated values were based on weighted survey responses.

households) was 62.5%. The total sample (≥ 30 years of age) included 962 respondents.

Response rates for the ED telephone survey and hospital inpatient telephone survey that were appended into the patient follow-up survey are reported separately. For the ED telephone survey, 426 people provided complete interviews out of the 1338 we attempted to contact. Because of a slow study start-up, 18.1% ($n=243$) of cases were excluded because the 13-week interview window had expired before consent could be obtained. An additional 300 people could not be contacted (eg, non-working phone number). Among those contacted ($n=795$), 46.4% of people refused the interview or were found to be ineligible during the interview process (ie, too ill, died, deaf, or currently in a nursing home). The overall response rate (number interviewed/[number selected—number ineligible]) was 34.4%.

For the inpatient survey, 449 of 1787 patients provided complete interviews. Among contacted patients ($n=1521$), 23.3% refused the interview and 47.1% of respondents were found to be ineligible during the interview. The overall response rate was 42.0%. The final sample sizes for the surveys were 962 and 875 for the RDD community survey and the patient follow-up survey, respectively.

Sample Characteristics

Table 1 lists demographic variables for each of the survey samples. The inpatient survey respondents were older and more frequently reported their ethnicity as non-Hispanic white. A greater proportion of ED survey respondents were male. Participants in the RDD community survey reported higher levels of education.

Intention to Use EMS and Actual EMS Use

Table 2 uses data from the RDD community telephone survey and the patient follow-up survey to compare bystander intent to use EMS with self-reported EMS use in each study community. On average, 89.4% of respondents in each study community indicated that they would call 911 if they witnessed a cardiac event. Very few (8.1%) would consider driving someone with a coronary emergency to the hospital.

The patient follow-up survey provided EMS use information for chest pain patients presenting to participating EDs in each study community. Contrary to the bystander intentions

expressed in the community survey, few actual chest pain victims used EMS (23.2%). Most victims were driven to the ED by someone else (60.4%) or drove themselves to the hospital (15.6%).

Factors Associated With Actual EMS Use

Demographic Variables

Using the patient follow-up survey data, demographic, situational, and belief factors were compared among EMS and non-EMS users. Several demographic variables were significantly associated with EMS use, including increasing age, white ethnicity, living alone, and presence of an ambulance service prepayment plan (Table 3).

Situational Factors

When considering actions taken by patients before calling 911 or going to the hospital, patients taking an antacid or aspirin were less likely to use EMS services. However, patients taking nitroglycerin were twice as likely to choose EMS transport. Regarding communications with others, requesting advice from family or friends before seeking medical attention was not associated with EMS use. However, patients communicating with a physician were less likely to use EMS transport to the hospital.

Belief Factors

The following question was significantly associated with EMS use (Table 3): “Did any factors or things cause you to go quickly (or wait to go) to the hospital?” Post hoc analyses of answer subcategories indicated that certainty that a patient’s symptoms were caused by a “heart attack” was associated with an increased likelihood of choosing EMS transport, whereas patients who thought their symptoms would go away were significantly less likely to use EMS. Pain severity was not associated with EMS use.

Multivariate Analysis

Using a multivariable logistic regression model, we examined the associations of the following factors with EMS use: sex, ethnicity (white versus non-white), living alone, taking nitroglycerin, communicating with a physician, and being prompted to “go quickly” or “waiting” to go to the hospital. The variable identifying the presence of an EMS prepayment

TABLE 2. Comparison of Bystander Intention to Use EMS and Self-Reported EMS Utilization Rates

