Mission: Lifeline –
Addressing the
System of STEMI Care

Alice K. Jacobs, M.D.
Boston University Medical Center
Boston, MA, USA

ACC West Virginia Chapter, April 2017
Disclosure Information

FINANCIAL DISCLOSURE:
No relevant relationships to disclose.

UNLABELED/UNAPPROVED USES DISCLOSURE:
None

- 30% of STEMI patients did not receive reperfusion therapy in the absence of contraindications
- Time to treatment within guideline recommendations in minority of patients
- Primary PCI preferred strategy
- 5000 acute care hospitals, 1330 cath labs with PCI
- Transfer time to PCI hospitals unacceptably long
Door-to-Balloon Time
Percent Treated in ≤ 90 Minutes by Transfer Status

- Non-transfer: 33.1% in 1994 to 41% in 2004
- Transfer: 3.9% in 1994 to 5.4% in 2004

Year of Discharge

Percent of Patients
The Reality of Reperfusion Therapy for STEMI – THEN *(2003-2004)*

- 30% of STEMI patients did not receive reperfusion therapy in the absence of contraindications
- Time to treatment within guideline recommendations in minority of patients
- Primary PCI preferred strategy
- 5000 acute care hospitals, 1330 cath labs with PCI
- Transfer time to PCI hospitals unacceptably long
- Model systems working successfully
Model STEMI System

✓ Integration of Pre-hospital ECG and Destination Protocols
✓ Treat and Transfer using integrated systems approach
STEMI SYSTEMS OF CARE

- POE 12-lead ECG
- “Definite STEMI”
- STEMI Alert
- Bypass ED
- No diversion
- Data Center
- DSMB
Boston EMS Bypass

STEMI Triage Plan & Treatment Registry

Door-to Balloon Time ≤ 90 Minutes (2003-2009)
Model STEMI System

- Integration of Pre-hospital ECG and destination Protocols
- Treat and Transfer using integrated systems approach
Regional STEMI Systems

- standardized treatment protocol
- training of all personnel
- tool kits with check lists, transfer forms, standing orders, adjunctive meds
- comprehensive feedback and quality assurance plan
Limitations to Implementing Regional STEMI Systems

- > 50% of patients did not use EMS
- Majority of EMS systems did not do 12-lead ECG
- Population density and cardiovascular mortality mismatch
Heart Disease is not evenly distributed by population...
Limitations to Implementing Regional STEMI Systems

- > 50% of patients did not use EMS
- Majority of EMS systems did not do 12-lead ECG
- Population density and cardiovascular mortality mismatch
- Prolonged transfer time in rural settings
- Hospital EDs frequently on diversion
- Financial disincentives for transfer
1. Now that the winter months are upon us, it is important to know the potential health problems facing people with heart disease during cold weather.

2. The American Heart Association’s premier scientific conference, Scientific Sessions, is Nov. 13-17, in Chicago. Check out our online newsroom to stay up to date on the latest heart disease and stroke research presented at this year’s conference.

3. Do you know the signs of caregiver burnout? Your healthy body, mind and spirit benefit your loved one as much as they benefit you.


5. Childhood obesity is a threat to kids’ health, making nutrition promotion and education critical. Urge Congress to pass the Child Nutrition Act now!

2010 Guidelines for CPR
We’re making CPR even easier so more people will perform it and more lives will be saved.
Learn more about the new CPR guidelines.
History 2004-2006

MAY 2004
AHA recruits an Advisory Working Group (AWG)

JUNE 2005
Price Waterhouse Coopers presents market research to AWG

MARCH 2006
AWG Consensus Statement in *Circulation*

Stakeholders called to action

AWG develops guiding principles

AHA conference of multidisciplinary groups involved in STEMI patient care
STEMI Systems of Care manuscripts are finalized

EARLY 2007

A cross-functional team is recruited to lead

APRIL 2007

Mission: Lifeline launched

MAY 2007

Eleven manuscripts are published in *Circulation*

JULY 2008

*Mission: Lifeline* launched.
• Community-based National initiative
• Improve quality of care + outcomes in STEMI
• Improve health care system readiness and response to STEMI.
Developing Systems of Care for STEMI

STEMI refers to ST-segment elevation myocardial infarction, a type of heart attack. Systems of care for STEMI involve a coordinated effort between various stakeholders to ensure timely and effective treatment. This includes the public, payers, health agencies, policymakers, and healthcare providers.

