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Original Contribution

Emergency medical services management of ST-segment elevation myocardial infarction in the United States—a report from the American Heart Association Mission: Lifeline Program

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ABSTRACT

Objective: ST-segment elevation myocardial infarction (STEMI) is a major cause of morbidity and mortality in the United States. Emergency medical services (EMS) agencies play a critical role in its initial identification and treatment. We conducted this study to assess EMS management of STEMI care in the United States.
Methods: A structured questionnaire was administered to leaders of EMS agencies to define the elements of STEMI care related to 4 core measures: (1) electrocardiogram (ECG) capability at the scene, (2) destination protocols, (3) catheterization laboratory activation before hospital arrival, and (4) 12-lead ECG quality review. Geographic areas were grouped into large metropolitan, small metropolitan, micropolitan, and noncore (or rural) by using Urban Influence Codes, with a stratified analysis.
Results: Data were included based on responses from 5296 EMS agencies (36% of those in the United States) serving 91% of the US population, with at least 1 valid response from each of the 50 states and the District of Columbia. Approximately 63% of agencies obtained ECGs at the scene using providers trained in ECG acquisition and interpretation. A total of 46% of EMS systems used protocols to determine hospital destination, cardiac catheterization laboratory activation, and communications with the receiving hospital. More than 75% of EMS systems used their own agency funds to purchase equipment, train personnel, and provide administrative oversight. A total of 49% of agencies have quality review programs in place. In general, EMS systems covering higher population densities had easier access to resources needed to maintain STEMI systems of care. Emergency medical services systems that have adopted all 4 core elements cover 14% of the US population.
Conclusions: There are large differences in EMS systems of STEMI care in the United States. Most EMS agencies have implemented at least 1 of the 4 core elements of STEMI care, with many having implemented multiple elements.

1. Introduction

ST-segment elevation myocardial infarction (STEMI) is a significant health problem in the United States, with 400000 to 500000 events per year, representing 30% of patients with acute coronary syndrome [1]. With the reliance of acute care hospitals on primary

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percutaneous coronary intervention (PCI) or fibrinolysis, increased emphasis has been placed on developing systems of care to integrate emergency medical services (EMS) activation, evaluation, treatment, and transport of patients with STEMI [2,3].

Widely disseminated national guidelines describe the integration of EMS into STEMI systems of care [4–8]. Identification of STEMI on the prehospital electrocardiogram (ECG) allows for transport of the patient to a PCI-capable center (if appropriate) and prehospital activation of the cardiac catheterization laboratory [9]. Some 80% of the US population lives within the 90-minute window of a PCI center, and three-fourths of the remaining 20% live within 120 minutes, making prompt identification and transport imperative [8]. Prehospital identification of STEMI leads to an approximate 10-minute decrease in door-to-drug time for patients receiving fibrinolysis and an 18-minute decrease in door-to-balloon time for primary PCI [2,10].

In 2007, the American Heart Association (AHA) introduced *Mission: Lifeline*, a national, community-based initiative to improve the quality of care and outcomes for patients with STEMI and to increase the health care system readiness and response to STEMI. The initial implementation of *Mission: Lifeline* was based on recommendations for programs, policy, and research published in the *Development of Systems of Care for STEMI* [11].

We conducted this study to assess the level of EMS involvement in state and regional STEMI systems of care using a nationwide sample stratified by population density. Our hypothesis was that significant variability exists in the adoption of selected components of STEMI systems of care in the United States.

2. Methods

2.1. Study design

The survey was developed by volunteers from the AHA *Mission: Lifeline* Emergency Cardiac Care Task Force. Instrument development started in summer 2007. The survey was validated by *Mission: Lifeline* committee members who were not part of the research team. Validation consisted of identification of objects of measurement, defining relevant survey elements, and developing questions for each element. The survey was pilot tested for 4 weeks in 8 states and was then modified based on feedback from those pilot tests. The instrument was organized into the following question topic areas: 13 general, 22 specific for STEMI, and 6 specific for stroke (see Appendix A for actual survey). The survey elicited information on EMS protocols, equipment, staffing, funding, training, existing process measures, and treatment decisions. Survey questions were answered by respondents at the director level or above in order to understand specific agency characteristics. The survey was designed to require approximately 20 minutes to complete. It was distributed using online survey software (Vovici Corporation, Dulles, VA) and written formats. The stroke data were reported separately [11].

