

# **Establishing a Nationwide STEMI Network (Including Primary PCI Without On-site Surgery)**

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**Duke** Clinical Research Institute

# Disclosure

- No Disclosures related to this presentation
- For full listing see *[www.dcri.duke.edu/research/coi.jsp](http://www.dcri.duke.edu/research/coi.jsp)*

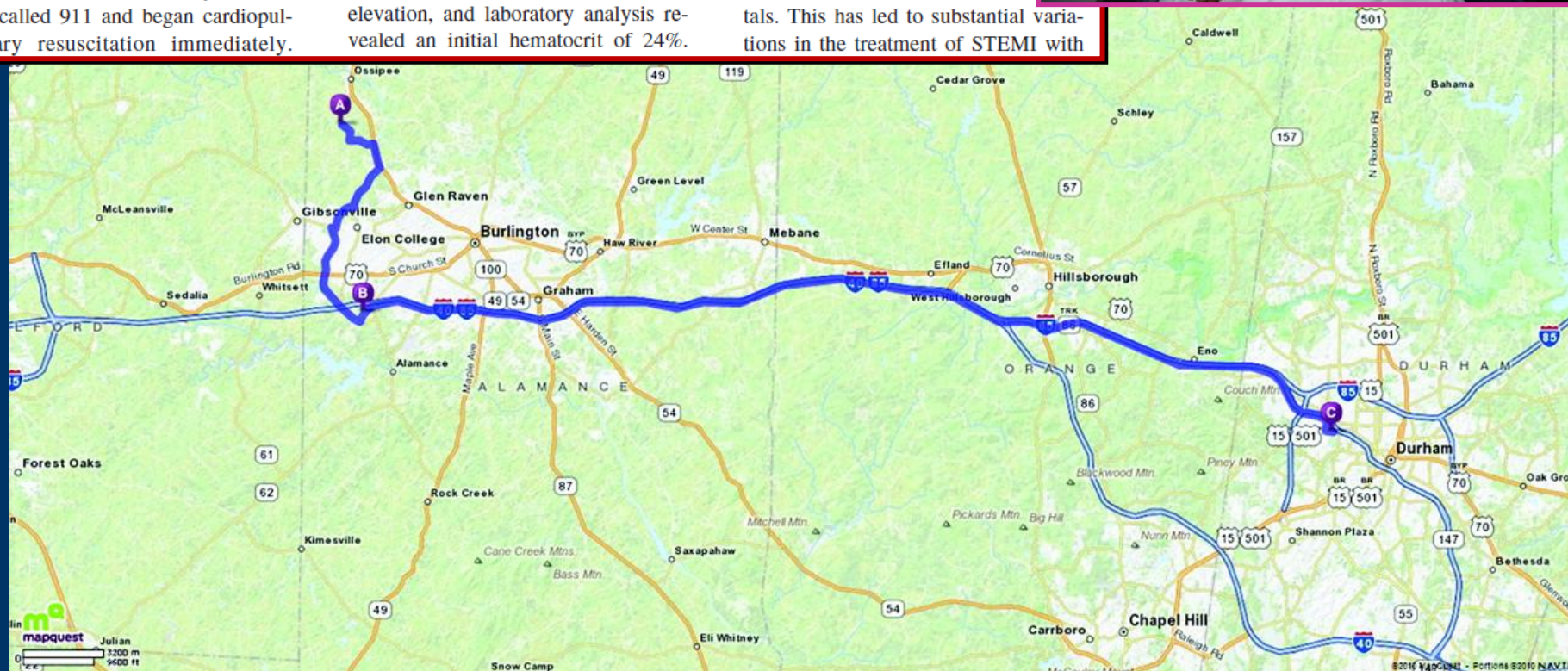
## The Need for Regional Integrated Care for ST-Segment Elevation Myocardial Infarction

John P. Vavalle, MD; Christopher B. Granger, MD

**C**ase 1 presentation: A 57-year-old man suffered a sudden cardiac arrest at home, witnessed by his son, who called 911 and began cardiopulmonary resuscitation immediately.

failure, requiring mechanical ventilation, and developed cardiogenic shock. An ECG revealed anterior ST-segment elevation, and laboratory analysis revealed an initial hematocrit of 24%.

of access is due to system barriers involving lack of coordination between EMS, non-PCI, and PCI hospitals. This has led to substantial variations in the treatment of STEMI with



# Why did Mr. Snipe survive?

- Son recognized arrest, called 9-1-1, did CPR
- EMS obtained 12-lead ECG
- EMS activated the Duke cath lab
  - Saves 35 minutes during drive, to achieve 95 min first medical contact to device time
- EMS bypassed a closer non-PCI center
  - 30 min extra drive time, saves 80 minutes compared to 110 min first door to device time
- Primary PCI, hypothermia, care of shock

Regional System of Care

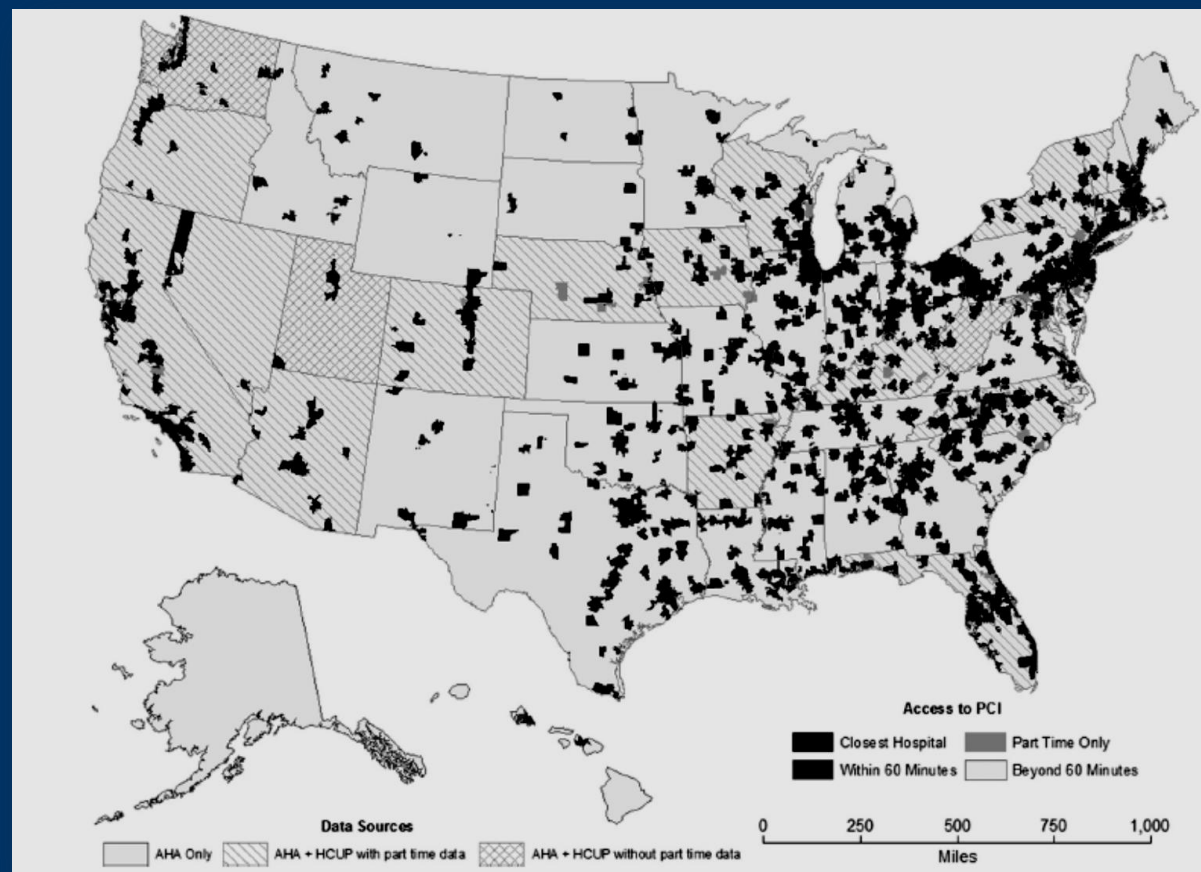
**Expansion of PCI centers including  
without surgical backup is a good  
opportunity for areas without  
coverage**



# 60 minute drive time to PCI lab

## 2001 – 2006 PCI Capable Hospital Expansion

- PCI-capable hospitals  
1176 to 1695
- Access to PCI  
79.0% to 79.9%



Concannon T, et al. Circ Cardiovasc Qual Outcomes. 2012;5:14-20

# A Percutaneous Coronary Intervention Lab in Every Hospital?

Thomas W. Concannon, PhD; Jason Nelson, MPH; Jessica Goetz, MPH; John L. Griffith, PhD

- In 2006, 1695 of 4673 US hospitals (36%) had a primary PCI program.
- Hospital PCI capability in 2006 was sufficient to provide timely primary PCI (<60 min drive time) to 80% of the population.
- From 2001 to 2006, hospital capability to perform PCI grew by 44%, whereas timely access to the procedure grew by only 1%.

*Circ Cardiovasc Qual Outcomes. 2012;5:14-20*

# STEMI Point of Entry Protocol



Onset of symptom of STEMI

9-1-1 EMS dispatch

EMS on-scene  
• Obtain 12-lead ECGs  
• Consider prehospital fibrinolytic if capable and EMS-to-needle within 30 min

Hospital fibrinolysis:  
Door-to-needle within 30 min  
FMC to device within 120 min



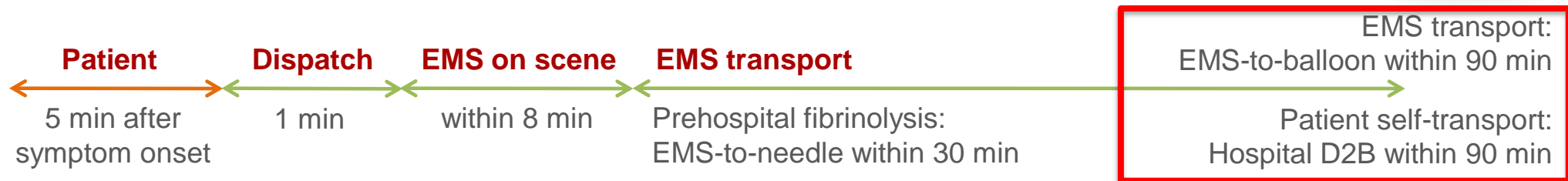
STEMI-referral hospital (non PCI-capable)

EMS Triage Plan

Inter-hospital transfer

STEMI-receiving hospital (PCI-capable)

## GOALS†



Total ischemic time: Within 120 min\*

\* Golden Hour = First 60 minutes



# **EMS bypass of non-PCI centers saves time**

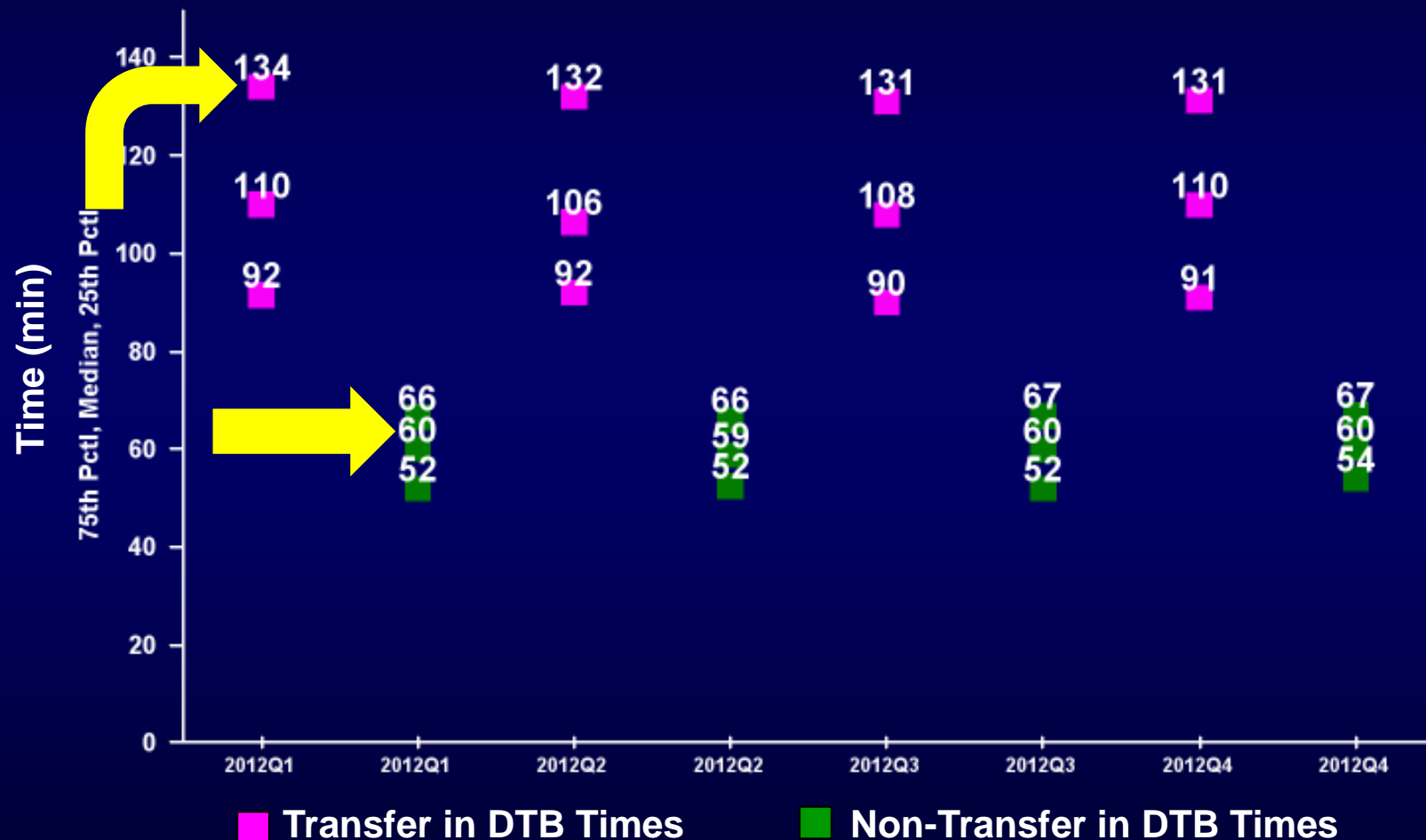
# The Impact of a Statewide Pre-Hospital STEMI Strategy to Bypass Hospitals Without Percutaneous Coronary Intervention Capability on Treatment Times

Emil L. Fosbol, MD, PhD; Christopher B. Granger, MD; James G. Jollis, MD; Lisa Monk, RN, MSN; Li Lin, MS; Barbara L. Lytle, MS; Ying Xian, MD, PhD; J. Lee Garvey, MD; Greg Mears, MD; Claire C. Corbett, MMS, NREMT-P; Eric D. Peterson, MD, MPH; Seth W. Glickman, MD

- Patients who call 9-1-1, have primary PCI, and are picked up more than 10 minutes further from a PCI than a non-PCI center
- Compare patients who drive further to a PCI center and those going to closer non-PCI and transferred
- 1288 patients
  - 826 (64%) direct to PCI facility
  - 462 (36%) first to non-PCI and transferred
- Longer transport times: median 42 vs. 26 minutes
- Shorter FMC to device: 93 vs 161 minutes
- Mortality 6.3% vs 9.3%; adjusted 13% lower

**D2B is optimized in most PCI centers, but transfers are still too SLOW!!**

# STEMI Door-to-Balloon Times Median Times for Transfer In and Non-Transfer In Patients



ACTION Registry-GWTG DATA: January 01, 2012 - December 31, 2012

**For US STEMI patients presenting to primary PCI centers in the US**

**EMS First Medical Contact to first device deployed within 90 minutes is achieved in only 50% of patients**



# Regional Systems of STEMI Care: a Class I Recommendation



**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. Performance can be facilitated by participating in programs such as Mission: Lifeline and the D2B Alliance.**



**Performance of a 12-lead ECG by EMS personnel at the site of FMC is recommended in patients with symptoms consistent with STEMI.**



*Helping Cardiovascular Professionals  
Learn. Advance. Heal.*

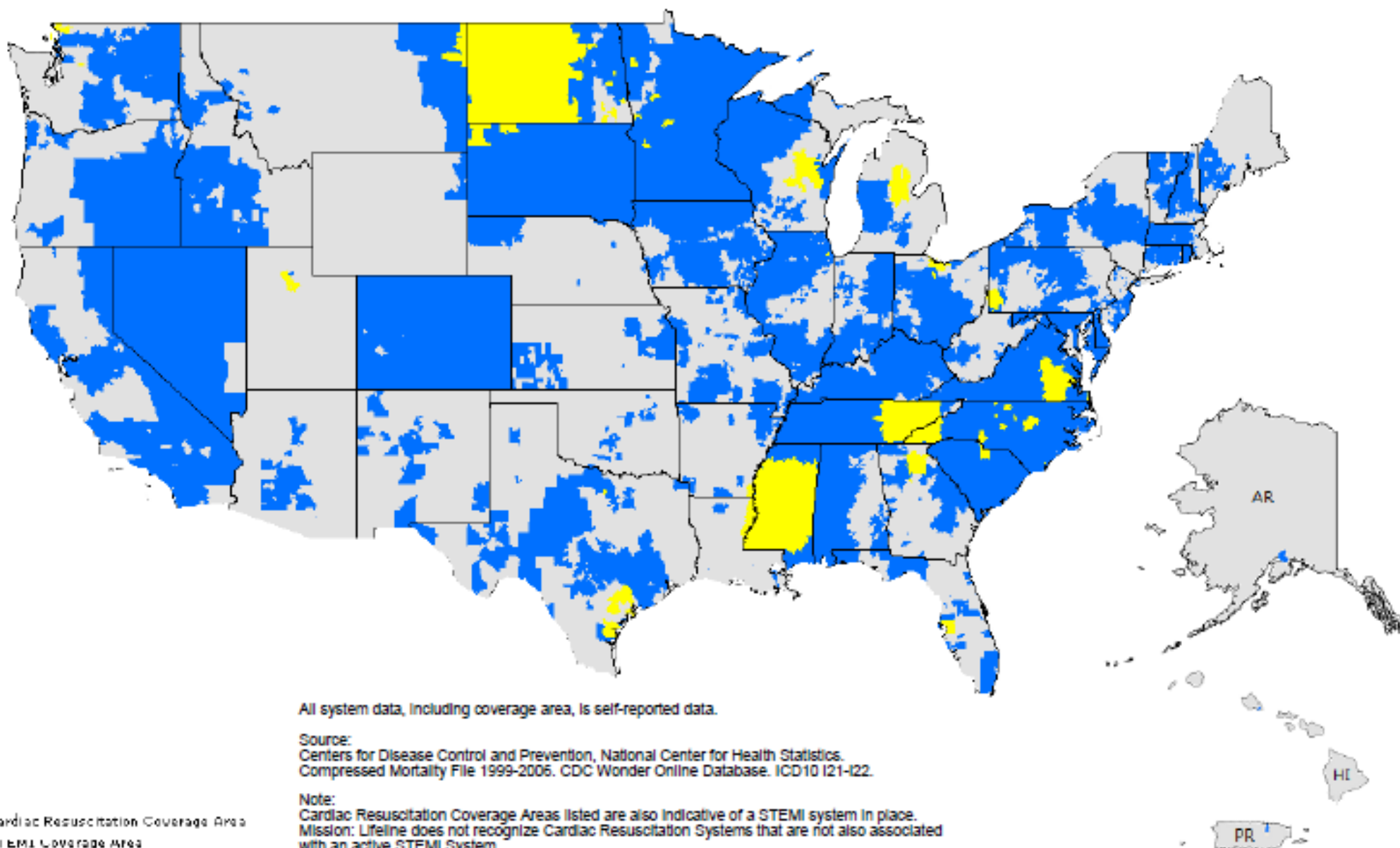


# STEMI + Cardiac Resuscitation System Coverage

As of 04/26/2013

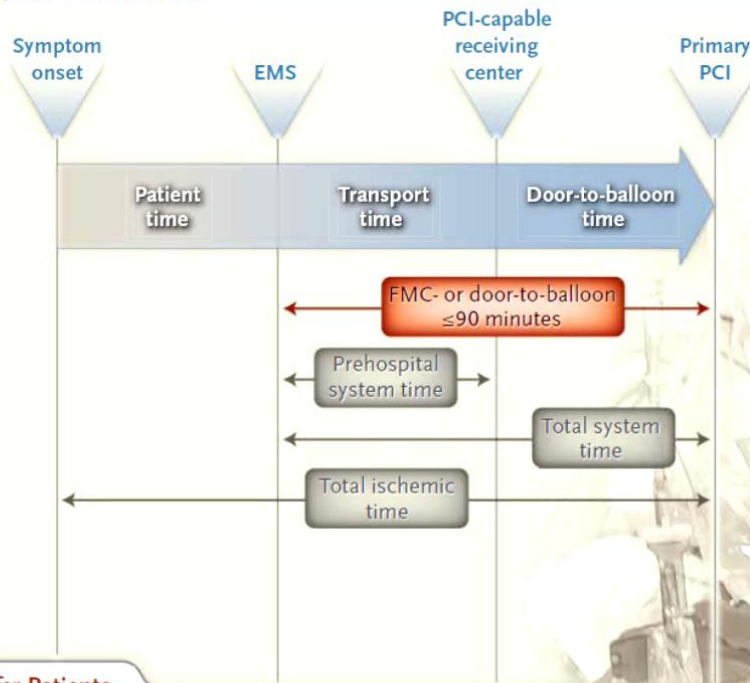
(665 STEMI Systems - 65.24% Population Coverage)

(37 Cardiac Resuscitation Systems - 4.76% Population Coverage)



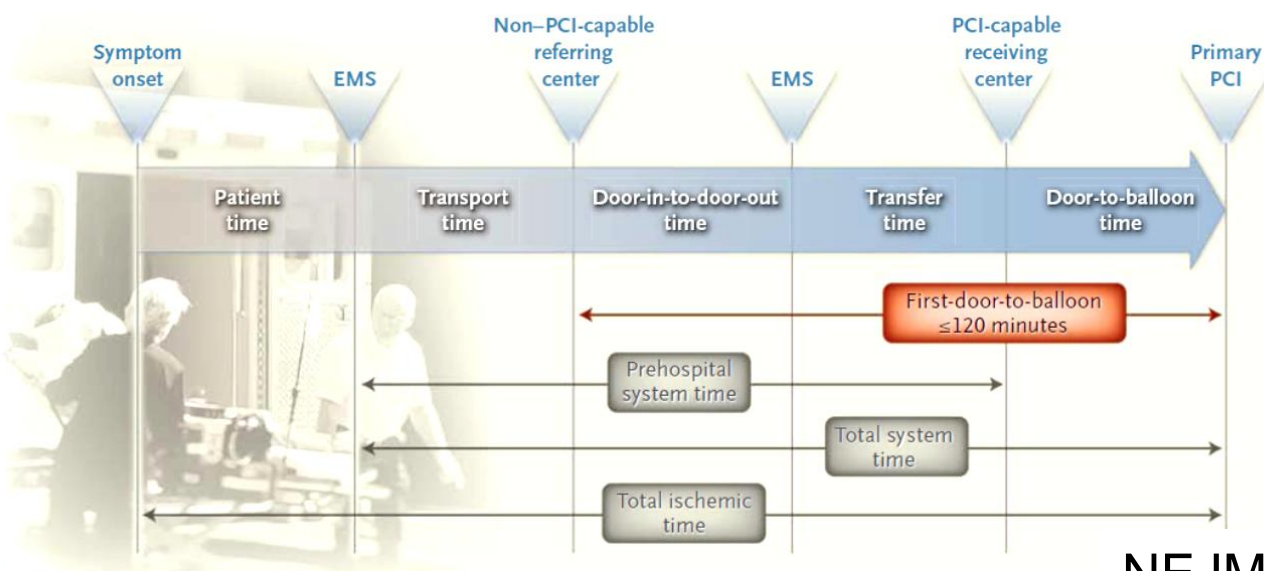
## Time-to-Treatment Goals for Primary PCI

### Directly-Admitted Patients



- Call 911 if ischemic symptoms are not relieved within 5 minutes after sublingual nitroglycerin
- EMS arrival expected within 8 minutes after activation
- ECG should be obtained within 10 minutes after first medical contact
- Best clinical outcomes achieved within 120 minutes after symptom onset

### Transfer Patients



NEJM 2013;369;10:889

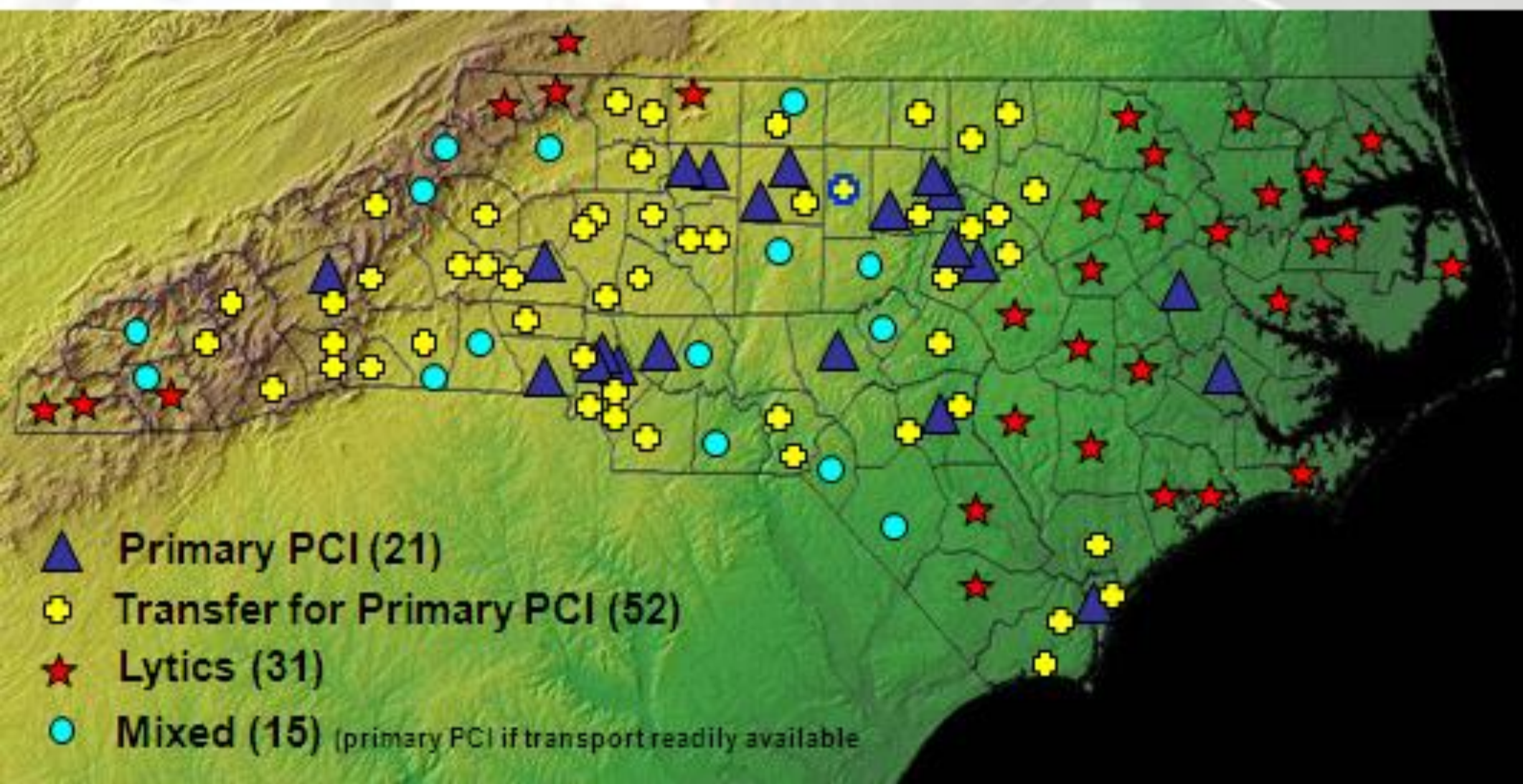
### Time-to-Treatment Goals for Primary PCI.

ECG denotes electrocardiogram, EMS emergency medical services, FMC first medical contact, PCI percutaneous coronary intervention, and STEMI ST-segment-elevation myocardial infarction.

**Do regional systems of care  
focused on eligible patients  
being treated and faster system  
times make a difference?**

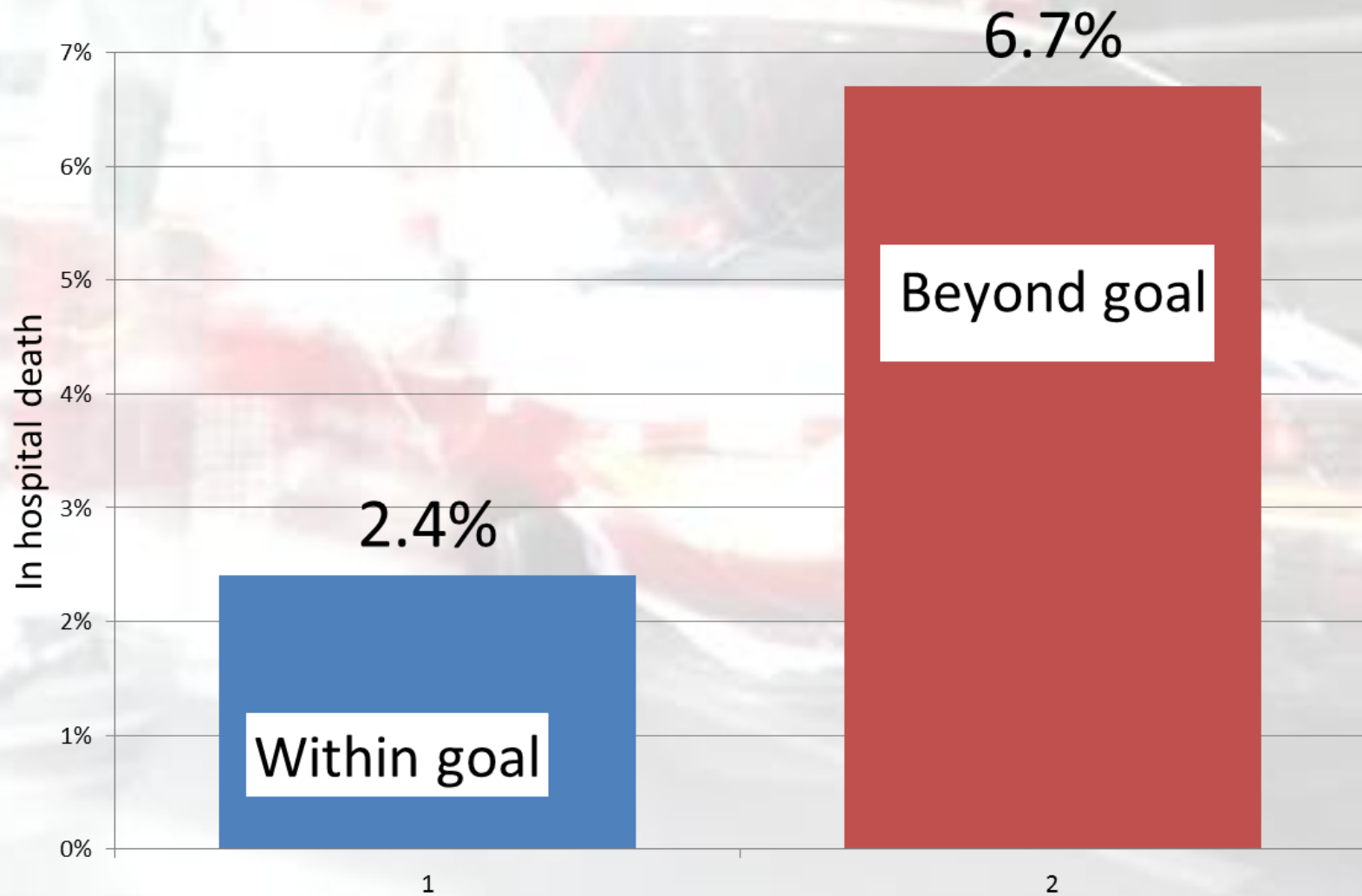


# RACE Hospitals by PCI and Reperfusion Designation





# Death by guideline goal



NC RACE, *Circulation*.2012;126:189–195.

# Patient Characteristics Direct Presentation vs. Transfer In



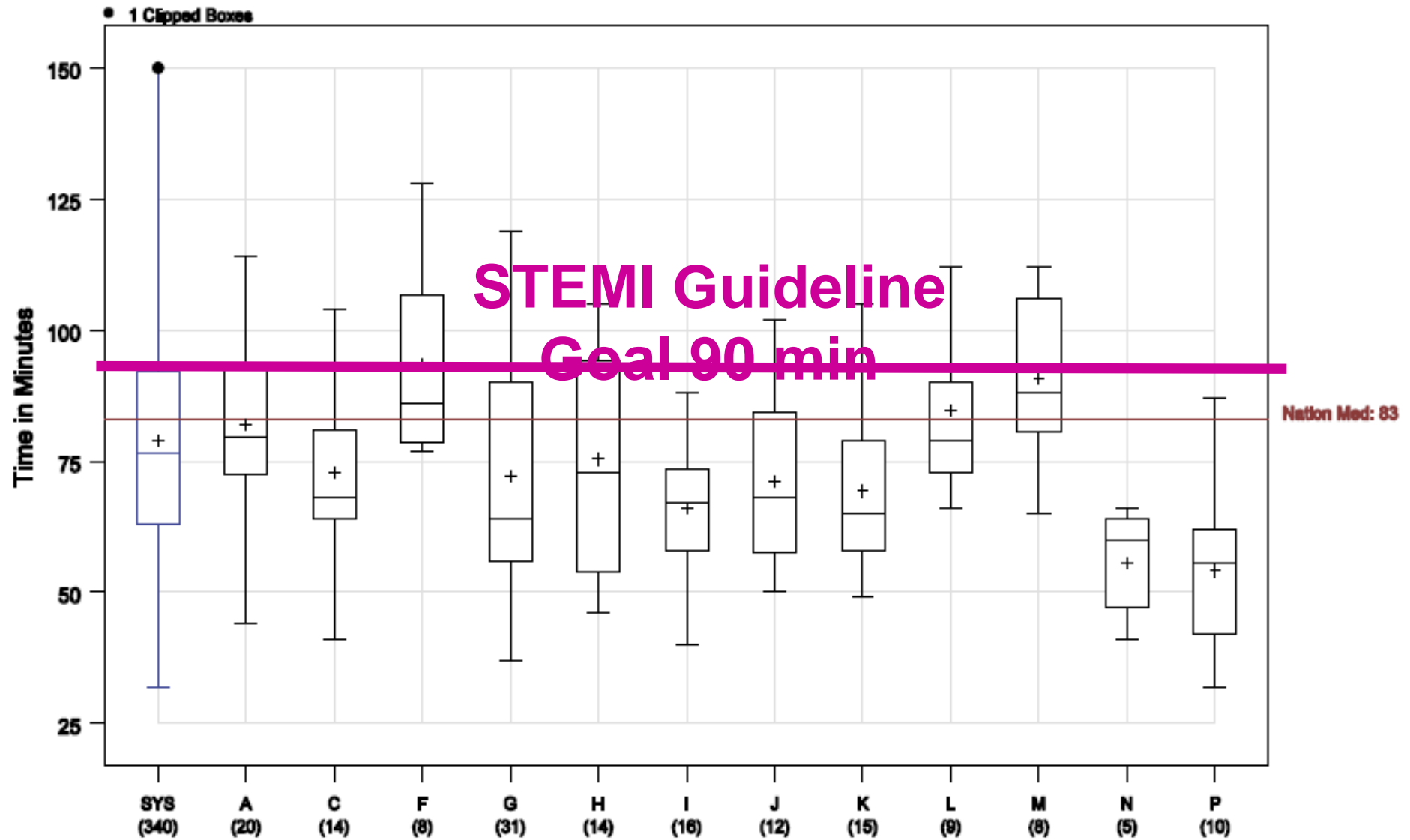
	Direct Presentation				Transfer In			
	System		State	Nation	System		State	Nation
	Last Qtr	Last 12 mo			Last Qtr	Last 12 mo		
<b>Number of STEMI Patients</b> .....	810	3,098	3,098	40,127	443	1,772	1,772	16,781
<b>Patient Demographics</b>								
Age (median years) .....	61.0	60.0	60.0	61.0	60.0	60.0	60.0	60.0
Female .....	32%	31%	31%	30%	33%	31%	31%	29%
Non-White .....	19%	18%	18%	15%	19%	18%	18%	11%
Hispanic Ethnicity .....	1%	2%	2%	6%	1%	1%	1%	4%
<b>Diagnosis</b>								
First ECG obtained Pre-Hospital (EMS Arr.) ..	89%	91%	91%	70%	50%	49%	49%	32%
STEMI Noted on first ECG .....	84%	85%	85%	86%	80%	80%	80%	86%
<b>Mode of Arrival (to First Facility)</b>								
POV .....	25%	26%	26%	37%	75%	71%	71%	71%
EMS (Ambulance) .....	72%	71%	71%	60%	25%	29%	29%	28%
<b>Reperfusion</b>								
Contraindicated to reperfusion .....	4%	5%	5%	6%	11%	8%	8%	7%
Eligible for reperfusion .....	96%	95%	95%	93%	89%	92%	92%	93%
Treated .....	89%	89%	89%	90%	92%	92%	92%	91%
Untreated .....	11%	11%	11%	10%	8%	8%	8%	9%
Median Time to Reperfusion								
Primary PCI .....	46.0	46.0	46.0	57.0	96.0	97.0	97.0	106.0
Fibrinolytic .....	-	38.0	38.0	46.0	31.5	28.0	28.0	31.0
<b>In-hospital Clinical Events (Exc. Trans-Out)</b>								
Reinfarction .....	0.6%	0.5%	0.5%	0.8%	1.1%	0.5%	0.5%	0.7%
Cardiogenic shock .....	5.1%	5.8%	5.8%	7.2%	5.0%	6.1%	6.1%	6.7%
Heart Failure .....	2.8%	3.6%	3.6%	5.7%	4.8%	4.4%	4.4%	5.6%
CVA/Stroke .....	0.4%	0.7%	0.7%	0.7%	1.1%	0.9%	0.9%	0.9%
Hemorrhagic stroke (Among CVA pts) .....	0.0%	4.5%	4.5%	15.6%	20.0%	43.8%	43.8%	25.5%
Suspected Bleeding Event .....	3.3%	2.5%	2.5%	3.6%	3.6%	3.4%	3.4%	3.9%
RBC/Whole Blood Cell Transfusion .....	3.9%	4.0%	4.0%	4.3%	4.1%	4.9%	4.9%	4.4%
Any of above events .....	14.8%	15.1%	15.1%	17.5%	17.2%	16.4%	16.4%	16.2%

0017: 2013 Q1

First Medical Contact to Device Activation  
Distribution of Times (minutes)  
Direct Presentaion, Arriving via EMS



MISSION:  
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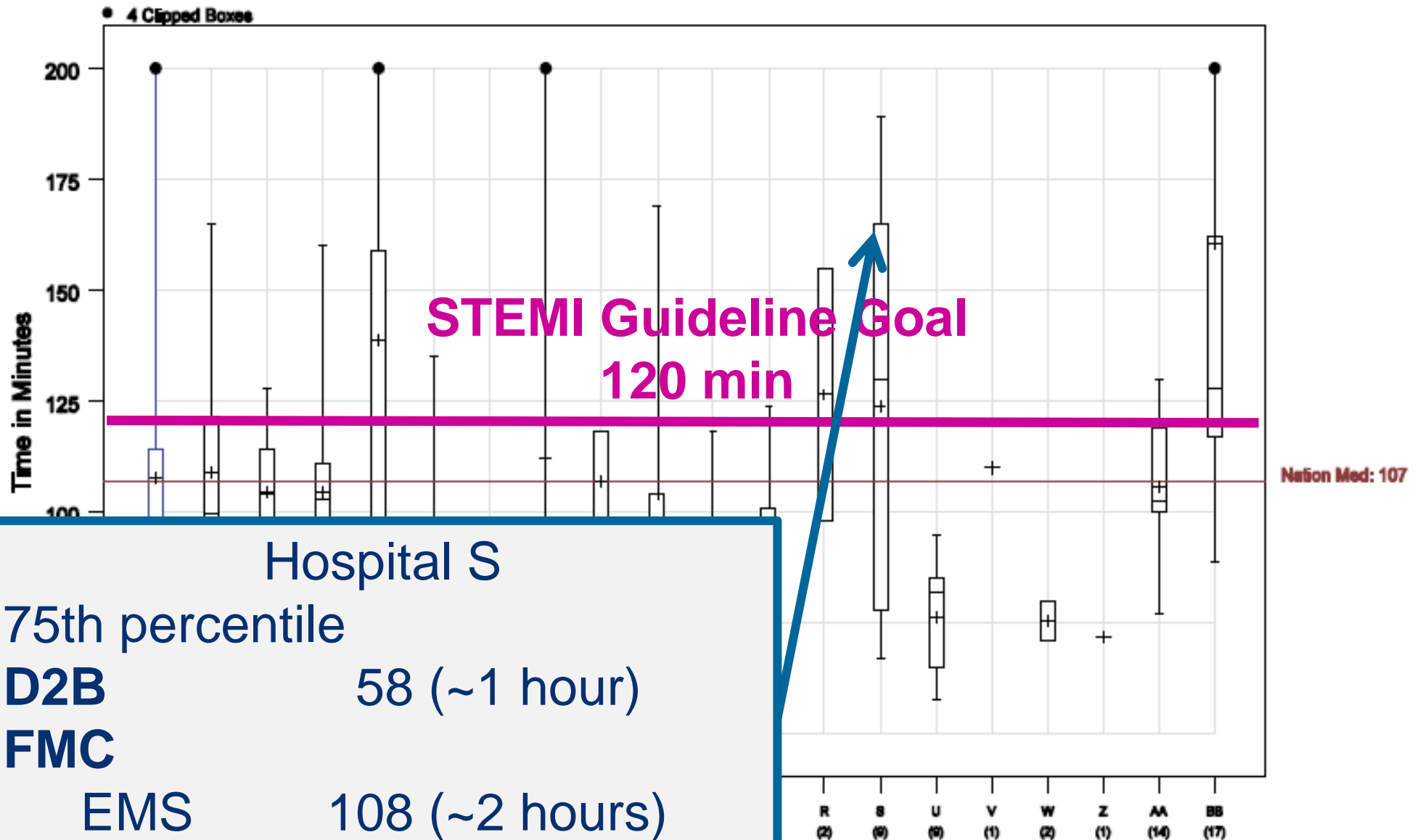


0017: 2013 Q1

Arrival at First Facility to Device Activation  
Distribution of Times (minutes)  
Transfer in for Primary PCI



MISSION:  
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Hospital S

75th percentile

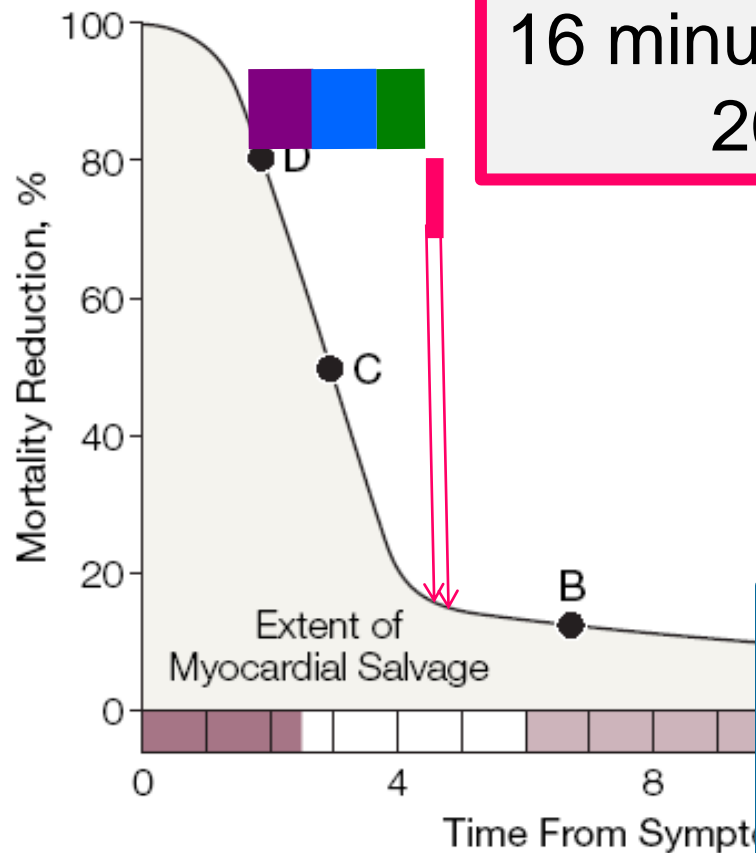
D2B 58 (~1 hour)

FMC  
EMS 108 (~2 hours)

Transfer 168 (~3 hours)

# Time is muscle

Relationship among symptom duration, myocardial salvage, and mortality reduction.



16 minute reduction D2B  
2006 - 2009

Outcomes  
With Different Treatment Strategies

A to B	No Benefit
A to C	Benefit
B to C	Benefit
D to B	Harm
D to C	Harm

Gersh, B. J. et al

Hospital S

75th percentile

**D2B**

58 (~1 hour)

**FMC**

EMS

108 (~2 hours)

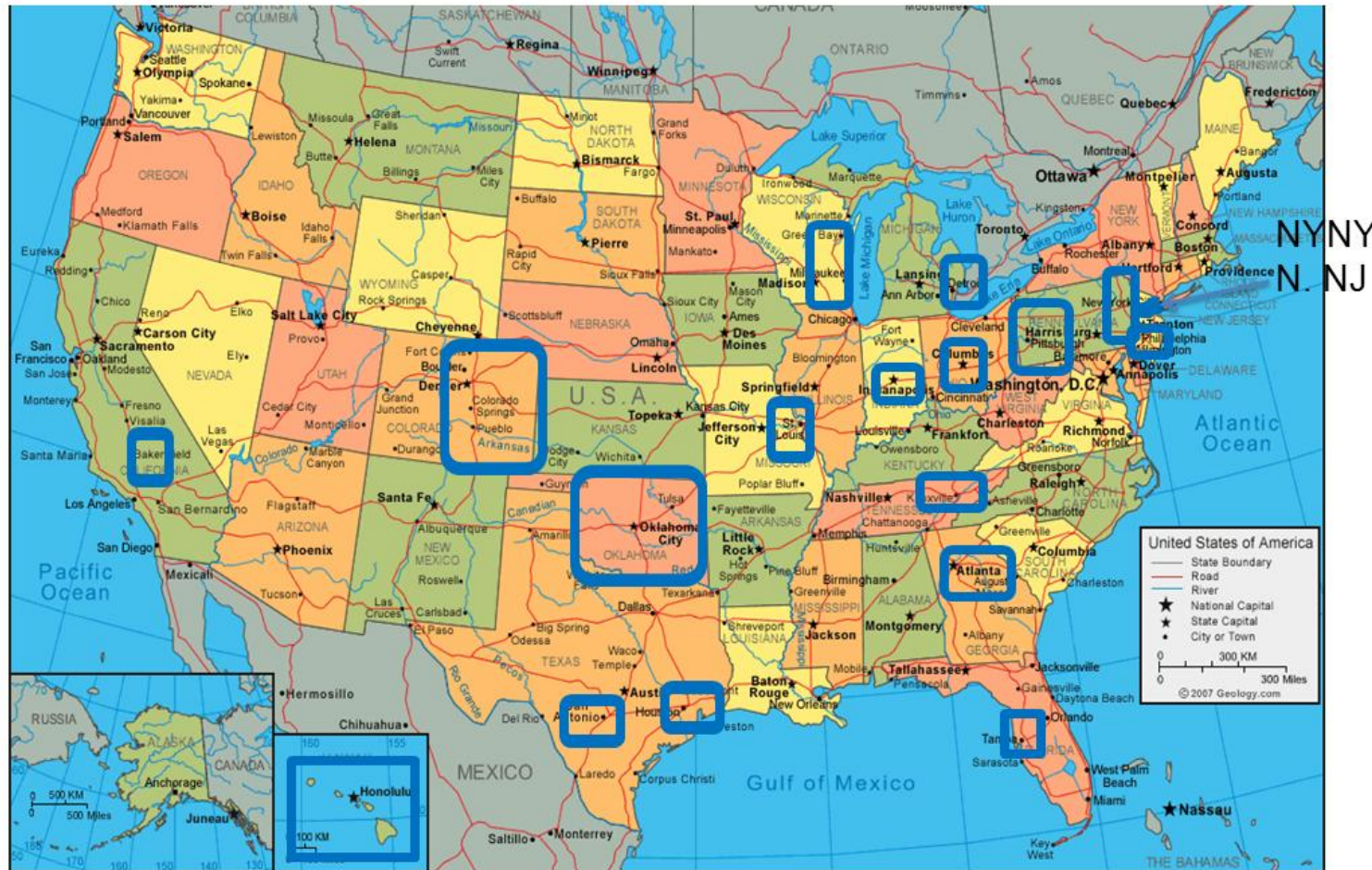
Transfer

168 (~3 hours)



# Regional Systems of Care Demonstration Project

## Mission Lifeline STEMI Accelerator



 STEMI Accelerator Sites

## The Center for Educational Excellence

Promoting excellence in clinical care and patient safety around the world



**American  
Heart  
Association®**

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*“Where you live should not determine  
whether you live”*

The Center for Educational Excellence

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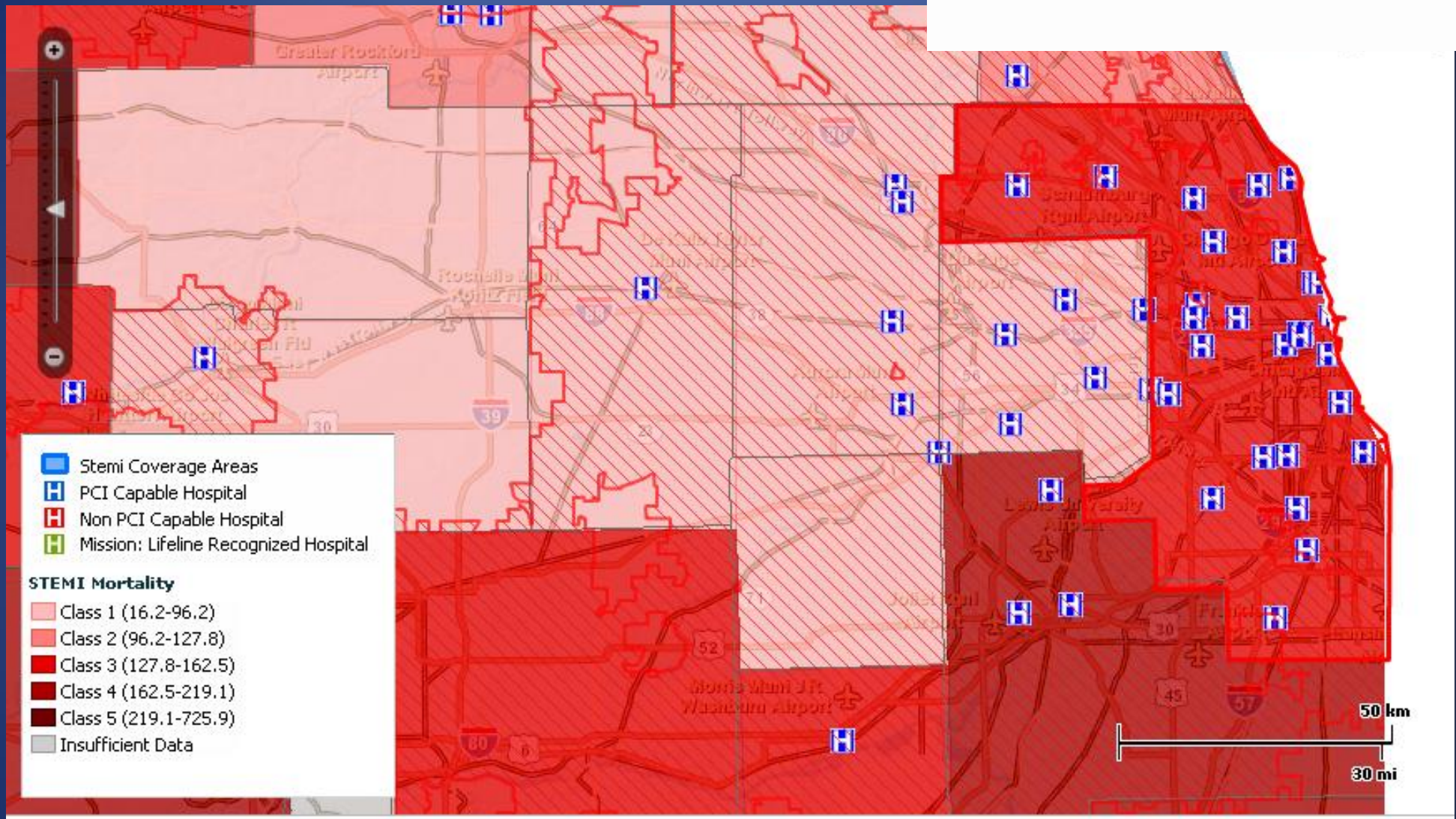


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# Pennsylvania PCI Hospitals







# Local to Regional to National Implementation

US  
Healthcare  
System

Mission:  
Lifeline  
2012

**250,000 MI's/yr**  
**250,000 arrests/yr**

RACE  
North  
Carolina

**40,000 MI's/yr**  
**2,000 cardiac  
arrests/yr**

**5,000 STEMI's per year**

Duke  
Central NC

**200 MI's per year**

Duke Clinical Research Institute