- **Patient:** The individual experiencing symptoms of STEMI.
- **Ambulance/EMS:** Emergency medical services that transport patients to the hospital.
- **STEMI-referral hospital (non-PCI-capable):** A hospital that can diagnose and stabilize the patient but does not have the capability to perform percutaneous coronary intervention (PCI).
- **STEMI-receiving hospital (PCI-capable):** A hospital equipped to perform PCI, a procedure for treating STEMI that involves placing a stent to open blocked arteries.

The process starts with the patient calling 911, initiating an ambulance, and then being transported to the nearest hospital. If the hospital is non-PCI-capable, the patient is transferred to a PCI-capable hospital for further treatment.

Effective systems of care for STEMI involve clear communication, timely transportation, and efficient transfer of care to ensure the best possible outcomes for patients.
<table>
<thead>
<tr>
<th>Heart Attack</th>
<th>Stroke</th>
<th>Warning Signs</th>
<th>System Strategies</th>
<th>Mission: Lifeline Resources/Tools</th>
<th>System Standards/Metrics</th>
<th>System Recognition/Certification Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideal Public</td>
<td>Ideal Public</td>
<td>Ideal EMS</td>
<td>Ideal EMS</td>
<td>Ideal STEM Mk Referral</td>
<td>Ideal STEM Mk Referral</td>
<td>Ideal STEM Mk Referral</td>
</tr>
<tr>
<td>Acute event Planning for an acute event</td>
<td>EMS initial Contact EMT Basic</td>
<td>EMS initial Contact EMT Paramedic</td>
<td>Emergency Dept Initial Hospital Non-PCI Facility</td>
<td>Primary PCI Hospital</td>
<td>STEM Mk System Strategies</td>
<td></td>
</tr>
<tr>
<td>ACT In TIME</td>
<td>Heart Attack Warning Signs</td>
<td>MI Patient Pathway</td>
<td>Reparusion Checklist</td>
<td>D2B Alliance</td>
<td>Minneapolis Heart Institute Level 1 FAE</td>
<td></td>
</tr>
<tr>
<td>POE Protocols</td>
<td>STEM Mk Protocols</td>
<td>RACE POE</td>
<td>Protocol</td>
<td>Project UPSTART</td>
<td>Boston Medical Center Sample STEM Mk Clinical Pathway</td>
<td></td>
</tr>
<tr>
<td>STEM Mk Protocols</td>
<td>RACE POE</td>
<td>Protocol</td>
<td></td>
<td>Boston Medical Center ACS Admit Orders</td>
<td>Boston Medical Center ACS Admit Orders</td>
<td></td>
</tr>
<tr>
<td>Preliminary Criteria</td>
<td>Preliminary Criteria</td>
<td>Preliminary Criteria</td>
<td>Regional System Metrics for Structure, Process, and Outcomes</td>
<td>Preliminary Criteria</td>
<td>Preliminary Criteria</td>
<td>Preliminary Criteria</td>
</tr>
<tr>
<td><a href="http://www.americanheart.org/missionlifeline">www.americanheart.org/missionlifeline</a></td>
<td>STEM Mk System Strategies</td>
<td>STEM Mk System Strategies</td>
<td>Regional System Metrics for Structure, Process, and Outcomes</td>
<td>Preliminary Criteria</td>
<td>Preliminary Criteria</td>
<td>Preliminary Criteria</td>
</tr>
</tbody>
</table>
The EMS Perspective

**Ideal System**
- Ambulances are equipped with 12-lead ECG machines.
- EMS providers are trained to use and transmit ECGs and care for STEMI patients.
- Standardized point of entry protocols define patient transport rules.
- When STEMI, Cath Lab is activated promptly.
- Patients transported to a STEMI Referral Center remain on stretcher with EMS pending transfer decision.
- When “walk-in” patients present to a STEMI Referral Center and primary PCI is needed, activation of EMS occurs.
The STEMI-ceiving Hospital Perspective

**Ideal System**

- Pre-hospital ECG, ED notification, and Cath Lab activation occur according to standard algorithms.
- Single call systems from STEMI Referral Hospitals immediately activate the Cath Lab.
- Primary PCI is provided as routine treatment 24/7.
- A multidisciplinary team meets regularly to identify and solve problems.
- A continuing education program is designed and implemented.
- A mechanism for monitoring performance, process measures, and patient outcomes is established.
STEMI Systems of Care manuscripts are finalized
Action items for the AHA begin to take shape

APRIL 2007
A cross-functional team is recruited to lead Mission: Lifeline

MAY 2007
Eleven manuscripts are published in *Circulation*
Mission: Lifeline launched

JULY 2008
Affiliate Staff Kick-Off is held

**History 2007-2008**

**EARLY 2007**

**APRIL 2007**

**MAY 2007**

**JULY 2008**
Trained AHA 350 field staff in Mission: Lifeline implementation in July 2008 (local adaptation of national recommendations)
Have You Registered Your STEMI System with Mission: Lifeline?