2.2. Population and setting

The survey was distributed to state or county lead agencies or regional EMS organizations. The AHA staff worked with local volunteers, state EMS offices, and state representatives from the National Association of State EMS Officials in all 50 states and the District of Columbia to identify the appropriate organizational leaders for survey completion. Respondents were asked to list all of the counties in which they provide EMS services.

2.3. Experimental protocol

Emergency medical services structure and financing were characterized as fire-based, volunteer-staffed, or third-service as well as not-for-profit, hospital-based, or for-profit. Staffing models were characterized as including 1 or more of EMT-basic, EMT-intermediate, paramedic, first responder, or helicopter-based. Demographic characteristics were obtained relating to finance, training, and legislation for prehospital STEMI care.

The Federal Information Processing Standard (FIPS) codes were used to assign a unique 5-digit number to each county within the 50 states and the US territories [12]. The FIPS codes were used to derive the population coverage counts and to determine the type of area (eg, rural vs metro) covered by the survey. Agencies were also grouped by US Census definition of regions (eg, Northeast, Midwest, South, and West) [13]. County population counts were derived from 2008 Environmental Services Research Institute, Inc, population estimates [14]. Duplicate responses from the same agency or those missing county designation were excluded.

The population density of participating counties was classified using Urban Influence Codes (UICs) [15]. The UICs were categorized into 4 broad population density categories for analysis: large metropolitan ($\geq$1 million residents), small metropolitan ($<$1 million residents), micropolitan ($\geq$1 urban cluster of at least 10 000 residents), and noncore or rural (without an urban cluster of at least 10 000 residents) [16].

Planned EMS response to STEMI was characterized whether or not the system had landline-enhanced 911 or wireless-enhanced 911. The 4 core elements for STEMI systems are listed in Table 3. Transfer capabilities were assessed by examining (1) the use of interfacility transport protocols, (2) whether interfacility transfers for STEMI were given the same priority as 911 calls, (3) the use of expedited transfer from non–PCI to PCI-capable centers keeping patient on EMS stretchers, (4) fibrinolysis inclusion/exclusion protocols for EMS, and (5) prehospital fibrinolysis protocols.

Respondents described the proportion of their EMS vehicles with 12-lead ECG, proportion of responders trained to interpret 12-lead ECG for STEMI, and estimate of false-positive 12-lead ECG readings.

2.4. Analytical methods

Survey responses were aggregated with FIPS codes, county name, state, the 2008 population estimate, and the UIC code. A subset of the survey data was created to include the agency's unique identification number, all the counties served by the agency, and the corresponding state. Survey subset responses were matched to the vertical data set through use of the agency's unique identifier using SAS 9.2.1 (SAS Institute, Cary, NC).

For counties served by more than 1 EMS agency, questions with dichotomous responses were scored as “yes” if at least 1 agency serving the county answered “yes” to a given question. For questions with multiple allowable responses, multiple response set variables were analyzed using Stata 10.0 (StataCorp LP, College Station, TX) for χ^2 analysis of geographic differences using methods described by Jenn [17] for managing surveys with multiple response sets. In order to assess differences, we conducted an overall Bonferroni-adjusted Pearson χ^2 on an expanded table of the frequencies of response “patterns” by geographic service type. The characteristics of EMS agencies' structure, function, legislative support, processes of care, and quality assurance related to patients with STEMI were compared by degree of population density using Pearson χ^2 test for trend.

All analyses were performed with commercial software including SPSS 17.0 (SPSS Inc, Chicago, IL), Stata 10.0 (StataCorp LP), or SAS 9.2.1 (SAS Institute, Cary, NC). Significance was declared at the .05 level.