State	Site	Community Survey (n=962)		Patient Follow-Up Survey (n=875)		
		Would Call 911	Would Drive Someone*	Did Call 911	Did Drive Oneself*	Driven By Someone*
Alabama	Tuscaloosa	55 (77.9)	4 (10.3)	3 (10.3)	6 (16.7)	26 (73.0)
	Huntsville	43 (81.3)	5 (13.8)	16 (18.8)	12 (16.9)	41 (64.4)
	Anniston	48 (85.4)	6 (15.1)	13 (18.4)	9 (15.4)	45 (64.4)
	Opelika	45 (85.5)	6 (9.7)	5 (13.2)	4 (25.1)	12 (61.7)
Massachusetts	Worcester	40 (82.6)	3 (8.7)	29 (32.8)	13 (16.2)	40 (47.8)
	Lowell	37 (90.5)	3 (6.8)	16 (32.8)	6 (16.7)	20 (50.5)
	Pittsfield	50 (98.1)	2 (4.7)	13 (21.3)	5 (17.4)	20 (56.5)
	Westfield	40 (86.4)	4 (5.9)	9 (18.7)	8 (15.8)	27 (65.5)
Wisconsin	Lacrosse	44 (88.4)	1 (0.9)	6 (15.7)	10 (27.6)	22 (56.7)
	Eau Claire	41 (83.0)	2 (2.5)	5 (15.3)	2 (6.9)	22 (77.8)
South Dakota	Sioux Falls	51 (92.3)	4 (5.3)	12 (26.2)	8 (18.5)	24 (55.3)
Minnesota	Fargo	36 (95.7)	4 (10.2)	10 (15.7)	14 (24.4)	31 (59.9)
Texas	Tyler	43 (92.6)	5 (12.6)	6 (11.9)	10 (18.3)	40 (69.8)
	Lake Charles	36 (90.6)	3 (7.3)	5 (16.1)	4 (9.7)	24 (74.2)
	Brownsville	30 (85.1)	5 (8.9)	8 (22.3)	7 (20.7)	19 (57.0)
	Laredo	35 (85.3)	3 (7.3)	1 (14.4)	0 (0)	8 (85.6)
Washington	Shoreline	50 (97.2)	5 (18.7)	17 (42.2)	5 (19.1)	11 (35.4)
	Olympia	51 (98.2)	5 (9.0)	23 (42.8)	5 (10.0)	24 (47.2)
Oregon	Beavertown	44 (96.3)	2 (4.5)	8 (27.1)	1 (5.6)	13 (67.3)
	Eugene	54 (95.7)	0 (0.0)	13 (48.7)	3 (12.4)	10 (39.0)
Mean values		89.4%	8.1%	23.2%	15.6%	60.4%

Values are n (%), and percentages were based on weighted survey responses.

*Variables associated with "driving to the hospital."

system was trichotomized to independently assess the effect of subscription services versus tax-based programs. The variables "took antacid" and "took aspirin" were combined to address the issue of a patient's self-medicating during a potential cardiac event. Age was excluded from the model because of its strong association with 2 other variables, "living alone" and "taking nitroglycerin." Separate models were analyzed using weighted and unweighted survey responses. Regression coefficients between the models were similar; thus, we report only the unweighted results.

The overall fit of the logistic model was good; it correctly classified 76% of all cases (Table 4). The variables "living alone," "taking nitroglycerin," and being prompted to "go quickly" to the hospital were strong predictors of EMS use. The presence of a tax-based, prepaid EMS system doubled the likelihood of using EMS compared with communities with no such system. Because the presence of an EMS prepayment plan was measured on the community level rather than on an individual level, including random effects associated with community appropriately inflated the confidence band associated with this variable. Thus, the 95% confidence interval associated with the prepayment variable included unity, so that statistical significance could not be attributed to a prepayment effect. This variable should be interpreted with some care. Being prompted to "wait before going," taking an antacid/aspirin, or consulting with a physician significantly decreased the likelihood that respondents would use EMS services.

Discussion

Findings indicate that, in general, community members recognize the benefit of EMS transport when acting as a bystander to a "public" cardiac event but individuals personally experiencing symptoms of an AMI often choose not to use EMS services. One should note, however, that bystander intentions may favor an EMS response simply because respondents assumed they were unacquainted with the victim and his/her extenuating circumstances. Bystander decisions can be decisive if personal circumstances do not complicate bystander decision-making. Alternatively, actual patients may not have considered their symptoms to be indicative of a heart attack and were, therefore, less inclined use EMS. It is unclear if similar findings would be present if intentions and actual events were documented for the same subject. Nevertheless, the magnitude of difference between bystander intentions and actions for self and the uniformity of this finding across geographic regions suggest that further investigation may prove useful in determining why the public would choose alternative transportation when faced with a cardiac emergency.

Situational factors that decreased EMS use during a cardiac event included taking an antacid/aspirin or communicating with a doctor before going to the hospital. However, patients taking nitroglycerin and patients believing their condition was heart-related were more likely to use EMS. These findings suggest that patients with familiar symptoms or

TABLE 3. Demographic, Situational, and Belief Factors Associated With Use of EMS Services