Mission: Lifeline

Each year, thousands of patients with ST-elevation myocardial infarction (STEMI) fail to receive critical reperfusion therapy for their infarct artery in a timely fashion. Even worse, nearly 30 percent of patients with STEMI do not receive any reperfusion treatment.

Mission: Lifeline™ is the American Heart Association’s national initiative to advance systems of care for STEMI patients. The initiative seeks to reduce mortality and morbidity and improve the overall quality of care for STEMI patients.

The ultimate goal of Mission: Lifeline™ is to save lives by closing the gaps that separate STEMI patients from timely access to the appropriate treatments.
Systems of Care for ST-Segment–Elevation Myocardial Infarction: A Report From the American Heart Association’s Mission: Lifeline

James G. Jollis, MD; Christopher B. Granger, MD; Timothy D. Henry, MD; Elliott M. Antman, MD; Peter B. Berger, MD; Peter H. Moyer, MD, MPH; Franklin D. Pratt, MD; Ivan C. Rokos, MD; Anna R. Acuña; Mayme Lou Roettig, RN, MSN; Alice K. Jacobs, MD

Background—National guidelines call for participation in systems to rapidly diagnose and treat ST-segment–elevation myocardial infarction (STEMI). In order to characterize currently implemented STEMI reperfusion systems and identify practices common to system organization, the American Heart Association surveyed existing systems throughout the United States.

Methods and Results—A STEMI system was defined as an integrated group of separate entities focused on reperfusion therapy for STEMI within a geographic region that included at least 1 hospital that performs percutaneous coronary intervention and at least 1 emergency medical service agency. Systems meeting this definition were invited to participate in a survey of 42 questions based on expert panel opinion and knowledge of existing systems. Data were collected through the American Heart Association Mission: Lifeline website.

Between April 2008 and January 2010, 381 unique systems involving 899 percutaneous coronary intervention hospitals in 47 states responded to the survey, of which 255 systems (67%) involved urban regions. The predominant funding sources for STEMI systems were percutaneous coronary intervention hospitals (n=320, 84%) and/or cardiology practices (n=88, 23%). Predominant system characteristics identified by the survey included: STEMI patient acceptance at percutaneous coronary intervention hospital regardless of bed availability (N=346, 97%); single phone call activation of catheterization laboratory (N=335, 92%); emergency department physician activation of laboratory without cardiology consultation...
Completion of national EMS Assessment and STEMI Systems Assessment
Emergency medical services management of ST-segment elevation myocardial infarction in the United States—a report from the American Heart Association Mission: Lifeline Program

Robert E. O’Connor, MD, MPH \(^{a, b}\), Graham Nichol, MD \(^{b}\), Louis Gonzales, EMT-P \(^{c}\), Steven V. Manoukian, MD \(^{d}\), Peter H. Mayo, MD \(^{e}\), Ivan Rokos, MD \(^{f}\), Michael K. Sayre, MD \(^{g}\), Robert G. Solomon, MD \(^{h}\), Gary L. Wingrove, EMT-P \(^{i}\), William J. Brady, MD \(^{j}\), Susan McBride, RN, PhD \(^{k}\), Andrea L. Lohden, MPH \(^{l}\), Mayme Lew Rottig, RN, MSN \(^{m}\), Anna Acuna, MHA \(^{n}\), Alice K. Jacobs, MD \(^{o}\)

\(^{a}\) Department of Emergency Medicine, University of Virginia School of Medicine, Charlottesville, VA
\(^{b}\) Department of Emergency Medicine, University of Washington, Seattle, WA
\(^{c}\) University of Washington/Highline Centre for Prehospital Emergency Care, University of Washington, Seattle, WA
\(^{d}\) Lifeline Emergency Medicine, Nashville, TN
\(^{e}\) Clinical and Preventive Services Group, Hospital Corporation of America, Nashville, TN
\(^{f}\) Bayside Emergency Medical Services, Venice, CA
\(^{g}\) Department of Emergency Medicine, Jefferson School of Medicine of St. Louis, University of Washington, Seattle, WA
\(^{h}\) LifeNet Emergency Medicine, Department of Medicine, University of Washington, Seattle, WA
\(^{i}\) Hennepin County Medical Center, Minneapolis, MN
\(^{j}\) Hartford Hospital, Hartford, CT
\(^{k}\) Critical Care Medical, Medical Transport, Baltimore, MD
\(^{l}\) School of Nursing, University of Kentucky, Lexington, KY
\(^{m}\) Department of Preventive Medicine, Texas A&M Health Science Center, College Station, TX
\(^{n}\) Duke Clinical Research Institute, Duke University, Durham, NC
\(^{o}\) American Heart Association, Dallas, TX

ORIGINAL CONTRIBUTION

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 determine the elements of STEMI care required to ensure necessary ERC (electronic record system) capability at the scene, (2) documentation...
Pre-hospital 12-Lead ECG

Percentage of Vehicles with 12-Lead ECG devices
Destination Protocol for Pre-hospital Identification of STEMI Patients

All Respondents
| **2009 - 2013** |
|-----------------|------------------|-----------------|-----------------|
| **SPRING 2009** | **FALL 2009**    | **2010**        | **2011**        |
| Completion of national EMS Assessment and STEMI Systems Assessment | Certification criteria with achievement and reporting measures for EMS Agencies, Hospitals and STEMI systems are released | Hospital recognition program and reports are released | AHA collaborates with SCPC and hospital accreditation program released |
STEMI SYSTEMS OF CARE

Mission: Lifeline Reports

<table>
<thead>
<tr>
<th>Hospital</th>
<th>State</th>
<th>Nation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Time from Cath Lab Arrival to First Device Activation (mins)</td>
<td>7.3</td>
<td>7.4</td>
</tr>
</tbody>
</table>

Median Time from First Medical Contact to Primary PCI (mins)¹

<table>
<thead>
<tr>
<th>Hospital</th>
<th>State</th>
<th>Nation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>94.3</td>
<td>95.4</td>
</tr>
<tr>
<td>Non-Transfer-In</td>
<td>88.3</td>
<td>95.4</td>
</tr>
<tr>
<td>% within 90 minutes</td>
<td>95%</td>
<td>87%</td>
</tr>
<tr>
<td>Arrived by EMS</td>
<td>55.7</td>
<td>95.4</td>
</tr>
<tr>
<td>Arrived by POV</td>
<td>55.4</td>
<td>100.4</td>
</tr>
<tr>
<td>Transfer-In</td>
<td>89.2</td>
<td>81.6</td>
</tr>
<tr>
<td>Arrived at referral facility by EMS</td>
<td>54.3</td>
<td>96.4</td>
</tr>
<tr>
<td>Arrived at referral facility by POV</td>
<td>54.5</td>
<td>97.5</td>
</tr>
<tr>
<td>% within 90 minutes</td>
<td>65%</td>
<td>54%</td>
</tr>
<tr>
<td>% within 120 minutes</td>
<td>65%</td>
<td>54%</td>
</tr>
</tbody>
</table>

Median Time from Arrival to Primary PCI (mins)

<table>
<thead>
<tr>
<th>Hospital</th>
<th>State</th>
<th>Nation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Transfer-In</td>
<td>78.5</td>
<td>79.4</td>
</tr>
<tr>
<td>% within 90 minutes</td>
<td>65%</td>
<td>54%</td>
</tr>
<tr>
<td>Arrived by EMS</td>
<td>78.5</td>
<td>74.5</td>
</tr>
<tr>
<td>Arrived by POV</td>
<td>79.3</td>
<td>67.5</td>
</tr>
<tr>
<td>Transfer-In (Time from Arrival at Referral Facility)</td>
<td>92.6</td>
<td>93.4</td>
</tr>
<tr>
<td>% within 90 minutes</td>
<td>65%</td>
<td>54%</td>
</tr>
<tr>
<td>Arrived at referral facility by EMS</td>
<td>90.4</td>
<td>90.5</td>
</tr>
<tr>
<td>% within 60 minutes</td>
<td>90.4</td>
<td>90.5</td>
</tr>
<tr>
<td>% within 90 minutes</td>
<td>90.8</td>
<td>95.4</td>
</tr>
<tr>
<td>Arrived at referral facility by POV</td>
<td>92.3</td>
<td>89.4</td>
</tr>
<tr>
<td>Transfer-In (Time from Arrival at Receiving Facility)</td>
<td>56.5</td>
<td>67.5</td>
</tr>
<tr>
<td>% within 30 minutes</td>
<td>65%</td>
<td>54%</td>
</tr>
<tr>
<td>% within 90 minutes</td>
<td>65%</td>
<td>54%</td>
</tr>
</tbody>
</table>