3. Results

Between October 6, 2008, and December 31, 2008, responses were obtained from 5410 agencies, representing 2602 counties. There were 114 (2.1%) agencies excluded due to missing service area information, leaving 5296 EMS agencies (85% of those in the United States),

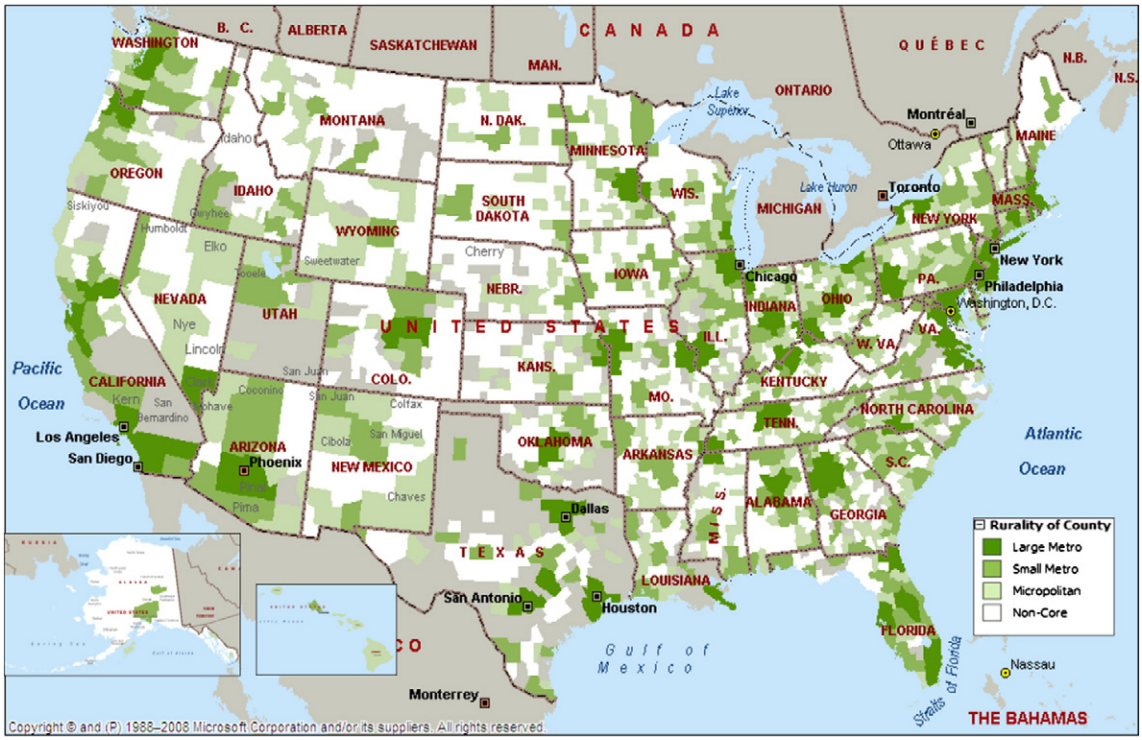

Figure. All respondents classified at the county level according to whether EMS covers a population that is large metro, small metro, micropolitan, or rural.

representing 91% of the population. [18,19] At 1one valid response was received from each of the 50 states and the District of Columbia, with a mean of 108 (range, 1-423) responses per state (Figure).

Multiple EMS agencies often covered 1 county. Some agencies (n = 763) covered large geographic areas, thereby crossing 2 or more of the 4 UIC aggregate groups with service to both rural and urban areas. Most agencies (4533) served areas with a single type of rurality (ie, single type of UIC group.) The other EMS agencies served 2 (n = 611), 3 (n = 115), or all 4 UIC types (n = 37), and 114 could not be categorized because of missing county information. Of the single UIC-

Table 1
EMS agency structure and administration by region

Characteristic	Large metropolitan	Small metropolitan	Micropolitan	Rural	All	*P*
Description of EMS Agency (n)	1160	1258	826	1092	4336	
Fire-based (%)	61	48	44	24	44	<.001
Paid (%)	88	82	81	70	19	<.001
Third service (%)	14	17	19	22	18	<.001
Not-for-profit (%)	12	17	15	17	15	.007
Hospital-based (%)	6	7	9	15	9	<.001
For-profit (%)	7	6	8	7	7	NS
Ambulance staffing (n)	1184	1305	852	1147	4488	
EMT-basic (%)	61	66	65	73	66	<.001
EMT-intermediate (%)	27	34	40	42	36	<.001
EMT-paramedic (%)	82	73	68	58	71	<.001
First responder (%)	14	20	19	16	17	<.001
Helicopter (%)	4	8	8	9	7	<.001
EMS medical record (n)	1195	1306	857	1152	4510	
Paper (%)	61	59	65	75	65	<.001
Electronic (%)	60	61	58	45	56	<.001
Funding for ECG machines (n)	927	848	516	519	2810	
EMS agency (%)	78	77	75	66	75	<.001
Grants and gifts (%)	22	21	25	30	24	.004
Hospital (%)	6	7	6	3	6	.084
County (%)	7	9	10	15	10	<.001
City (%)	10	11	10	5	9	.016
State (%)	1	2	1	1	1	NS
12-Lead ECG training for EMS personnel (n)	1099	1132	743	884	3858	
(%)	73	64	55	41	59	<.001
Enabling legislation for EMS (n)	249	166	99	131	645	
City (%)	12	9	10	9	11	NS
County (%)	31	39	29	28	32	NS
State (%)	66	63	72	74	68	NS
Legislative protocols for prehospital ECG (%)	640 (26)	577 (17)	312 (17)	443 (17)	1917 (19)	<.001

