

# Time is Muscle

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## CORONARY ARTERY DISEASE

### ATHEROSCLEROSIS



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STEMI is ST-T Segment  
Elevation Myocardial Infarction  
= Closed Coronary Artery

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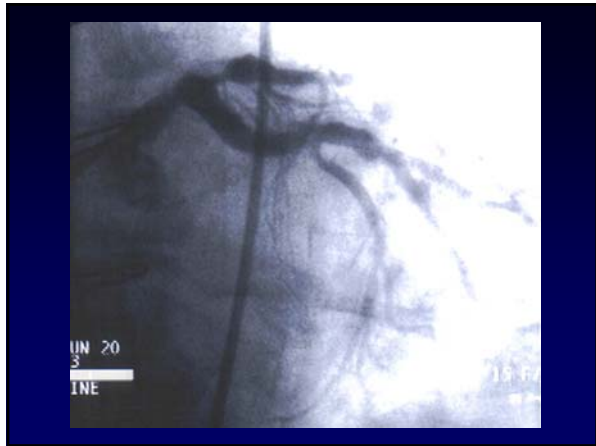
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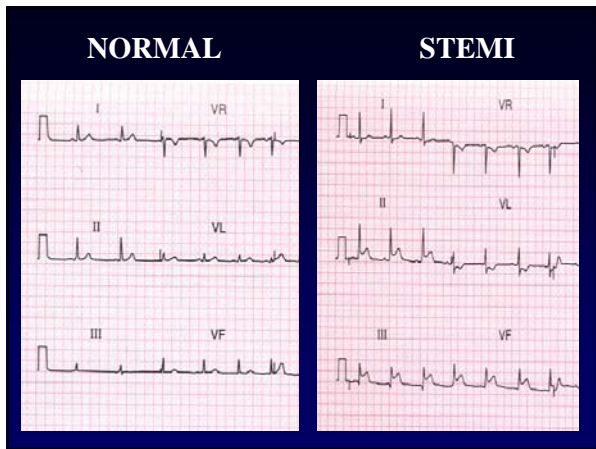
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**TIME  
IS  
MUSCLE**

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## Muscle Loss vs. Time

- **Golden Hour:** maximal salvage occurs in the first hour
- **Over 50%** of vulnerable muscle loss occurs by **2 hours**.
- Almost all vulnerable muscle loss occurs by 6 hours.

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## Muscle Is Life

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## STEMI Outcomes

- **Death and Disability** depend on **Amount of Muscle Lost**
  - 25-40% = moderate disability
  - 40-50% = severe disability
  - 50% or more = death
- Most deaths occur by **2 hours** (Self Electrocutation)

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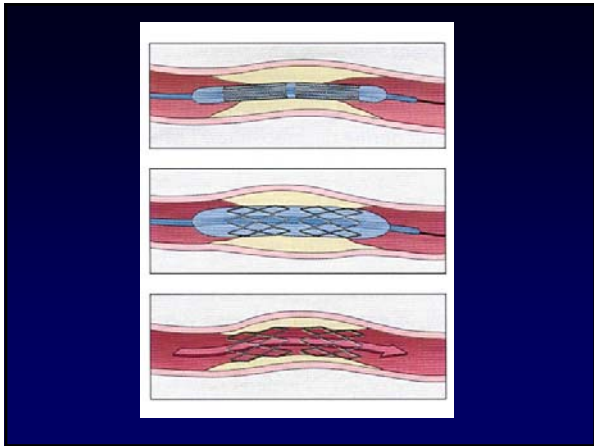
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Primary PCI is superior to fibrinolysis if performed expeditiously by experienced cath lab team

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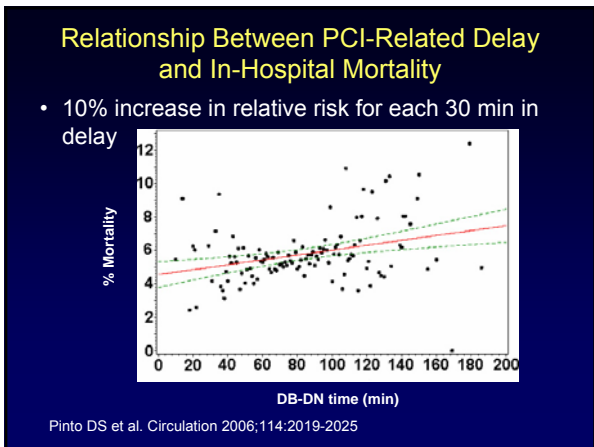
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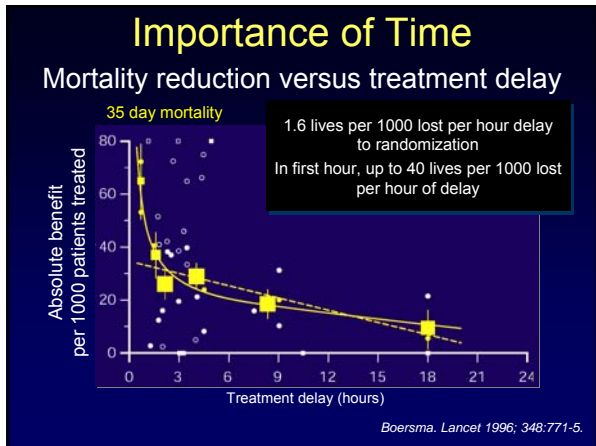
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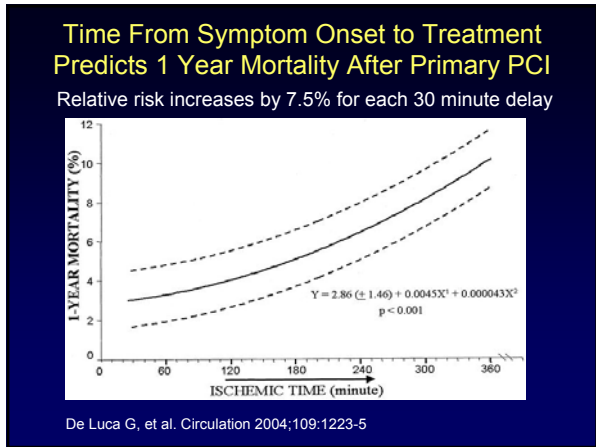
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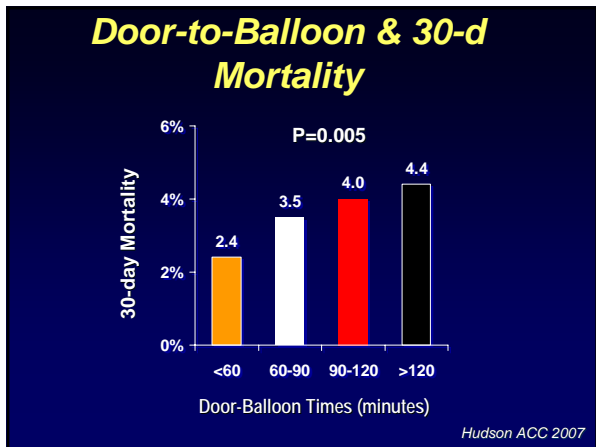
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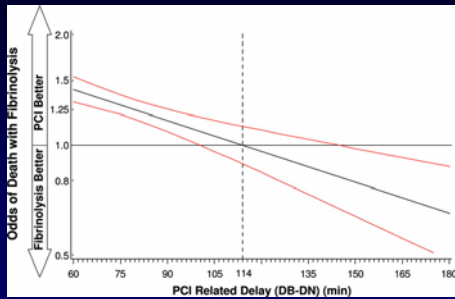
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## Effect of PCI-Related Delay on In-Hospital Mortality



Pinto DS et al. Circulation 2006;114:2019-2025

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## Mortality Rates Depend on Door-to-Balloon Time

From meta analysis of clinical trials

- Primary PCI advantage lost when DB-DN time >62 min
- Every 10 min delay in PCI: 1% mortality advantage lost
- Benefit extends out to at least a year

Nallamothu BK and Bates ER. Am J Cardiol 2003;92:824-6

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Integrated Care Delivery  
is a  
Systems Engineering Problem

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## Rationale

- 2006 AHA position paper advocated:
  - A community-based systematic triage and treatment protocol to treat STEMI patients
  - Primary percutaneous intervention (PPCI) is the preferred therapeutic strategy
  - STEMI patients should be transported directly to a hospital capable of performing PPCI 24 hours a day 7 days a week
  - First **medical contact-to-balloon** time <90 min

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### The Problem

NRMI-5: North Carolina, July 2003-June 2004

	NC	Nation	
N	2,738	79,927	
% eligible treated	81%	80%	
Door-balloon	101 min	100 min	<90 min
<b>11PM to 7AM</b>	<b>107 min</b>		
<b>Weekend</b>	<b>105 min</b>		
<b>Transfer</b>			
1 <sup>st</sup> door – balloon	191 min	165 min	<90 min
1 <sup>st</sup> d-b <90 min	0.8%	5.5%	100%

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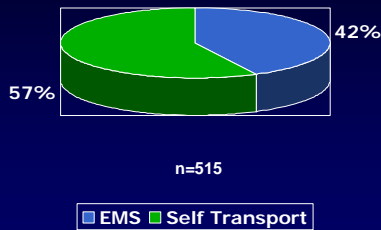
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## Pre-Intervention Data Hospital Arrival Mode




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## Optimizing the System

- Understand what the **System** is:
  - Begins with the patient
  - Prehospital environment
  - Emergency Department (both non-PCI & PCI)
  - Cardiology interface
  - Catheterization laboratory for PCI, or fibrinolytic drug administration

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## Rational for Trauma Model

- Outcome is time-dependent: The Golden Hour
- Interdisciplinary care delivery model
- Team coordination, cooperation, and integration
- Rapid feedback using a robust CQI process

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## Participants in Care Delivery

- Patient
  - Symptom recognition
  - Early response
- EMS Services
  - STEMI Diagnosis (ECG)
  - Premedication
  - Triage and Transportation
  - R2R program
- Hospital
  - Coordination of ED and Cath Lab
  - Involvement of administration, nurses, and physicians
  - D2B program

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## Levels of Integration

- Patient
  - Symptom recognition
  - Appropriate response
- Hospital
  - D2B Program
- EMS Services
  - R2R Program
- Community-wide
- State-wide
- Country-wide, e.g. Sweden

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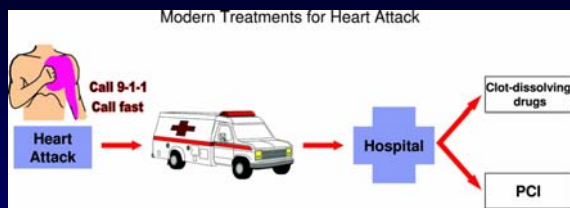
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## Triage and Transportation



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## Care Integration

- Hospital ↔ EMS
- Clearly articulated goals
  - Data-driven CQI process
  - Data verification
  - Integration of outcomes data
  - Rapid feedback

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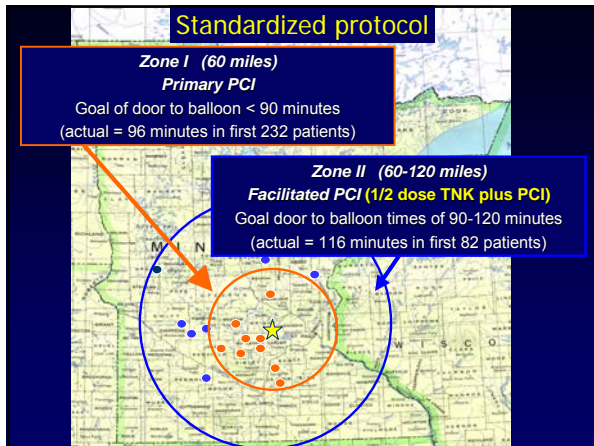
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- Strategies and Door-to-Balloon Time Saved**
- ED physicians activate the cath lab (8.2 minutes)
  - Single call to a central page operator activate the lab (13.8 minutes)
  - ED activate the cath lab while the patient is en route to the hospital (15.4 minutes)
  - Expecting staff to arrive in the cath lab within 20 minutes after being paged (vs. >30 minutes) (19.3 minutes)
  - Attending cardiologist always on site (14.6 minutes)
  - Having staff in the ED and the cath lab use real-time data feedback (8.6 minutes)
- Bradley N Engl J Med 2006;355:2308-2320

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- Boston STEMI System**
- Boston EMS**
- EMS-Driven
  - In the field ECG
  - Diversion of STEMI to closest PCI hospital
  - Hospitals will never be on diversion for ST-elevation MI (similar to trauma center plan)
  - Each hospital will perform a minimum of 36 primary PCI or rescue PCI procedures / year
  - PCI will be performed within 120 minutes of hospital arrival (ie, door-to-balloon time of 120 minutes) in 75% of "ideal" patients
  - Currently achieving door-to-balloon times of <90 minutes 75% of time

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## Hillsborough County Effort

- Began in 2002
- Developed as an extension of the stroke triage initiative
- Involves representatives of all hospitals and EMS services
- Co-chaired by:
  - Joel A. Strom, M.D., USF
  - Charles Sand, M.D., St. Joseph's Hospital
- Supported by:
  - Hillsborough County Emergency Medical Council (EMPC)
  - Florida Emergency Physicians
  - Hillsborough Medical Society

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## Goals

- Develop and implement a data-driven county-wide triage and treatment protocol for the timely treatment of STEMI employing primary PCI to improve delivery of therapy and outcomes while reducing costs
- Achieve STEMI therapeutic intervention rates and timeliness of delivery that meets current and future guidelines.
- Achieve a first medical contact-to-balloon time of <90 minutes in 85% of all eligible STEMI
- Develop a paradigm for regionalized STEMI care that can be implemented in other large multi-hospital systems, e.g. State of Florida.

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## Project Organization

### STEMI Task Force

- Steering Committee
- Data and Safety Monitoring Committee
- EMS Services and Hospital Data Collection Committees
- ECG Committee

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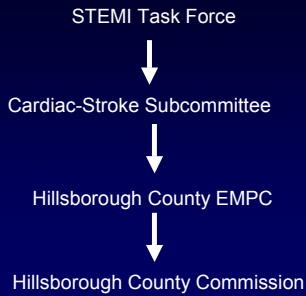
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## Reporting



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## Objectives (1)

Develop a county-wide coordinated triage and treatment system:

- Participation by all hospitals and EMS services
- Develop a unified triage and treatment protocol:
  - Primary PCI-designated hospitals will meet performance criteria
  - EMS will transport all STEMIs to PPCI-designated hospitals
  - EMS will perform 12-lead ECG's and diagnose a STEMI
  - All STEMIs transported PPCI hospitals will receive primary PCI unless contraindicated

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## Objectives (2)

- STEMIs presenting to non-PCI capable hospitals will either be transferred to PCI hospitals or be treated with fibrinolysis
- Primary PCI: first medical contact-to-balloon time of <90 minutes or a door-to-balloon time of <60 minutes if a walk in
- Fibrinolysis: a door-to-needle time of <30 minutes, respectively, in 85% of patients treated
- Develop a data-driven protocol for process improvement that can then rapidly implement advances in therapy
- Export this program to other hospital systems
- Regionalization