FOOTNOTES:
¹ Among EMS arrival to first facility
STEMI SYSTEMS OF CARE

Cardiovascular Center of Excellence Accreditation
AHA/ACC Cardiovascular Center of Excellence
Developing Systems of Care for STEMI

Mission: Lifeline

Where are we NOW?

STEMI-referral hospital (non PCI-capable)

(PCI-capable)

American Heart Association
Learn and Live
Mission: Lifeline STEMI System Coverage*
As of 9/30/2008 (87 systems, 24.0% Population Coverage)

Registered STEMI System Coverage

* Population coverage based on self-reported ZIP code coverage area. Coverage area data is not currently available for all registered systems.
STEMI + Cardiac Resuscitation System Coverage

As of 05/12/2015
(856 STEMI Systems - 82.94% Population Coverage)
(86 Cardiac Resuscitation Systems - 9.25% Population Coverage)

Source:

Note:
Cardiac Resuscitation Coverage Areas listed are also indicative of a STEMI system in place. Mission: Lifeline does not recognize Cardiac Resuscitation Systems that are not also associated with an active STEMI system.
## Trends in Treatment, Process and Outcomes for STEMI Patients 2008-2012

<table>
<thead>
<tr>
<th>Variable</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals (n)</td>
<td>179</td>
<td>224</td>
<td>334</td>
<td>383</td>
<td>445</td>
</tr>
<tr>
<td>STEMI Patients (n)</td>
<td>18,583</td>
<td>21,670</td>
<td>29,886</td>
<td>35,683</td>
<td>41,644</td>
</tr>
<tr>
<td>Eligible, No reperfusion (%)*</td>
<td>6.2</td>
<td>6.2</td>
<td>6.2</td>
<td>4.4</td>
<td>3.3</td>
</tr>
<tr>
<td>Pre-hospital ECG (% [direct]*)</td>
<td>45</td>
<td>58</td>
<td>61</td>
<td>66</td>
<td>71</td>
</tr>
<tr>
<td>FMC-to-device (min) [direct]*+</td>
<td>93</td>
<td>89</td>
<td>88</td>
<td>85</td>
<td>84</td>
</tr>
<tr>
<td>Door-to-device (min) [direct]*+</td>
<td>68</td>
<td>63</td>
<td>61</td>
<td>60</td>
<td>59</td>
</tr>
<tr>
<td>First door-to-device (min)*+ [transfer]</td>
<td>130</td>
<td>122</td>
<td>119</td>
<td>114</td>
<td>112</td>
</tr>
<tr>
<td>Symptom onset to FMC (min)+</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>52</td>
<td>49</td>
</tr>
</tbody>
</table>

* P<0.0001; +median minutes

In-hospital Mortality for STEMI Patients 2008-2012

Relation Between Observed In-hospital Mortality and Annual Door-to-Balloon Times

Nallamothu BK. Lancet 2014;Epub November 18.
Is It All About Door-to-Balloon?

FMC

Door-in-Door-out

Door-to-Balloon ≤ 90 min 90%
STEMI SYSTEMS OF CARE

Transfers: Arrival at 1st Facility to Transfer Out (Door-In Door-Out) Median Times (2012 – 2016*)

<table>
<thead>
<tr>
<th>Year</th>
<th>Median Time (minutes)</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>45</td>
<td>n = 11,468</td>
</tr>
<tr>
<td>2013</td>
<td>45</td>
<td>n = 13,226</td>
</tr>
<tr>
<td>2014</td>
<td>45</td>
<td>n = 13,607</td>
</tr>
<tr>
<td>2015</td>
<td>45</td>
<td>n = 13,948</td>
</tr>
<tr>
<td>2016</td>
<td>45</td>
<td>n = 15,144</td>
</tr>
</tbody>
</table>

*Through Q3 2016

Median Door-In Door-Out Times
### Trends in Treatment, Process and Outcomes for STEMI Patients 2008-2012

<table>
<thead>
<tr>
<th>Variable</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitals (n)</td>
<td>179</td>
<td>224</td>
<td>334</td>
<td>383</td>
<td>445</td>
</tr>
<tr>
<td>STEMI Patients (n)</td>
<td>18,583</td>
<td>21,670</td>
<td>29,886</td>
<td>35,683</td>
<td>41,644</td>
</tr>
<tr>
<td>Eligible, No reperfusion (%) *</td>
<td>6.2</td>
<td>6.2</td>
<td>6.2</td>
<td>4.4</td>
<td>3.3</td>
</tr>
<tr>
<td>Pre-hospital ECG (%) [direct] *</td>
<td>45</td>
<td>58</td>
<td>61</td>
<td>66</td>
<td>71</td>
</tr>
<tr>
<td>FMC-to-device (min) [direct] *+</td>
<td>93</td>
<td>89</td>
<td>88</td>
<td>85</td>
<td>84</td>
</tr>
<tr>
<td>Door-to-device (min) [direct] *+</td>
<td>68</td>
<td>63</td>
<td>61</td>
<td>60</td>
<td>59</td>
</tr>
<tr>
<td>First door-to-device (min) [transfer] *+</td>
<td>130</td>
<td>122</td>
<td>119</td>
<td>114</td>
<td>112</td>
</tr>
<tr>
<td>Symptom onset to FMC (min)+</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>52</td>
<td>49</td>
</tr>
</tbody>
</table>

* P<0.0001; +median minutes


<table>
<thead>
<tr>
<th>Year</th>
<th>ARG Contracts</th>
<th>Hospitals Participating in Mission: Lifeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>640</td>
<td>196</td>
</tr>
<tr>
<td>2011</td>
<td>656</td>
<td>345</td>
</tr>
<tr>
<td>2012</td>
<td>680</td>
<td>534</td>
</tr>
<tr>
<td>2013</td>
<td>708</td>
<td>878</td>
</tr>
<tr>
<td>2014</td>
<td>792</td>
<td>951</td>
</tr>
<tr>
<td>2015</td>
<td>890</td>
<td>1036</td>
</tr>
<tr>
<td>2016</td>
<td>988</td>
<td>1079</td>
</tr>
</tbody>
</table>
National Number of STEMI Patients
(2012 – 2016*)

*Through Q3 2016
EMS First Medical Contact to 1st Device Activation Median Times (2012 – 2016*)

*Through Q3 2016

<table>
<thead>
<tr>
<th>Year</th>
<th>Median (Minutes)</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>82</td>
<td>32,709</td>
</tr>
<tr>
<td>2013</td>
<td>81</td>
<td>40,507</td>
</tr>
<tr>
<td>2014</td>
<td>81</td>
<td>43,123</td>
</tr>
<tr>
<td>2015</td>
<td>80</td>
<td>46,524</td>
</tr>
<tr>
<td>2016</td>
<td>79</td>
<td>50,627</td>
</tr>
</tbody>
</table>
Door-to-Balloon and EMS FMC-to-Device

% Door to Balloon and (EMS) FMC to PCI

By Year – Using Mission: Lifeline Q1 Reports

- Door to Balloon < 90 Minutes
- FMC to PCI < 90 Minutes
Median Door-to-Balloon Times (Minutes)
## Transfers: Arrival at 1st Facility to Primary PCI

### Median Times (2012 – 2016*)

<table>
<thead>
<tr>
<th>Year</th>
<th>Median Time (Minutes)</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>106</td>
<td>11,468</td>
</tr>
<tr>
<td>2013</td>
<td>106</td>
<td>13,226</td>
</tr>
<tr>
<td>2014</td>
<td>105</td>
<td>13,607</td>
</tr>
<tr>
<td>2015</td>
<td>104</td>
<td>13,948</td>
</tr>
<tr>
<td>2016</td>
<td>104</td>
<td>15,144</td>
</tr>
</tbody>
</table>

*Through Q3 2016
Transfers: First Door-to-Device < 120 Minutes

Arrival at Referral Facility to PCI < 120 Minutes

By Year – Using Mission: Lifeline Q1 Reports


Percent Achievement

70.5 70.7 70.6
Mission: Lifeline in West Virginia

ST-Elevation Acute Myocardial Infarction
Hospital Treatment Capability
Drive Time to Primacy PCI Capable Hospital

Drive Time to PCI Hospital
- 30 minutes to PCI
- 45 minutes to PCI

FIBRINOLYTICS/TRANSFER

PRIMARY PERCUTANEOUS CORONARY INTERVENTION
1. BLUEFIELD REGIONAL MEDICAL CENTER
2. CABELL-HUNTINGTON HOSPITAL, INC
3. CAMDEN CLARK MEDICAL CENTER
4. CHARLESTON AREA MEDICAL CENTER - MEMORIAL HOSPITAL
5. BERKELEY MEDICAL CENTER
6. MONONGALIA GENERAL HOSPITAL
7. RALEIGH GENERAL HOSPITAL
8. ST MARY'S MEDICAL CENTER
9. THOMAS MEMORIAL HOSPITAL
10. UNITED HOSPITAL CENTER
11. WERTON MEDICAL CENTER
12. WEST VIRGINIA UNIVERSITY HOSPITALS - RUBY MEMORIAL
13. WHEELING HOSPITAL

Total Hospitals: 55
PCI Capable Hospitals: 13
Mission: Lifeline in West Virginia

Number of Patients Treated for STEMI by Quarter

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Number of Patients</th>
<th>Number of Hospitals Participating</th>
</tr>
</thead>
<tbody>
<tr>
<td>QTR 1, 2015</td>
<td>62</td>
<td>4</td>
</tr>
<tr>
<td>QTR 2, 2015</td>
<td>92</td>
<td>5</td>
</tr>
<tr>
<td>QTR 3, 2015</td>
<td>118</td>
<td>7</td>
</tr>
<tr>
<td>QTR 4, 2015</td>
<td>133</td>
<td>8</td>
</tr>
<tr>
<td>QTR 1, 2016</td>
<td>158</td>
<td>8</td>
</tr>
<tr>
<td>QTR 2, 2016</td>
<td>181</td>
<td>8</td>
</tr>
<tr>
<td>QTR 3, 2016</td>
<td>172</td>
<td>8</td>
</tr>
</tbody>
</table>
9-1-1 Utilization

- N=1
- N=8
Increase in 9-1-1 Utilization

- Self/Family Utilization:
  - QTR 2, 2015 (5 HOSP): 47%
  - QTR 3, 2015 (7 HOSP): 33%
  - QTR 4, 2015 (8 HOSP): 40%
  - QTR 1, 2016 (8 HOSP): 35%
  - QTR 2, 2016 (8 HOSP): 37%
  - QTR 3, 2016 (8 HOSP): 38%

- EMS Utilization:
  - QTR 2, 2015 (5 HOSP): 51%
  - QTR 3, 2015 (7 HOSP): 66%
  - QTR 4, 2015 (8 HOSP): 59%
  - QTR 1, 2016 (8 HOSP): 61%
  - QTR 2, 2016 (8 HOSP): 58%

N=5  N=7  N=8  N=8  N=8  N=8  N=8  N=8
Increase 12-lead ECG Use by EMS
Hospital ECG Within 10 Minutes of Arrival

- QTR 1, 2015 (4 HOSP): 75%
- QTR 2, 2015 (5 HOSP): 66%
- QTR 3, 2015 (7 HOSP): 72%
- QTR 4, 2015 (8 HOSP): 58%
- QTR 1, 2016 (8 HOSP): 59%
- QTR 2, 2016 (8 HOSP): 76%
- QTR 3, 2016 (8 HOSP): 66%
- QTR 4, 2016 (8 HOSP): 64%
Door-to-Device < 90 Minutes
(Median, Minutes)
EMS FMC to Device Time <90 Minutes
(Median, Minutes)
Transfers – From Door at First Facility to PCI <120 Minutes (Median, Minutes)
Door In-Door-Out Referral Hospital <45 Minutes (Median, Minutes)
STEMI SYSTEMS OF CARE

Time in Receiving Hospital ED for Transfer-In Patients

- N=4
- N=5
- N=7
- N=8
- N=8
- N=8
- N=8
- N=8
In-hospital Mortality (Adjusted)

<table>
<thead>
<tr>
<th>Quarter</th>
<th>State</th>
<th>Nation</th>
</tr>
</thead>
<tbody>
<tr>
<td>QTR 1, 2015 (5 HOSP)</td>
<td>6.9%</td>
<td>6.9%</td>
</tr>
<tr>
<td>QTR 2, 2015 (7 HOSP)</td>
<td>5.2%</td>
<td>5.3%</td>
</tr>
<tr>
<td>QTR 3, 2015 (8 HOSP)</td>
<td>5.9%</td>
<td>6.0%</td>
</tr>
<tr>
<td>QTR 4, 2015 (8 HOSP)</td>
<td>6.8%</td>
<td>6.8%</td>
</tr>
<tr>
<td>QTR 1, 2016 (8 HOSP)</td>
<td>6.0%</td>
<td>6.7%</td>
</tr>
<tr>
<td>QTR 2, 2016 (8 HOSP)</td>
<td>6.0%</td>
<td>6.9%</td>
</tr>
<tr>
<td>QTR 3, 2016 (8 HOSP)</td>
<td>5.5%</td>
<td>6.0%</td>
</tr>
<tr>
<td>QTR 4, 2016 (8 HOSP)</td>
<td>5.8%</td>
<td>6.8%</td>
</tr>
</tbody>
</table>

N=5  N=7  N=8  N=8  N=8  N=8  N=8
Major Focus Areas for Year 3

- FMC-to-Device Time
- EMS initiates STEMI Alert from the field
- Implement Pre-Hospital Activation Protocol
- EMS ED Bypass Protocol
- Implementation of Prehospital Lytic protocol for EMS agencies transporting STEMI patients to STEMI Referring Center
- Inter-facility Transport Protocol
- Referring Center engagement
- Feedback Loops
STEMI SYSTEMS OF CARE

Challenges
False Activations

What is a "false activation"?

• over-activation
• inappropriate activation
• unnecessary activation
• false-positive activation
• misread ECG / improper activation
• properly read ECG / open artery
• STEMI in patient not eligible for acute catheterization
STEMI SYSTEMS OF CARE

STEMI RECEIVING CENTER VOLUME REPORT

Patients with Prehospital ECG+STEMI

Cath Lab Activations

Patients who received PCI

Cath Lab Cancelations

Cath Lab without PCI

<table>
<thead>
<tr>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td></td>
<td></td>
<td></td>
<td>2010</td>
<td></td>
<td></td>
<td></td>
<td>2011</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All data are self-reported by hospitals.
30-Day Mortality at PCI and Non-PCI Hospitals in NYS

Elderly and African Americans and pts with heart rate ≥100 bpm, heart failure, depression, fluid and electrolyte disorders and metastatic cancer were less likely to be transferred.
Mission: Lifeline
On the Horizon….

• MISSION: LIFELINE™ STEMI SYSTEMS ACCELERATOR II
• Mission: Lifeline EMS Task Force
  - CALL 9-1-1
  - Pre-activation protocol
  - EMS recognition
• Northeast USA STEMI System
  - Cost-effectiveness analysis
• Dallas, Texas STEMI System
  - Patient and public recognition initiative
ST EMI SYSTEMS OF CARE

Don’t Die of Doubt

**The Responsible Generation** (ages 64-84 years)
This generation relies on their healthcare providers for health information and direction and is most likely to comply with directives. They prefer traditional media for news and information (local newspapers, TV). About 56% of men and 49% of women use the internet, and 71% of those who go online use the internet for healthcare information.

**Baby Boomers** (ages 50-68 years)
Baby Boomers trust their doctor for information, with magazines, TV and websites following closely after. Forty percent have some form of cardiovascular disease. Baby Boomers compose one-third of U.S. internet users, and they appreciate storytelling techniques to convey information.

**Mid-acculturated Hispanics** (ages 50 and over)
Mid-acculturated Hispanics are either foreign-born or U.S.-born and are learning or know how to navigate the U.S. culture. They are bilingual, although some may prefer Spanish, and have influence to persuade those who are less acculturated about health choices during community and family interactions. Average household size is five with a mix of parents and grandparents.
STEMI SYSTEMS OF CARE

Guideline Transformation & Optimization

1. Innovate processes that will accelerate guidelines into practice

2. Activate HCPs and Systems to leverage science faster and measure clinical effectiveness and quality

3. Empower Patients & Caregivers to better manage health and participate in care coordination
American Heart Association Systems of Care

The Vision