Participants were allowed multiple responses to questions resulting in fluctuation in sample sizes. In order to assess differences, we conducted an overall Bonferroni-adjusted Pearson χ^2 on an expanded table of the frequencies of response patterns by geographic service type.

type agencies, 1199 (26%) covered large metro areas, 1317 (29%) served small metro areas, 861 (19%) covered micropolitan areas, and 1156 (26%) served rural areas.

The structure and administration of EMS agencies that participated in the survey was significantly associated with the population density (Table 1). Emergency medical services agencies in metropolitan areas were more likely than those in rural areas to be fire based (61% vs 24%), whereas rural systems tended to have more volunteers (30% vs 12%). Rural agencies were more likely to be staffed by basic EMTs (73% vs 61%) and less likely to be staffed by paramedics (58% vs 82%). Agencies in metropolitan areas were more likely than those in rural areas to use electronic medical records (73% vs 61%), more likely to use agency funds to obtain 12-lead ECG machines (78% vs 66%), and more likely to provide 12-lead ECG training for EMS personnel (73% vs 41%). Population density was not associated with differences in enabling legislation (Table 2).

Obtaining 12-lead ECGs at the scene, using protocols defining hospital destination, using protocols for prehospital activation of the catheterization laboratory, and the use of quality review programs for 12-lead ECGs differed significantly between the 4 categories (Table 3). Emergency medical services care delivery and quality assurance related to patients with STEMI were also significantly associated with population density.

Mode of communication differed significantly among communities in the following areas: ECGs were more likely to be communicated to the base hospital in metropolitan areas compared with rural and smaller communities (25% vs 12%). In contrast, there were no significant differences in the use of radio or landline to send interpretations of ECGs or computer interpretation of ECGs based on size of the community.

Emergency medical services agencies provision of interfacility transport for patients with STEMI, the urgency of such transport, and use of fibrinolysis inclusion/exclusion protocols for EMS or prehospital fibrinolysis protocols were not significantly associated with the degree of rurality.

Quality assurance of prehospital care of patients with STEMI was significantly associated with the population density, including review of the quality of 12-lead ECG interpretation and performance measures for patients with suspected STEMI. Agencies were more likely to examine the accuracy of 12-lead ECG interpretation (false positives and negatives) in large metro and small metro areas.

Table 3 shows the proportion of the population covered by an EMS agency using 1 or more of the 4 core elements, namely, scene ECG, destination protocols, prehospital catheterization laboratory activation, and ECG quality review.

Table 2
EMS care delivery and quality assurance by region

Characteristic	Large metropolitan	Small metropolitan	Micropolitan	Rural	Total	*P*
Total number	1194	1306	849	1146	4495	
Landline E-911 (%)	99	99	97	93	97	<.001
Wireless E-911 (%)	91	90	86	79	87	<.001
Prehospital 12-lead ECG capabilities for at least 80% of patients (%)	1098 (70)	1125 (64)	739 (56)	884 (45)	3846 (60)	<.001
Communication mode (n)	745	719	367	352	2183	
EMS staff interpretation sent by radio/telephone (%)	74	75	78	80	76	NS
Computer interpretation sent by radio/telephone (%)	27	28	31	24	27	NS
ECG communicated to base hospital (%)	25	19	17	12	20	<.001
ECG communicated by Bluetooth (%)	17	15	13	9	14	<.001
ECG communicated by cell phone (%)	38	37	27	27	34	<.001
ECG communicated by radio (%)	12	13	13	16	13	NS
Communication receipt (n)	1098	1125	739	884	3846	
PCI hospital (%)	40	37	18	12	28	<.001
Non–PCI hospital (%)	23	21	32	26	25	<.001
Other hospital (%)	8	7	4	7	7	.02
Medical control facility (%)	22	17	17	11	17	<.001
No communication (%)	30	36	44	55	40	<.001
Interfacility transport (%)	269 (37)	352 (38)	321 (41)	503 (40)	1445 (39)	**NS**
Interfacility transfers for STEMI given same priority as 911 calls (%)	410 (74)	462 (80)	398 (76)	615 (81)	1885 (78)	NS
Expedited transfer from non–PCI to PCI-capable centers keeping patient on EMS stretcher (%)	404 (31)	431 (32)	406 (27)	616 (27)	1857 (29)	NS
Fibrinolysis inclusion/exclusion protocols for EMS (%)	641 (24)	675 (25)	504 (24)	718 (22)	2538 (24)	NS
Prehospital fibrinolysis protocols (%)	978 (6)	1001 (6)	646 (6)	893 (7)	3518 (6)	NS
STEMI data collection (n)	1085	1152	749	1007	3993	
State agency (%)	52	53	52	55	53	NS
Other organization (%)	23	21	21	13	20	<.001
Not reported (%)	35	35	35	36	35	NS
Review of EMS ECG interpretations (n)	770	818	509	634	2731	
Non–PCI hospital agency (%)	8	6	7	6	7	NS
PCI hospital (%)	28	24	17	9	21	<.001
Emergency medicine (%)	27	26	30	21	26	.019
Cardiology (%)	12	15	6	3	10	<.001
EMS agency (%)	17	18	21	19	18	<.001
Medical director (%)	79	79	76	80	79	NS
Performance measures	888	908	598	783	3177	
False-positive ECG data collected (%)	33	29	20	12	24	<.001
False-negative ECG data collected (%)	27	24	15	11	20	<.001
Complications during transport (%)	48	45	46	45	46	NS
EMS dispatch time (%)	71	71	69	69	70	NS
EMS arrival time (on scene) (%)	65	67	63	57	63	<.001
EMS arrival time at hospital (%)	61	60	57	52	58	.008
Scene to hospital interval (%)	56	57	52	46	53	<.001
None (%)	20	19	20	22	20	NS
Time of symptom onset (%)	34	35	36	30	34	NS

Participants were allowed multiple responses to questions resulting in fluctuation in sample sizes. In order to assess differences, we conducted an overall Bonferroni-adjusted Pearson χ^2 on an expanded table of the frequencies of response patterns by geographic service type.

Table 3
Planned EMS response to STEMI: core elements

Core element	Large metropolitan	Small metropolitan	Micropolitan	Rural	All	*P*
ECG capability at the scene (%)	1190 (80)	1304 (67)	851 (62)	1151 (42)	4496 (63)	<.001
Destination protocols (%)	1101 (60)	1011 (52)	648 (36)	898 (30)	3568 (46)	<.001
Prehospital 12-lead ECG triggers catheterization laboratory activation before hospital arrival (%)	1009 (67)	1117 (59)	720 (35)	943 (21)	3789 (47)	<.001
12-Lead ECG quality review (%)	881 (59)	923 (56)	551 (41)	663 (31)	3018 (49)	<.001

Participants were allowed multiple responses to questions resulting in fluctuation in sample sizes. In order to assess differences, we conducted an overall Bonferroni-adjusted Pearson χ^2 on an expanded table of the frequencies of response patterns by geographic service type.

4. Discussion

4.1. Emergency medical services structure

Emergency medical services agencies rely on a variety of organizational structures to provide service to the public. Survey respondents were most likely to represent a fire-based service, with volunteers, third service, not-for-profits, hospital-based, and for-profit equally represented in the remainder. Of note, fire-based service is disproportionately represented in large metropolitan areas as opposed to smaller metropolitan and rural areas. Volunteer agencies are much more common in rural areas.

4.2. Prehospital 12 leads

National guidelines and other consensus and scientific statements have recommended the use of prehospital ECGs during the initial evaluation of patients with symptoms suggestive of acute coronary syndrome [1–12,20–22]. Our results show that 80% of EMS agencies in large metropolitan areas reported performing ECGs, and 67% of metropolitan agencies with ECG capabilities use this information to activate the cardiac catheterization laboratory, compared with 21% of rural agencies.

Most EMS agencies were responsible for purchasing their 12-lead ECG devices. In rural EMS agencies, there was a greater reliance on grants or donations. Governmental agencies and hospitals provided funding in less than 20% of all EMS agencies. Startup funding borne by the EMS agency thus represents one potential barrier to developing the prehospital component of STEMI systems in the United States [23].

Agencies that did not transmit or communicate ECG findings were more likely to be rural than urban, a difference that may be due to the increased proportion of EMS personnel at the EMT-basic level or may be due to problems with transmission. In rural settings, more than one-half did not transmit. In major metropolitan areas, approximately one-third of agencies did not transmit or communicate their 12-lead ECG findings.

Without transmission or verbal reporting, it is difficult or impossible to modify destination decisions or to activate cardiac catheterization laboratory in advance of patient arrival. It should be emphasized that transmission may not be required if paramedics are trained to interpret and verbally report ECG findings. Accuracy of paramedic interpretation of STEMI is high, although, in one study, transmission to the emergency department for physician interpretation improved the positive predictive value of the prehospital 12-lead ECG for triage and therapeutic decision making [24].

4.3. Regional systems

The rationale for establishing regional ST-elevation myocardial infarction receiving center networks has been reviewed previously [25]. Prehospital ECG programs may reduce the time from EMS arrival at the scene to arrival at the PCI center because of expedited scene and transport time, and direct transport protocols, thus bypassing non–PCI-capable hospitals, if necessary [12,26–28]. Of note, in rural systems, more than one-half of all patients with STEMI do not have access to prehospital ECG or bypass protocols.

Large metropolitan areas have more destination choices and use destination and bypass protocols more frequently. Rural EMS has fewer choices for destination hospital and makes greater use of secondary transfer. Even with the need for secondary transfer to a PCI facility, only 29% of receiving hospitals specifically instructed EMS to remain with the patient while kept on the EMS gurney during non–PCI center evaluation in anticipation of subsequent transfer to a PCI center.

4.4. Staffing

Emergency medical services staffing levels demonstrate a greater proportion of EMT-paramedic in more populous EMS service areas and a greater proportion of EMT-basic and EMT-intermediate in the smaller population centers. Because of the larger proportion of EMT-basic providers in rural areas, programs must accommodate providers who are capable of ECG acquisition and transmission instead of interpretation. Systems with a higher proportion of EMT-paramedic should consider training these advanced providers in ECG interpretation to facilitate system activation for patients with STEMI [24,29].

4.5. Quality

Most EMS agencies rely on the agency medical director to review ECG interpretation quality. From our survey data, it appears that some EMS systems use contemporaneous review of interpretation quality in addition to retrospective agency medical director review.

Although most EMS Systems measure response and transport intervals, it is notable that approximately 1 in 4 does not. Increasing the use of an electronic health record may help agencies with data collection. Of the agencies that record and report STEMI data, more than one-half of all EMS systems report to a state agency, usually the state EMS office. Others report to some other external organization such as regional or local EMS agencies.

4.6. Legislation

Most respondents cited state law as the source of enabling EMS legislation for STEMI protocols, with a smaller proportion relying on county- or city-level legislation. Most STEMI system legislation enables development and maintenance of the program but does not provide funding. It is likely that this lack of funding is preventing the development of prehospital STEMI programs in many EMS regions.

5. Limitations

This survey reflects data collected at a single point in time and is several years old at this point. As a single data point, the results are not reflective of changes over time, where arguably, there have been significant advances in STEMI system of care, specifically in rural settings.

The data collected in this survey describe observations only and cannot be used to infer association or causation. The observations are based on responses from personnel at individual EMS agencies and may

not reflect the opinions of the majority. Responses were not vetted with the represented agencies and thus reflect the opinions of the respondent.

Because the survey was sent to known EMS jurisdictions, specific regions of the country may be overrepresented if specific government jurisdictions such as cities, counties, or states were covered by multiple EMS agencies, with overlapping coverage.

The survey results allowed the authors to assess the characteristics of the responding EMS system. If a survey was not completed, the structure of EMS service remained unknown, making comparisons between responders and nonresponders impossible. Because of the high response rate, the authors believe that the survey is representative of EMS practices as they existed at the time of the survey.