Variable	EMS Transport	Other Transport	P	Odds Ratio
Demographics				
Age, y	64.8±16.5	54.8±15.1	<0.001	...
Ethnicity				
White	185 (82.8)	520 (80.0)	0.046	1.58
Nonwhite	26 (17.2)	116 (20.0)		
Male sex	115 (49.5)	356 (48.6)	0.386	0.94
Education				
≤High school	133 (60.3)	372 (55.8)	0.283	1.18
>High school	84 (39.7)	279 (44.2)		
Live alone, yes	68 (64.6)	113 (47.5)	0.006	1.90
EMS payment plan, yes	40 (30.1)	56 (22.6)	<0.001	2.41
Situational factors*				
Took an antacid	9 (3.1)	63 (9.8)	0.006	0.40
Took aspirin	15 (6.7)	78 (12.3)	0.022	0.54
Took nitroglycerin	82 (34.9)	139 (18.1)	<0.001	2.24
Advice from peers	31 (13.6)	69 (10.3)	0.141	1.41
Communicated with doctor	15 (7.0)	82 (12.3)	0.022	0.52
Belief factors*				
Went quickly	180 (82.1)	463 (70.3)	<0.001	2.03
Symptom certainty	45 (21.6)	86 (11.6)	0.006	1.72
Severe pain	101 (46.4)	300 (46.1)	0.876	1.02
Waited to go	91 (43.5)	372 (58.1)	<0.001	0.55
Symptoms go away	16 (5.4)	60 (9.0)	0.042	0.65

Values are mean±SD or n (%); calculated values were based on weighted survey responses.

*Responses to questions in yes/no format.

experience with a heart condition are more likely to rely on EMS care as a valued form of medical care and transport. Additional published work has associated symptom familiarity with increased EMS use.¹⁵

The fact that communication with a doctor decreased EMS use is problematic. It is unclear if doctors were acting as

managed care “gatekeepers” to EMS care or if they reduced patient anxiety in a way that made EMS transport seem optional. There may be a variety of valid reasons why physicians who are familiar with individual patient histories may not dictate EMS use during phone contact with a concerned patient. However, our data indicate that 83% of patients who spoke with a physician and did not use EMS transport were subsequently admitted to the hospital.

Regarding belief factors, no correlation existed between seeking advice from peers or pain severity and EMS transport, which is contrary to other studies demonstrating a positive correlation between these factors and EMS use.^{6,9,15} The perception among patients that their symptoms would go away decreased EMS use; this result is similar to findings reported elsewhere.¹⁵

Several demographic variables were associated with EMS use. Living alone and increasing age (although unadjusted) enhanced EMS use. These results may reflect the fact that the elderly and those in single-person households have fewer transportation options. Other demographic variables, including ethnicity, sex, and education, were not related to EMS use, which contrasts with the results of previous studies.^{6,8,9} However, one should note that previous research addressing this question originated in one state with a relatively high EMS use rate.^{9,13,15–18} Thus, contradictions between previous findings and current results may represent geographic differences in patient population, EMS structure, etc.

TABLE 4. Multivariate Logistic Analysis of Demographic, Situational, and Belief Factors That Affect EMS Use

Variable	Parameter Estimate	Adjusted Odds Ratio	95% Confidence Intervals
Male sex	0.068	1.07	0.76, 1.50
Nonwhite ethnicity	−0.109	0.89	0.55, 1.45
Live alone, yes	0.645	1.90	1.30, 2.79
EMS payment plan, none	Reference
Subscription service, yes	0.168	1.18	0.51, 2.69
Tax-based system, yes	0.761	2.14	0.70, 6.49
Took antacid/aspirin, yes	−0.582	0.55	0.33, 0.92
Took nitroglycerin, yes	0.635	1.88	1.31, 2.70
Communicated with doctor, yes	−0.723	0.48	0.26, 0.89
Go quickly, yes	0.581	1.78	1.17, 2.71
Waited to go, yes	−0.464	0.62	0.44, 0.87
Intercept	−1.660

Model was based on unweighted survey responses.

Of interest is the fact that the presence of an EMS prepayment system increased EMS use. One other study documented a similar increase among residents of lower income census blocks.¹³

There are several important limitations to this study. A potential source of bias relates to the fact that ED and inpatient survey data were obtained retrospectively, 7 to 13 weeks after the cardiac event. The event or the extended period of time between the event and our interviews may have affected patient responses. At least one other study, however, has shown that acute health conditions requiring medical attention often represent "sentinel events" and may be accurately recalled for up to 6 months.²³ A second limitation involved the low response rate to the ED and inpatient surveys (<42%). Missing interviews may systematically favor an income group, degree of chronic illness, or some other unmeasured variable that limits the generalizability of our findings. The fact that our study sample included communities with diverse mean incomes and ethnic distributions may temper some potential bias due to sample selection.¹⁹

In summary, people seem to understand the prudent actions to take when faced with a public cardiac event, but they may be unwilling to take the appropriate steps when facing a personal cardiac emergency, perhaps due to symptom uncertainty or other behavioral factors. Variables representing demographic, situational, and self-efficacy (or belief) factors can inhibit or promote EMS use during a cardiac event. Subscription services and taxed-based systems that offset the cost of EMS services need to be analyzed further to determine if these programs represent a major factor among patients evaluating options for emergency transportation.