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## Data Analysis

- Central data coordination center
  - Independent of participating hospitals
- Robust CQI processes
- Clear definitions
- Data validation
- Rapid feed back
- IRB issues (HIPAA)

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## Challenges

- Know your community
- Garner community support
- Involve all stakeholders
- Understand and address stakeholders' concerns early
- Patience

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## Know Your Community

- Hillsborough County
  - One of 6 counties in the Tampa Bay Region
  - 1226 sq. mi.
  - 1.2 million people, >300,000 in Tampa
  - Urban, suburban, rural areas
  - Mean age 35 years; 24% ≥ 45 years
  - 35% identified as minority
  - Progressive county-wide indigent health plan
  - Population of indigent agricultural workers

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### Participating Hospitals

#### Primary PCI Hospitals

- Tampa General Hospital
- St. Joseph's Hospital
- University Community Hospital
- Brandon Regional
- (James A. Haley VAH)

#### Non-PCI Hospitals

- Memorial Hospital
- Town & Country
- UCH Carrollwood
- South Florida Baptist
- South Bay

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### Primary PCI Hospitals

- Independent and competitive
- Fairly centrally located
- Serve different geographical regions
- None are university hospitals
- No tradition of strong academic programs
- Cardiologists are independent practitioners
- Level of CQI programs vary widely

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### Non-PCI Hospitals

- Tend to be smaller
- Two have diagnostic cath labs
- Are located in more peripheral areas of county
- Three are linked to PCI hospital:
  - Owned satellite (1)
  - Hospital network (2)

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## Hospital Challenges

- Inherent competitiveness and distrust
- Lack of unified
  - STEMI care protocols
  - On-call schedules
  - Activation protocols
  - Data collection and reporting
  - CQI processes
  - ECG receiving equipment, e.g. Fax, internet
- Inadequate training of ED physicians personnel

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## Hospital Solutions

- Simplify protocols
- Allow for some variation but track results
- Encourage participation in national databases, protocols and D2B program
- Identify strong leaders
- Only present combined data

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## EMS Services

- Tampa Fire Rescue
- Hillsborough County Fire Rescue
- Temple Terrace EMS
  - Only transports to one hospital (UCH)
- Plant City EMS Service
  - Transports patients to Lakeland Regional Hospital (Polk County)

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## EMS Challenges

- Differences in:
  - Equipment
  - ECG transmission capabilities
  - Operating procedures
  - Treatment protocols
- Solutions:
  - Find common ground
    - Simplify protocols to ones that can be most adhered to
  - The larger services will drive the project
  - Use data to drive change

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## Transportation Issues

- Goal: Transport all STEMI to closest PPCI hospital  $\leq 30$  min.
- We have shown that except for the extremities of the county this can be achieved at normal driving speed.
- Challenges: Rush hours, inclement weather, accidents
- Role of helicopter transport?

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## Community Support

- Community physicians
- State and local medical societies
- AHA/ACC
- Political and community leaders' support
- University of South Florida
- Avoid premature publicity and heightened expectations

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## Stakeholder Involvement

- Identify key stakeholders
  - All hospital CEO's
  - Directors of cardiac and emergency services
  - Medical directors of cardiology, catheterization laboratories, and emergency services
  - EMS chiefs and medical directors
  - Must commit to program in writing
  - Community leaders

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## Non-PCI Hospital Concerns

### Financial

- Non-PCI hospitals will lose all their cardiac patients
  - All cardiac patients will go to PCI hospitals
- PCI hospitals will not perform according to protocol
  - STEMI patients will not receive PCI
- Inaccurate EMS triage to PCI hospitals
- Loss of CMI

### Solution:

- Non-PCI hospitals to act as honest brokers by dominating Data and Safety Monitoring Committee

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## Community Concerns

- Patient triage and care independent of financial status
- Patient comfort being treated by unfamiliar hospital and physicians
- Will follow-up care be available independent of financial status
- Will regionalization reduce medical care to outlying regions

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## Patient Education

- Integral to success of the project
- Community cardiac groups can be very useful, e.g. AHA Community Board
- Focus on all phases of care:
  - Pre-Hospital
    - Recognize signs and symptoms of MI
    - Take rapid action – don't wait
    - Take ASA if not allergic
    - Call EMS
    - Do not go by private transportation
  - Intra-Hospital
    - Understand treatment options
  - Post Discharge
    - Secondary prevention
    - Medications (ASA, clopidogrel, statins,  $\beta$ -blockers)
    - Become an advocate

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## Patience or “Time Wounds All Heels”

- Frequent meetings of all stakeholders can build trust
- Pace of implementation depends on the local community
- Often triage patterns change before implementation
  - New community standard of care
  - The 800 lb gorilla

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## Statewide Triage and Treatment Program

- “One stop Shopping”
- Data driven protocols
- Seamless triage and treatment
  - EMS
  - Emergency Department
  - Cardiac Cath Lab
- Rapid Identification and mobilization of Cath Lab Team
- Robust Data Collection and CQI Process

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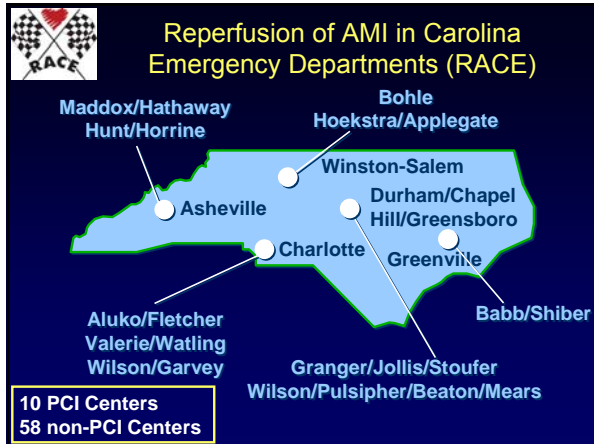
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**RACE Manual**  
<http://www.nccacc.org/race.html>

Optimal system specifications for each component of AMI care

- EMS (prehosp ECG, transport)
- ED (guideline-based algorithms, training, feedback)
- Transfer (single contact, fastest option, streamline, automatic cath lab activation)
- Receiving hospital (“hotline” approach)
- Cath lab (automatic activation)
- Other system issues – communication, feedback, interdisciplinary team, payers, regulations

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**“Politics is the Art of the Possible”**

- In Florida, emergency PCI can be performed at hospitals without surgical backup (AHA does not support)
- A bill is before the Florida Legislature
  - Treat STEMI equivalent to stroke law
  - Transport all STEMI to PPCI hospital
  - Designated PPCI hospitals must conform to ACC/AHA guidelines
  - Quality assessment tools to be developed

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## Heart Services Improvement Act HB 947

This bill implements ACC/AHA pre-hospital STEMI guidelines

- DOH provides list of emergency PCI Centers to EMS Directors
- DOH provides best practice cardiac triage guidelines and expected outcomes to EMS Directors
- EMS providers to implement protocols to comply with guidelines and expected outcomes
- DOH biennial survey of EMS of equipment quality, training requirements, and performance
- DOH survey report to EMS providers and medical directors

AHCA will implement ACC/AHA guidelines for PCI Centers

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## Top Ten List

10. Use local ambulance to transport pts (within ~50 miles)
9. Keep patient on local ambulance stretcher
8. Give heparin bolus (70 U/kg) and no IV infusion
7. Establish protocol for lytics vs PCI for each ED
6. Establish single call number to PCI centers that "automatically" activates cath lab
5. Provide standardized feedback reports
4. System for rapid triage of walk-ins, rapid ECGs
3. Prehospital ECGs for all CP pts (and ED use them!)
2. "Certify" all EMTs/paramedics to read ST ↑ on ECGs, immediately activate reperfusion (lytics or cath lab)
1. Create EMS, ED, cardiology team with committed leadership

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