6. Conclusions

We conclude that metropolitan areas have greater access to resources, including funding and/or access to content expertise, to support the key elements of prehospital STEMI care, whereas rural areas do not. Although most of the population is served in the metro area, the largest impact could arguably be made by improving programs in the rural areas where hospital distance is also a limiting factor to reaching time to treatment thresholds. Enhancement of systems of care in more rural areas should be a focus of future efforts to improve access to resources.

Appendix A. EMS assessment for STEMI and stroke

Thank you for taking the time to complete the EMS Assessment. Your responses will provide valuable information to help the American Heart Association assess EMS needs for your area. The full assessment should take no longer than 20 minutes to complete. **Only one assessment should be filled on behalf of the designated lead agency(ies) or organizations who respond to 911 requests in your region with a complaint of chest pain or other potential AMI symptoms**. The assessment should be completed by the director or the medical director for the agency/organization or their designee.

General Questions

Q1 Your name:
Q2 EMS role or professional title:
Q3 Your agency's name:
Q3a You agency's contact phone number and address:
Q4 EMS agency/lead organization description?
Fire
Third service
Private agency
For profit
Not for profit
Hospital based
Q5 Your state:
Q6 Please list the county (ies) in which you operate.
Q7 Do you transport patients with high suspicion of acute myocardial infarction to a hospital?
Yes
No
Q8 What is the population in your service area?
Q9 How many square miles of area does your service cover?
Q10 Is 9-1-1 coverage available for your city or county?
E-911 for 100% of the population for landline
Wireless 911 coverage for at least 75% of the population
Landline E9-1-1 (include hyperlink)
Yes
No
Wireless 9-1-1
Yes
No
Q11 How do your EMS units document patient information once the patient has been transported to the receiving hospital? Check all that apply.
Documentation is on paper form
Documentation is entered onto an electronic health record
Q12 How does your organization report the patient information data on STEMI? Check all that apply.
Data are reported to a state agency
Data are reported to another organization
Please name the organization (text box):_____
Data are not reported to an external organization
Don't know
Q13 How does your organization report the patient information data on stroke? Check all that apply.
Data are reported to a state agency
Data are reported to another organization
Please name the organization (text box):_____
Data are not reported to an external organization
Don't know

STEMI Questions

Q14 Describe the staffing of the EMS or first-response vehicles that respond to treat patients with chest discomfort. Check all that apply.
EMT-basic
EMT-intermediate
EMT-paramedic
Nontransporting first responder agency
Helicopter transport
Don't know/not applicable
Q15 What is the total number of staffed ambulances in your agency/organization that are typically available to respond to chest pain patients in your agency/organization's response area?
Number of staffed ground ambulances:_____
Number of staffed helicopters:_____
Don't know/not applicable
Q16 In your agency/organization, is the field provider's 12-lead ECG information used to activate the catheterization laboratory prior to arrival at the receiving facility?
Yes, for all receiving facilities
Yes, sometimes or for some receiving facilities
No
Don't know
Q17 Does your organization have 12-lead ECG devices available at the scene for at least 80% of the patients with chest pain?
Yes
No
Q18 What percentage of your vehicles responding to suspected cardiac patients in your agency/organization have 12-lead ECG acquisition devices?
10% or less
11%-25%
26%-50%
51%-75%
76%-100%
Don't know
Q19 Who provided the funding for the 12-lead ECG devices? Check all that apply.
Organization purchased the devices
Organization purchased the devices through a grant/donation
PCI hospital(s) assisted in the purchased devices
County provided devices
City provided devices

State provided devices
Don't know/not applicable

Q20- Q21 Did your organization's responders receive 12-lead ECG STEMI identification training?
Yes
No

If yes, *please list the course length and how the training was provided (ie. classroom, self taught, Internet, etc)*.

Q22 What percentage of your organization's responders that see suspected cardiac patients are trained to read and interpret 12-lead ECGs for STEMI diagnosis?
10% or less
11%-25%
26%-50%
51%-75%
76%-100%
Don't know

Q23 Does your organization communicate prehospital 12-lead information? Check all that apply.
Yes, to PCI hospital
Yes, to base hospital
Yes, in some ambulances and to some hospitals
Yes, to a medical control facility
No

(**Please note: if "No" skip questions 24-26**)

Q24 How is the 12-Lead ECG information transmitted? Check all that apply.
ECG read by EMS personnel and interpretation called by phone/radio
ECG read by computer algorithm and called by phone/radio to base hospital
ECG communicated to base hospital
ECG communicated by blue tooth
ECG communicated by cell phone
ECG communicated by radio
Don't know/not applicable

Q25 What is your estimate of the false positive (ie, catheterization laboratory activated but ECG did not really show ST elevation) of 12-lead ECG readings? Check the answer that best applies.
Greater that 50%
26%-50%
10%-25%
Less than 10%
Don't know

Q26 Does your organization have a process for collecting and analyzing data related to 12-lead ECG acquisition and interpretation or quality review and improvement reasons?
Yes
No

Q27 Is your organization's data review performed with: (Check all that apply)
Non–PCI hospital
PCI hospital
ED
Cardiologists
State Agency or Department of EMS
Agency medical director
None of the above
Don't know/not applicable

Q28 Does your organization track and review any of the following performance measures for patients with suspected STEMI? Check all that apply.
12-Lead ECG interpretation accuracy including false-positive rate, if applicable
12-Lead ECG interpretation accuracy including false-negative rate, if applicable
Complications (including death) during transport
Time ambulance dispatched to call
EMS arrival on scene (first medical contact)
EMS arrival at hospital door
Medical transport unit's on scene time to hospital door arrival time
No performance measures are captured
Patient AMI symptom onset time
Don't know/not applicable

Q29 Are there destination protocols (ie, bypass non–PCI hospitals to go directly to PCI centers) for patients that have had a prehospital identification of a STEMI?
Yes
No
Don't know/not applicable

Q30 Was state, city or county legislation needed to implement the bypass protocols? (add hyperlink)
Yes
No
Don't know/not applicable

Q31 Please specify if the legislation/regulation was initiated at the (Check all that apply):
City level
County level
State level
Don't know/not applicable

Q32 If your organization does not routinely transfer patients with AMI to a PCI center, do you utilize an inclusion/exclusion fibrinolytic criteria checklist completed on patients with suspected STEMI prior to ED arrival?
Yes
No
Don't know/not applicable

Q33 Is prehospital fibrinolysis used in your organization?
Yes.
No
Sometimes
Don't know/not applicable

Q34 For interfacility transports from non–PCI to PCI hospitals, is there a transport time goal from departure of non–PCI center to arrival at the PCI hospital door.
Yes and the expected response time is _____
No
Don't know/not applicable

Q35 For non–PCI hospitals that use interfacility transfers to a PCI facility for patients with STEMI, do the patients with suspected STEMI stay on an ambulance stretcher for evaluation?
Yes.
Always
Frequently
Occasionally
No
Don't know/not applicable

Q36 Do the interfacility STEMI patients need to be transferred to a PCI facility given the same priority as a 911 calls?
Yes
No
Don't know/not applicable

Stroke Questions

Q37 Does your organization's dispatch center utilize established standards for emergency medical dispatch (EMD) protocols for

stroke patients that meet national guidelines [A] established by AHA through emergency cardiovascular care or policy papers?
Yes
No
Don't know/not applicable

Q38 If yes, which one?
Emergency cardiac care
Policy papers
Don't know/not applicable

Q39 Do all emergency medical trained responders within your organization utilize a stroke triage assessment tool for every suspected stroke patient that meets AHA/ASA guidelines [A] (*including Cincinnati Stroke Scale, LA, MENDS or other validated tool*)?
Yes
No
Don't know/not applicable

Q40 Do all emergency medical responders within your organization utilize a stroke treatment protocol that meets (at a minimum) AHA/ASA guidelines [A] and emergency cardiovascular care ACLS standards?
Yes
No
Don't know/not applicable

Q41 Do all EMS responders within your organization utilize stroke transport protocols with the intent to transport qualified acute stroke patients to the most appropriate treatment facilities (ie, primary stroke center).
Yes
No
Don't know/not applicable

Q42 Do all emergency medical trained responders within your organization that care for stroke patients complete a minimum of 2 hours of stroke assessment education and care per year as a part of their certification or registration renewal requirements?
Yes
No
Don't know/not applicable

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