Acknowledgment

Mr Brown was a summer research student in the Department of Emergency Medicine at Oregon Health Sciences University during the time this research was conducted. The majority of Dr Mann's efforts on this project occurred during his time as part of the faculty of the Department of Emergency Medicine at Oregon Health Sciences University. The REACT trial was supported by cooperative agreements U01-HL-53141, U01-HL-53412, U01-HL-53149, U01-HL-53155, U01-HL-53211, and U01-HL-53135 from the National Heart, Lung, and Blood Institute, Bethesda, Md. In addition, an American Heart Association Summer Student Award was made to Mr Brown. The authors are solely responsible for the content of the article, and their opinions do not necessarily represent the views of any listed funding source.

References

1. National Heart, Lung, and Blood Institute. *Morbidity and Mortality: Chart Book on Cardiovascular, Lung, and Blood Diseases*. Bethesda, Md: US Department of Health and Human Services, Public Health Service; 1992.
2. American Heart Association. *Heart Facts*. Dallas, Tex: American Heart Association; 1992.
3. Effectiveness of intravenous thrombolytic treatment in acute myocardial infarction: Gruppo Italiano per lo Studio della Streptochinasi nell' Infarto Miocardico (GISSI). *Lancet*. 1986;1:397-402.
4. Eisenberg MS, Ho MT, Schaeffer S, et al. A community survey of the potential use of thrombolytic agents for acute myocardial infarction. *Ann Emerg Med*. 1989;18:838-841.
5. Matthews KA, Siegal JM, Kuller LH, et al. Determinants of decisions to seek medical treatment by patients with acute myocardial infarction symptoms. *J Pers Soc Psychol*. 1983;44:1144-1156.
6. Hedges JR, Mann NC, Meischke H, et al. Assessment of chest pain onset and out-of-hospital delay using standardized interview questions: the REACT pilot study. *Acad Emerg Med*. 1998;5:773-780.
7. Dracup K, Moser DK. Treatment-seeking behavior among those with signs and symptoms of acute myocardial infarction. *Heart Lung*. 1991; 20:570-575.
8. Meischke H, Eisenberg MS, Larsen MP. Prehospital delay interval for patients who use emergency medical services: the effect of heart-related medical conditions and demographic variables. *Ann Emerg Med*. 1993; 22:1597-1601.
9. Meischke H, Eisenberg MS, Schaeffer SM, et al. Utilization of emergency medical services for symptoms of acute myocardial infarction. *Heart Lung*. 1995;24:11-18.
10. Dracup K, Moser DK, Eisenberg M, et al. Causes of delay in seeking treatment for heart attack symptoms. *Soc Sci Med*. 1995;40:379-392.
11. Dean NC, Haug PJ, Hawker PJ. Effect of mobile paramedic units on outcome in patients with myocardial infarction. *Ann Emerg Med*. 1988; 7:1034-1041.
12. Lewis RP, Lanese RR, Stang JM, et al. Reduction of mortality from prehospital myocardial infarction by prudent patient activation of mobile coronary care system. *Am Heart J*. 1982;103:123-130.
13. Siepmann DB, Mann CN, Hedges JR, et al. Association between prepayment systems and EMS use among patients with acute chest discomfort syndrome. *Ann Emerg Med*. In press.
14. Simon AB, Feinleib M, Thompson H. Components of delay in the pre-hospital phase of acute myocardial infarction. *Am J Cardiol*. 1972; 30:476-482.
15. Meischke H, Ho MT, Eisenberg MS, et al. Reasons patients with chest pain delay or do not call 911. *Ann Emerg Med*. 1995;25:193-197.
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;87:1705-1709.
17. 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;24:202-208.
18. 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;18:727-731.
19. Simons-Morton DG, Goff DC, Osganian S, et al. Rapid early action for coronary treatment: rationale, design, and baseline characteristics. *Acad Emerg Med*. 1998;5:726-738.
20. 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.
21. *International Classification of Diseases*, 9th revision. Washington, DC: Public Health Service, US Dept of Health & Human Services; 1980.
22. Littell RC, Milliken GA, Stroup WW, et al. *SAS System for Mixed Models*. Cary, NC: SAS Institute Inc; 1996.
23. Schmidt TA, Mann NC, Federiuk CS, et al. Do patients refusing transport remember descriptions of risks after initial ALS assessment? *Acad Emerg Med*. 1998;5:796-801.