A State Approach to STEMI Regionalization

RACE

Reperfusion in Acute myocardial infarction in Carolina Emergency departments

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Duke University Medical Center
Cross Town Classic
Outline

- Introduction
- What are the unique aspects of the RACE program
- The “RACE story”- How to build a regional/state system for the care for the STEMI population
- Review the RACE process
- Success- What has worked?
- RACE Initial Results
- Next steps
- Conclusion/Q/A
- Mission: Lifeline
This Figure Looks Familiar......

Panel A

Onset of symptoms of STEMI

9-1-1 EMS Dispatch

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

EMS transport
- Prehospital fibrinolysis:
  - EMS-to-Needle within 30 min

Total ischemic time: Within 120 min*

*Golden Hour = First 60 minutes

Goals†

Patient: 5 min after symptom onset
Dispatch: 1 min
EMS on scene: Within 8 min
EMS transport: EMS-to-Balloon within 90 min

Antman et al. 2004
ACC/AHA Practice Guidelines

Not PCI capable
Hospital fibrinolysis:
Door-to-Needle within 30 min
EMS Triage Plan
Inter-Hospital Transfer
PCI capable
Strategy 1
Strategy 2

ACC - www.acc.org
AHA - www.americanheart.org
North Carolina Hospitals

Hospital Compare → “Consumer compare”
Reperfusion

STEMI patients presenting to a hospital with PCI capability should be treated with primary PCI within 90 minutes of first medical contact.

*Modified recommendation*

STEMI patients presenting to a hospital without PCI capability and who cannot be transferred to a PCI center for intervention within 90 minutes of first medical contact should be treated with fibrinolytic therapy within 30 minutes of hospital presentation, unless contraindicated.

*Modified recommendation*

*Circulation 2007; on line, december 10.*
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Health Services and Outcomes Research

Times to Treatment in Transfer Patients Undergoing Primary Percutaneous Coronary Intervention in the United States

National Registry of Myocardial Infarction (NRMI)-3/4 Analysis

Brahmajee K. Nallamothu, MD, MPH; Eric R. Bates, MD; Jeph Herrin, PhD; Yongfei Wang, MS; Elizabeth H. Bradley, PhD; Harlan M. Krumholz, MD, SM; for the NRMI Investigators

95.8% of patients treated after 90 minutes

1st Door to Balloon

Door to Door

Circulation 2005;111:761-767
RACE
Unique aspects

1. Involve all hospitals and EMS systems, not just PCI hospitals

2. Include transferred patients
   • Patients with longest delays

3. PCI or Lytics
   – Support “best available therapy” according to resources / local conditions

4. Focus on front lines
   – EMS / ED rather than the cath. lab
“Move care forward”

- EMS does ED work
- ED does Cardiology work
- Cardiology lives in the cath lab
North Carolina Reality in 2005……

• **326,617** North Carolinians have coronary heart disease.

• Heart disease was the leading cause of death of both men and women.

• In North Carolina:
  - 1 death every hour.
  - Death from heart attack **3 times more common** than death from motor vehicle accidents.
Establish a state-wide system for reperfusion, as exits for trauma care, to overcome systematic barriers to:

1) *Increase speed of reperfusion*

2) *Increase reperfusion rate*
Bottom Line………………
the old mantra rings true!

Time is Muscle
Time is Life

System saves time!
System saves muscle!
Systems saves lives!
When in doubt about what to do…….

What would Trauma do?
Brief RACE History

- Phase 2 Genesis (2004) → BCBS Grant (Dec 2004)
- Formation of RACE Central (Jan 2005)
- Sought NC ACC Counselor Support (Winter 2005)
- Convincing Regional PCI Hospital Administration to co-sponsor & hire the Regional Coordinators (3/2005-10/2005)
- PCI Launch and non-PCI Approach/Data Collection (6/05-3/06)
- Jan 2006-nonPCI and EMS RACE Launch and Intervention
- Q1 2007 Data Collection

Organize regions  
Baseline data  
Intervention  
Post data

2005  
Q3 2005  
2006  
Q1 2007
RACE
2005-2007 Partners
North Carolina vs Illinois Stats

- **Population**
  - 9.06 million (10th most populous)
  - 12.83 million (5th Most populous)
- **Size (sq. miles)**
  - 53,819 (28th in total area)
  - 55,583 (25th in total area)
- **Hospitals**
  - ~100 Acute care hospitals
  - *20 pPCI hospitals with Surgical Backup (+2 w/o)*
  - 182 acute care hospitals Illinois
  - pPCI too numerous to count
- **Counties**
  - 100 (101 Cherokee Nation)
  - 102 counties
North Carolina BBQ
Illinois Everything.....
I'll give you 5 bucks if you walk yourself to the ambulance.
Outline

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• The “RACE story”— How to build a regional/state system for the care for the STEMI population
• Review the RACE process
• Success- What has worked?
• RACE Initial Results
• Next steps
• Conclusion/Q/A
How to build a regional STEMI system

- **Funding**
- **Data/Quality**
- **Organization**
  - Leadership, Oversight, Steering committee
  - Regional coordinator
  - An inclusive model
- **The RACE process**
- **What has worked**
Funding
Every source possible

• Unrestricted grants or educational grants
  – avoid appearance of marketing / conflict
Funding

Every source possible

- Medicare Quality Improvement Organization
  - CMS contracted to assure quality
- American Heart Association affiliate
- Payors
  - BCBS Foundation (grant provided)
- Hospitals
  - PCI centers
- State government
  - Trauma / EMS systems / Dept. of Health
  - Hospital Association
- Other foundations & philanthropic sources
Funding
Every source possible

- Borrow cars, planes, conference rooms
- Academics / medical school faculty and facilities
- Piggyback on existing meetings / organizations
- Time of professionals already involved in STEMI care

Enlist the few thousand people in the state who focus on STEMI/AMI care as a profession
   → Rally your grass roots base
   → In many cases, it already part of their job!
How to build a regional STEMI system

- Funding
- **Data/Quality**
- Organization
  - Leadership, Oversight, Steering committee
  - Regional coordinator
  - An inclusive model
- The RACE process
- What has worked
Quality for Regional STEMI Systems

• Who will “Quality” be attributed to?
  – EMS
  – Referring hospital
  – Receiving hospital
  *Plurality of Care

• Duplication of efforts
DATA

Measurement and feedback leads to change

- Use existing resource / data
  - National Registry of Myocardial Infarction (retired)
    - *RACE hospitals now participating in NCDR ACTION™ -GWTG*
    - Reperfusion system “inventory” by hospital
      - JCAHO / CMS MI measures
      - State data
      - EMS data (These need to be linked to hospital)
  - Small custom data collection for smaller hospitals
- Ongoing immediate feedback
  - Record calls
  - Emails with times
  - Consistent call from PCI operator to EMS or ED.
How many of these sites have a regional STEMI transfer program for Primary PCI?
STEMI – D2B and D2N Times: Cumulative 12 Month Data

ACTION DATA: January 1, 2007 – December 31, 2007 (n=19,523)

DTB = 1st Door to Balloon for Primary PCI
DTN = Door to Needle for Lytics
ACTION Door-to-Balloon Times – Median Times for Transfer In and Non-Transfer In Patients

- **Q1 07**
  - Transfer in: 236 min
  - Non-Transfer in: 123 min

- **Q2 07**
  - Transfer in: 223 min
  - Non-Transfer in: 103 min

- **Q3 07**
  - Transfer in: 215 min
  - Non-Transfer in: 102 min

- **Q4 07**
  - Transfer in: 212 min
  - Non-Transfer in: 95 min

**Time (min)**: 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260

**Legend**:
- **Pink**: Transfer in DTB Times
- **Green**: Non-Transfer in DTB Times
How to build a regional STEMI system

• Funding
• Data/Quality
• **Organization**
  – Leadership, Oversight, Steering committee
  – Regional coordinator
  – An inclusive model
• The RACE process
• What has worked
Organization (2005-2007)

- Supported by grant from Blue Cross Blue Shield of North Carolina
- Nurse coordinator and steering committee (EMS, ED, nursing, hospital administration, QI experts, cardiology) for each region
- Buy-in from all PCI centers in each region
  - Co-funded RACE Regional Coordinators
- Co-sponsored by NC Chapter of ACC with focus on the patient by promoting ACC/AHA STEMI guidelines
- Data systems support from Genentech, Inc. –NRMI 5
Organization

• Leadership
  • RACE Central
    – National thought leader MD,
    – Cardiology MSN skilled in systems development, PR / fundraiser
    – Low key passionate cardiologist

• Regional Leaders
  • Emergency medicine
  • Interventional cardiologists
  • Nursing
  • EMS
  • Heart center administrators
  • Quality
  • Insurance company foundation
  • Physician board member
Organization

- Leadership
  - Steering committee
  - Every organization involved in system
    - Hospital administrators, nurses, cath lab techs and managers, emergency medicine, cardiology, EMS directors, critical care transport, state administrators
  - Meet on a quarterly to semiannual basis for organization and execution
  - Focused meetings – Optimal PCI approach, Air/Critical care transport
Organization

- **Leadership**
  - Oversight board (borrowed from clinical trials and Boston model)
    - Charge – Advise to assure success and avoid harm.
    - Bill O’Neill, Pam Douglas, Rob Califf, Greg Mears, Bruce Brodie, Robert Harris
    - Honorarium and travel
    - Occasional meetings
Organization

- Leadership
  Regional Coordinators
  - Combination educator, QA, outreach person with experience in STEMI care
  - Co-funded by RACE and the PCI Center
  - Organize PCI hospitals and assist collaboration with non-PCI and EMS
  - Hospital by hospital review of reperfusion plan & facility questionnaire
  - Pre and post data collection
  - The most important and critical part of the entire system… basically the drivers of change
Organization

- The elements of reperfusion
  - EMS
    - EMT-P and EMT-I
    - 911 Dispatch (may not be medical)
    - Critical care transport
      - Helicopter
      - Mobile ICU
NC Office of EMS Acute Cardiac Toolkit
In the field ECG, EMS dispatch… as quality measures
Prehospital ECG Key!
ECG training
Online

http://www.elephantshoe.biz/ecg/course2Edits/index.html
Organization

• The elements of reperfusion
  – ED
    • Registration (nurse first)
    • ECG equipment / tech
    • ED Physician
    • Ed Staff
    • If transfer, Quick EMTALA forms
Organization

• The elements of reperfusion
  – Catheterization laboratory
    • Communications
    • Patient registration
    • Staff / techs. / nurses
    • Interventional cardiologist (possibly also a non-interventional cardiologist)
Am I on Call? .........
Organization

• The elements of reperfusion
  – Greatest targets for improvement:
    • Hospital transfers
      – “Getting stuck in a net”
    • EMS support and training
    • Cath lab activation by EMS and any ED
How to build a regional STEMI system

- Funding
- Data
- Organization
  - Leadership, Oversight, Steering committee
  - Regional coordinator
  - An inclusive model
- The RACE process
- What has worked
The RACE Process

- Identify regions
- Organize PCI hospitals
- Include non-PCI hospitals and associated EMS
- Data measurement and feedback
- Target “systematic barriers”
  - Consensus / guideline based general recommendations
  - Hospital by hospital / EMS by EMS based issues
- Integrate process into standing systems
North Carolina Trauma Centers
RACs- Regional Advisory Committee

The mission is to participate in the development of standardized regional trauma care, as well as the establishment and maintenance of a coordinated trauma system to promote optimal trauma care for all citizens within the Trauma RAC’s area.
RACE Centers and Regions
65 hospitals (10 PCI, 55 non PCI)

Asheville
Winston-Salem
Durham-Chapel Hill-Greensboro
Charlotte
East Carolina

Each non-PCI center was assessed for reperfusion designation based on resources, transfer ability, and transfer time to PCI center.
RACE Participating Hospitals by Region (2005-2007)
5 Regions, 65 hospitals

Asheville:
- Mission Hospitals, Asheville (PCI)
- Angel Medical Center, Franklin
- Harris Regional Hospital, Sylva
- Haywood Regional Medical Center, Waynesville
- Highlands-Cashiers, Highlands
- McDowell Hospital, Marion
- Murphy Medical Center, Murphy
- Pardee Hospital, Hendersonville
- Park Ridge Hospital, Fletcher
- Rutherford Hospital, Rutherfordton
- Spruce Pine Community Hospital, Spruce Pine
- St. Luke’s Hospital, Columbus
- Transylvania Community Hospital, Brevard

Charlotte:
- Carolinas Medical Center (CMC) (PCI)
- CMC-Mercy (PCI)
- Presbyterian Hospital (PCI), Charlotte
- CMC- Lincoln, Lincoln
- CMC- Pineville, Charlotte
- CMC-Union, Monroe
- CMC-University, Charlotte
- Cleveland Medical Center, Shelby
- Lake Norman Regional Hospital, Mooresville
- Presbyterian Hospital, Huntersville
- Presbyterian Hospital, Matthews
- Rowan Regional Medical Center, Salisbury

Durham-Greensboro-Chapel-Hill:
- Duke University Medical Center, Durham (PCI)
- Moses H. Cone Memorial Hospital, Greensboro (PCI)
- North Carolina Memorial Hospital, Chapel-Hill (PCI)
- Alamance Regional Medical Center, Burlington
- Annie Penn Hospital, Reidsville
- Chatham Hospital, Siler City
- Franklin Regional Medical Center, Louisburg
- Maria Parham Medical Center, Henderson

Durham-Greensboro-Chapel-Hill (continued)
- Morehead Memorial Hospital, Eden
- Person Memorial Hospital, Roxboro
- Randolph Hospital, Asheboro
- Sampson Regional Medical Center, Clinton
- Wesley Long Community Hospital, Greensboro

East North Carolina:
- Pitt County Memorial Hospital, Greenville (PCI)
- Beaufort County Hospital, Washington
- Bertie Memorial Hospital, Windsor
- Chowan Hospital, Edenton
- Duplin General Hospital, Kenansville
- Halifax Regional Medical Center, Roanoke Rapids
- Heritage Hospital, Tarboro
- Lenoir Memorial Hospital, Kinston
- Martin General Hospital, Williamston
- Nash General Hospital, Rocky Mount
- Onslow Memorial, Jacksonville
- Our Community Hospital, Scotland Neck
- Pungo District Hospital, Belhaven
- Roanoke-Chowan hospital, Ahoskie
- Washington County Hospital, Plymouth

Winston-Salem:
- Forsyth Medical Center, Winston-Salem (PCI)
- Wake Forest University/Baptist Medical Center, Winston-Salem (PCI)
- Alleghany Memorial Hospital, Sparta
- Ashe Memorial Hospital, Jefferson
- Davis Regional Medical Center, Statesville
- Hugh Chatham Memorial Hospital, Elkin
- Iredell Memorial Hospital, Statesville
- Northern Hospital of Surry County, Mount Airy
- Lexington Memorial Hospital, Lexington
- Thomasville Medical Center, Thomasville
- Twin County Regional Hospital, Galax
- Wilkes Regional Medical Center, N. Wilkesboro
The RACE Process

• Organize PCI hospitals
  – Letter of intent
  – Single number cath lab activation
  – 24 / 7 availability
  – No Diversion Policy for STEMI
  – Surgical backup (proxy for quality / volume)
  – Ongoing data collection
  – Shared financial support of Regional Coordinator
    (integrate into QA / outreach process)
The RACE Process

• Approach non-PCI hospitals and associated EMS
  – Maintain referral lines
  – Coordinator and PCI hospital (s) that a facility uses
  – Approach hospital
    • Administrator, ED Leader, Cardiology, EMS, Other contacts
  – Review current approach and resources
    Facility reperfusion survey
The RACE Process

- Approach non-PCI hospitals
  - Recommend
    - STEMI team – hospital administration, ED, EMS, nursing, cardiology * key to involve if a specialty group on site
    - Focus on SYSTEMATIC BARRIERS to care
    - “Nurse first,” then register
    - ECG in the ED
      - Typical symptoms over age 30
      - Atypical symptoms over age 50 (nose to naval)
  - For EMS transported patients, don’t routinely repeat ECG… use EMS data / info.
The RACE Process

• Approach non-PCI hospitals
  Recommend
  • Single reperfusion plan according to available resources
  • Emergency physician able to activate the cath lab.
  • Provide cath lab activation number (s)
  • For likely transfer patients:
    – Stay on the stretcher
    – Avoid IV drips (asa, heparin bolus)
    – Fax records to cath lab rather than copy

• Operations manual”
Optimal system specifications by point of care

- EMS
- ED
- Transfer
- Receiving hospital
- Cath. Lab
- Other system issues – payers, regulations
RACE Interventions

EMS: Initial Contact EMT-Paramedic

Basic recommendations
- In the field ECG.
- Training to recognize ST-elevation MI on ECG.
- Review reperfusion checklist (p.17).
- Relay the ECG (or at least its findings) and checklist findings to a predetermined medical control facility and/or receiving hospital.
- Aspirin (162 to 325 mg chewed) to chest pain patients suspected of having ST-elevation MI unless contraindicated or an adequate dose of immediate-release aspirin can be verified as taken.
- Patient stays on ambulance stretcher for STEMI evaluation for hospitals that routinely transfer all or some patients by same ambulance.

Advanced recommendations
- Direct communication with Emergency Department physician, Cardiology, Catheterization Lab., or Coronary Care Unit to activate reperfusion plan.
- Prehospital fibrinolysis system as appropriate for local resources and needs.
- Direct and transport ST-elevation MI patients with contraindication to fibrinolysis or cardiac arrest shock to a facility capable of performing primary angioplasty. (Prehospital destination protocol)
- EMS has same IV tubing as predominate receiving hospitals.

Emergency Department Initial Hospital / Non-PCI Facility

Basic recommendations
- All patients presenting to ED with possible symptoms of acute myocardial infarction to undergo ECG within 10 minutes regardless of room or nurse availability.
- Specify system for rapidly acquiring ECG including specific location in the ED, ECG equipment in ED, and personnel.
- ED personnel trained to interpret ECG for ST-elevation MI.
- Establish a predetermined, institution-specific, written protocol for rapid reperfusion (see Reperfusion Regimens A & B, p.18) that includes:
  - ECG within 10 minutes of door.
  - Door to needle within 30 minutes.
  - Door to balloon within 90 minutes.
  - Reperfusion checklist.
  - Standard pharmacologic regimen.
  - Fibrinolytic agent stored in the emergency department.
  - Ability to reconstitute and administer fibrinolytic in emergency department.
  - If contraindication to fibrinolysis or uncertain diagnosis, expedited transfer plan to primary angioplasty facility.
  - Care pathway/algorithm/standing orders developed by key stakeholders.
  - Ongoing training and assessment program.
  - When possible there should be a single protocol per institution agreed upon by all cardiology and emergency department physicians.

- The choice of initial ST-elevation MI treatment should be made by the emergency medicine physician on duty according to established local guidelines / care pathways.
AMI Guidelines
Consider time and risk

Fibrinolysis preferred
– Early presentation
  < 3 hours from symptom onset
– Delay to PCI
  • Door to balloon >90 minutes
  • PCI vs. Lysis > 60 minutes
– PCI not an option
  • PCI available
  • High risk AMI
    • Cardiogenic shock (SBP <= 90 mmHg)
    • Rales > 1/2
    • Increased bleeding risk
– Late presentation
  > 3 hours
– Unclear diagnosis
  • Early repol., LBBB, pericarditis, dissection

PCI preferred
– PCI available
– Late presentation
  > 3 hours
– