Final Results of the Regional Systems of Care Demonstration Project: Mission: Lifeline™

STEMI Accelerator Study

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Study sponsored through research and educational grants by:

- The Medicines Company
- AstraZeneca
- Philips Healthcare
- Abiomed, Inc.

I have no relationships with industry related to this study
Organization
Duke Clinical Research Institute in Collaboration with The American Heart Association

Regional Leadership

AHA National and Affiliate* Leadership
Lori Hollowell
Chris Bjerke

169 Primary PCI Hospitals**

214 Non PCI Hospitals

1253 EMS Agencies
*Listed slide 4
**Listed at end of presentation

Study Coordinating Center
DCRI

Central Organizing Committee
Dr. Chris Granger, MD
Dr. James Jollis, MD
Mayme Lou Roettig, RN, MSN
Tammy L. Gregory, American Heart Association- National Center

DCRI Project Team & Statistics
Kathleen Fox, BA, RN
Hussein Al-Khalidi, PhD
Joan Gu, M.S
Ashley Mitchell
Michael Redden
<table>
<thead>
<tr>
<th>Region</th>
<th>Regional Leader</th>
<th>Affiliation</th>
<th>AHA Personnel</th>
</tr>
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<tr>
<td>Atlanta, GA</td>
<td>Michael A. Ross, MD</td>
<td>Emory University</td>
<td>Jeffrey Walker</td>
</tr>
<tr>
<td></td>
<td>Mike Jernigan, EMT-P</td>
<td>Metro Atlanta Ambulance Service</td>
<td>Mary Robichaux</td>
</tr>
<tr>
<td>Columbus, OH</td>
<td>Ernest Mazzaferr, Jr., MD</td>
<td>The Ohio State University Medical Center</td>
<td>Lory Sheeran Winland</td>
</tr>
<tr>
<td>Denver, CO</td>
<td>Jeb Burchenal, MD</td>
<td>University of Colorado Denver</td>
<td>Loni Denne</td>
</tr>
<tr>
<td>Hartford, CT</td>
<td>Richard Kamin, MD</td>
<td>Univ. of Conn. Health Science Center</td>
<td>Lisa Bemben</td>
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<tr>
<td></td>
<td>C. Steven Wolf, MD</td>
<td>John Dempsey / St Francis Care</td>
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<tr>
<td>Houston, TX</td>
<td>James McCarthy, MD</td>
<td>Memorial Hermann Hospital</td>
<td>Loni Denne</td>
</tr>
<tr>
<td></td>
<td>Todd Caliva, MD</td>
<td>HCA Healthcare</td>
<td></td>
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<td></td>
<td>Catherine Bissell</td>
<td>SETRAC</td>
<td></td>
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<tr>
<td>Kern County, CA</td>
<td>Lynn Ashbeck, MS, RD, Jeff Fariss, Ross Elliott</td>
<td>Hospital Council Bakersfield, Public Health Dept</td>
<td>Rea Anne Arcangel</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ron Loomis</td>
</tr>
<tr>
<td>Louisville</td>
<td>Jesse Adams, MD</td>
<td>Baptist Health Louisville</td>
<td>Alex Kuhn</td>
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<tr>
<td>New York City, NY</td>
<td>Norma Keller, MD</td>
<td>New York University Medical Center</td>
<td>Zainab Magdon-Ismail</td>
</tr>
<tr>
<td></td>
<td>Jacqueline Tamis-Holland, MD; Glenn Asaeda, MD</td>
<td>Mount Sinai St Lukes Hospital, Fire Department New York City</td>
<td>Molly Perini</td>
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<tr>
<td></td>
<td>John Freese, MD</td>
<td></td>
<td>Pamela Borg-Jensen</td>
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<tr>
<td>Northern NJ</td>
<td>Mark Zucker, MD; Mark Merlin, DO; Steven Sheris, MD</td>
<td>Newark Beth Israel Medical Center, MONOC Control &amp; Newark Beth Israel/Barnabas Health, Overlook Medical Center</td>
<td>Samantha Cole</td>
</tr>
<tr>
<td>Oklahoma City, OK</td>
<td>Charles Bethea, MD</td>
<td>Plaza Medical Center</td>
<td>Loni Denne</td>
</tr>
<tr>
<td>Philadelphia, PA</td>
<td>Elliot Barnathan, MD</td>
<td>Johnson and Johnson</td>
<td>Laurie St. Claire</td>
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<tr>
<td>Pittsburgh, PA</td>
<td>Bruce MacLeod, MD</td>
<td>West Penn Hospital</td>
<td>Alex Kuhn</td>
</tr>
<tr>
<td>St. Louis, MO</td>
<td>Richard G. Bach, MD, Michael J. Lim, MD, George M. Kichura MD, Stuart T. Higano, MD</td>
<td>St. Louis should be Barnes-Jewish Hospital, St. Louis University Hospital, and Missouri Baptist Hospital</td>
<td>Robin Hamann</td>
</tr>
<tr>
<td>San Antonio, TX</td>
<td>Dudley Wait, BBA, EMT-P, Eric Epley, NREMT-P, Jorge Alvarez, MD</td>
<td>Schertz EMS, Southwest Texas Regional Advisory Council for Trauma</td>
<td>Diana Barrett</td>
</tr>
<tr>
<td>Tampa, FL</td>
<td>Robert Sanchez, MD</td>
<td>HCA Healthcare</td>
<td>Kathy Fenelon</td>
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<td></td>
<td>Xavier Prida MD</td>
<td>Bay Heart Group</td>
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<tr>
<td>Wilkes-Barre / Scranton</td>
<td>Steven Voyce, MD</td>
<td>Geisinger Health System</td>
<td>Alex Kuhn</td>
</tr>
<tr>
<td></td>
<td>John Ellis, MD</td>
<td>Commonwealth Health</td>
<td></td>
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</tbody>
</table>
Organization
National Faculty

Physician Faculty
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Christopher B. Granger, MD - Cardiologist; Duke University Medical Center, Durham
Timothy D. Henry, MD
Cedar Sinai Heart Institute
James G. Jollis, MD - Cardiologist; Duke University Medical Center, Durham, NC
William Koenig, MD - Emergency Medicine
Los Angeles EMS Medical Director
Craig Manifold, DO - Emergency Medicine
University of Texas, HSC San Antonio
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American Heart Association
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American Heart Association
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DCRI, Durham, NC
Stephanie Starling, MHA, BSN
Novant Health Winston-Salem, NC
Background

- Timely reperfusion improves survival in patients with ST segment elevation myocardial infarction (STEMI) yet only half of patients are treated within guideline goals.

- These delays in treatment are primarily related to fragmentation of the health system and lack of coordination among 15,000 EMS agencies and 5,200 acute care hospitals.

- For example only 17% of EMS agencies can pre-activate cardiac cath. labs in all receiving hospitals.

2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction

All communities should create and maintain a regional system of STEMI care that includes assessment and continuous quality improvement of EMS and hospital-based activities.

EMS transport directly to a PCI-capable hospital for primary PCI with an ideal FMC-to-device time system goal of 90 minutes or less.

Immediate transfer to a PCI-capable hospital for primary PCI with an FMC-to-device time system goal of 120 minutes or less.
Objective

To increase the rate of timely coronary reperfusion by organizing coordinated STEMI care on a regional basis.
Study Design

Goal: Improve the % patients reaching guideline goals

Recruitment of 21 Metropolitan Statistical Regions
2012 Q2 – 2013 Q1

Gap Analyses - Strategic Planning - Regional Leadership Meetings
2012 Q3- 2013 Q1

Regional Education Intervention
2012 Q3- 2013 Q1
Focus on pre-hospital activation and common regional plans for reperfusion

16 Regions Met Study Requirements
Quarterly data review, ongoing mentorship, establish and execute protocols

23,809 STEMI Patients with Symptoms <12 Hours

5 Regions Continued to Recruit Beyond Entry Deadline

STUDY REQUIREMENTS
70% of PCI Hospitals in ARG
Regional Leadership
Common Protocols
Enter all STEMI patients for 6 consecutive quarters
Optimal STEMI system specifications by point of care Operations manual

- EMS
- Non-PCI and PCI ED
- Transfer
- Catheterization lab
- Other system issues – payers, regulations
- Choice of PCI or lytic reperfusion regimens

Intervention Sites

16 regions
484 hospitals
1,253 EMS agencies

Kern County
Colorado Front Range
Oklahoma
St. Louis
Louisville
Northern New Jersey
New York City
Hartford
Wilkes-Barre/Scranton
Pittsburgh
Columbus
Philadelphia
Atlanta
San Antonio
Tampa
Houston
Columbus
Philadelphia
Atlanta
San Antonio
Tampa

Duke Clinical Research Institute
American Heart Association
Mission: Lifeline
## Patient characteristics

<table>
<thead>
<tr>
<th></th>
<th>Direct EMS</th>
<th>Direct Self</th>
<th>Transfer</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>11,765</td>
<td>6,502</td>
<td>5,542</td>
<td>23,809</td>
</tr>
<tr>
<td>Age (median)</td>
<td>62</td>
<td>59</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Female</td>
<td>32%</td>
<td>26%</td>
<td>27%</td>
<td>29%</td>
</tr>
<tr>
<td>No insurance</td>
<td>16%</td>
<td>17%</td>
<td>16%</td>
<td>16%</td>
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## Patient characteristics

<table>
<thead>
<tr>
<th></th>
<th>Direct EMS</th>
<th>Direct Self</th>
<th>Transfer</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>27%</td>
<td>27%</td>
<td>26%</td>
<td>27%</td>
</tr>
<tr>
<td>Prior MI</td>
<td>13%</td>
<td>11%</td>
<td>11%</td>
<td>12%</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>10%</td>
<td>3%</td>
<td>10%</td>
<td>8%</td>
</tr>
<tr>
<td>Shock</td>
<td>11%</td>
<td>3%</td>
<td>8%</td>
<td>8%</td>
</tr>
</tbody>
</table>
## Patient characteristics

<table>
<thead>
<tr>
<th></th>
<th>Direct EMS</th>
<th>Direct Self</th>
<th>Transfer</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptom onset to first medical contact (median)</td>
<td>47</td>
<td>114</td>
<td>89</td>
<td>69</td>
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<tr>
<td>PCI</td>
<td>90%</td>
<td>90%</td>
<td>89%</td>
<td>90%</td>
</tr>
<tr>
<td>Eligible untreated</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
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## Patient characteristics

<table>
<thead>
<tr>
<th>In hospital outcomes</th>
<th>Direct EMS</th>
<th>Direct Self</th>
<th>Transfer</th>
<th>Overall</th>
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<tbody>
<tr>
<td>Stroke</td>
<td>0.8%</td>
<td>0.7%</td>
<td>0.9%</td>
<td>0.8%</td>
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<tr>
<td>Shock</td>
<td>9%</td>
<td>6%</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>Death</td>
<td>8%</td>
<td>3%</td>
<td>6%</td>
<td>6%</td>
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</table>
First medical contact and door to device
75th Percentile for Baseline Quarter (Mission:Lifeline goal)
ED time and Risk-adjusted in-hospital mortality
Direct EMS patients

In hospital mortality

<table>
<thead>
<tr>
<th>Emergency department time</th>
<th>n=4939</th>
<th>n=2575</th>
<th>n=3054</th>
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<tr>
<td>&lt;= 30 min</td>
<td>3.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 - 45 min</td>
<td></td>
<td>7.0%</td>
<td></td>
</tr>
<tr>
<td>&gt; 45 min</td>
<td></td>
<td></td>
<td>10.8%</td>
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P<0.001
Primary Outcome   FMC to Device Time
% Meeting Guideline Goal

<table>
<thead>
<tr>
<th></th>
<th>Direct</th>
<th>EMS</th>
<th>Hospital transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n=18,271</td>
<td>n=11,765</td>
<td>n=5,542</td>
</tr>
<tr>
<td></td>
<td>p = 0.025</td>
<td>p = 0.0046</td>
<td>p = 0.007</td>
</tr>
<tr>
<td>Direct</td>
<td>&lt;=90 min</td>
<td>&lt;=90 min</td>
<td>&lt;=120 min</td>
</tr>
<tr>
<td></td>
<td>62%</td>
<td>54%</td>
<td>65%</td>
</tr>
<tr>
<td></td>
<td>63%</td>
<td>56%</td>
<td>65%</td>
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<tr>
<td></td>
<td>63%</td>
<td>58%</td>
<td>65%</td>
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<tr>
<td></td>
<td>64%</td>
<td>58%</td>
<td>64%</td>
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<tr>
<td></td>
<td>65%</td>
<td>58%</td>
<td>65%</td>
</tr>
<tr>
<td></td>
<td>64%</td>
<td>57%</td>
<td>65%</td>
</tr>
<tr>
<td></td>
<td>65%</td>
<td>53%</td>
<td>65%</td>
</tr>
<tr>
<td></td>
<td>59%</td>
<td>53%</td>
<td>53%</td>
</tr>
</tbody>
</table>

2012Q3 2012Q4 2013Q1 2013Q2 2013Q3 2013Q4 2014Q1

EMS
n=11,765
p = 0.0046

Hospital transfer
n=5,542
p = 0.007
Primary Outcome  FMC to Device Time
% Meeting Guideline Goal
5 Most improved regions

Direct EMS patients

Region 1*  Region 2  Region 3*  Region 4  Region 5**  All 5**

2012Q3 2012Q4 2013Q1 2013Q2 2013Q3 2013Q4 2014Q1

N=4,208  *P<0.05  **P<0.01

49%  56%  53%  55%  55%  57%  59%  61%

77%

Duke Clinical Research Institute

American Heart Association  MISSION: LIFELINE
Limitations

• Majority of the intervention time dedicated to establishing leadership, recruiting hospitals to participate in a national database, establishing and training regional protocols.

• Thus, greatest impact toward end of study period and continuing after measurement period.

• This is an observational study and included the possibilities of confounded patient selection and improvement not related to the intervention.
Conclusions

• Our results highlight the opportunity to shift the focus from hospital door to first medical contact to improve regional STEMI care.

• Emergency department time is an important indicator of coordination of care between paramedics and hospitals and is associated with improved survival.

• Organizing regional STEMI care results in significant improvements in the percent of patients achieving national reperfusion goals.

• We identified numerically lower mortality among participating regions compared with national rates, suggesting that regional STEMI programs can provide important improvements to public health.
Region PCI Centers (Acknowledgement)

**New York City**
Bellevue Hospital Center  
Bronx Lebanon Hospital Center  
Brookdale Hospital & Medical Center  
Jamaica Hospital Medical Center  
Lenox Hill Heart and Vascular Institute of New York  
Lutheran Medical Center  
Montefiore Medical Center  
Mount Sinai Beth Israel  
Mount Sinai St. Luke’s  
New York Hospital Medical Center of Queens  
New York Methodist Hospital  
New York Presbyterian/Weill Cornell Medical Center  
New York Presbyterian/Columbia University Medical Center  
NYU Langone Medical Center  
St. Barnabas Hospital  
St. Luke’s Roosevelt Hospital Center - St. Luke’s

**Northern New Jersey**
Bayonne Medical Center  
Chilton Hospital  
Christ Hospital  
Clara Maass Medical Center  
Englewood Hospital and Medical Center  
Hackensack University Medical Center  
Hackensack UMC - Mountainside  
Holy Name Medical Center  
Jersey City Medical Center  
JFK Medical Center  
Morristown Medical Center  
Newark Beth Israel Medical Center  
Overlook Medical Center  
Raritan Bay Medical Center  
Robert Wood Johnson University Hospital Rahway  
Saint Barnabas Medical Center  
Saint Clare’s Hospital/Denville  
St. Joseph Regional Medical Center  
St. Mary’s Hospital  
Saint Michaels Medical Center  
The Valley Hospital  
Trinitas Regional Medical Center  
The University Hospital

**Hartford**
Hartford Hospital  
Saint Francis Hospital & Medical Center  
The Hospital of Central Connecticut  
University of Connecticut Health Center/John Dempsey Hospital
Region PCI Centers (Acknowledgement)

**Pittsburgh**
Butler Memorial Hospital
Exela Health Westmoreland Hospital
Forbes Regional Hospital
Jefferson Regional Medical Center
Monongahela Valley Hospital
Sharon Regional Health System
The Uniontown Hospital
UPMC Passavant Hospital
UPMC Presbyterian Hospital
Washington Health System
West Penn Allegheny Health System

**Philadelphia**
Albert Einstein Medical Center
Aria Health
Hahnemann University Hospital
Holy Redeemer Hospital and Medical Center
Hospital of the University of Pennsylvania
Jeanes Hospital
Lankenau Hospital
Mercy Fitzgerald Hospital
Nazareth Hospital
Penn Presbyterian Medical Center
Pennsylvania Hospital
Temple University Hospital
Thomas Jefferson University Hospital

**Wilkes- Barre/Scranton**
Geisinger Community Medical Center
Geisinger Wyoming Valley Medical Center
Lehigh Valley Hospital - Hazleton
Wyoming Valley Health Care System
## Region PCI Centers (Acknowledgement)

**Colorado Front Range**
- Avista Adventist Hospital
- Denver Health Medical Center
- Exempla Good Samaritan Medical Center
- Littleton Adventist Hospital
- McKee Medical Center
- Medical Center of Aurora
- Medical Center of the Rockies
- Memorial Health System
- North Colorado Medical Center
- Parker Adventist Hospital
- Parkview Medical Center
- Penrose Hospital
- Porter Adventist Hospital
- Presbyterian/St. Luke's Medical Center
- Saint Mary's Hospital and Regional Medical Center
- Sky Ridge Medical Center
- St Anthony North Hospital
- St. Anthony Hospital
- St. Francis Medical Center
- Swedish Medical Center
- University of Colorado Hospital Authority

**St. Louis**
- Barnes-Jewish Hospital
- Barnes-Jewish St. Peters Hospital
- Christian Hospital
- SSM DePaul Health Center
- Des Peres Hospital
- Mercy Hospital Jefferson
- Mercy Hospital St. Louis
- Missouri Baptist Medical Center
- Progress West Healthcare Center
- Saint Louis University Hospital
- SSM St. Clare Health Center
- SSM St. Joseph Health Center
- SSM St. Joseph Hospital West
- SSM St. Mary's Health Center
- St. Anthony's Medical Center

**Louisville**
- Baptist Health Louisville
- Clark Memorial Hospital
- Floyd Memorial Hospital and Health Services
- Hardin Memorial Hospital
- Jewish Hospital
- Norton Audubon
- Norton Hospital
- University of Louisville Hospital
# Region PCI Centers (Acknowledgement)

**San Antonio**
- Baptist Medical Center
- CHRISTUS Santa Rosa Hospital - New Braunfels
- CHRISTUS Santa Rosa Hospital – Westover Hills
- CHRISTUS Santa Rosa Medical Center
- Methodist Hospital
- Methodist Stone Oak Hospital
- Methodist Texsan Hospital
- Metropolitan Methodist Hospital
- Mission Trail Baptist Hospital
- North Central Baptist Hospital
- Northeast Baptist Hospital
- Northeast Methodist Hospital
- St. Luke's Baptist Hospital
- Southwest General Hospital
- University Hospital

**Houston**
- Bayshore Medical Center
- CHI/Baylor St. Luke's Medical Center
- Clear Lake Regional Medical Center
- Conroe Regional Medical Center
- Cypress Fairbanks Medical Center
- Houston Northwest Medical Center
- Kingwood Medical Center
- Mainland Medical Center
- Memorial Hermann SouthWest
- Memorial Hermann Hospital TMC
- Memorial Hermann Memorial City Hospital
- Memorial Hermann Northeast
- Memorial Hermann Northwest Hospital
- Memorial Hermann Southeast Hospital
- Memorial Hermann The Woodlands Hospital
- St. Lukes Patients Medical Center
- St. Luke's Sugar Land Hospital
- ST. Luke's The Woodlands Hospital
- St. Luke's Vintage
- West Houston Medical Center

**North Central Oklahoma**
- Deaconess Hospital
- Hillcrest Hospital South
- Hillcrest Medical Center
- INTEGRIS Baptist Medical Center
- Integris Bass Baptist Health Center
- Jane Phillips Memorial Medical Center
- Norman Regional Health System
- Oklahoma State University Medical Center
- OU Medical Center
- St. Anthony Hospital
- Stillwater Medical Center

**Kern County**
- Bakersfield Heart Hospital
- Bakersfield Memorial Hospital
- San Joaquin Community Hospital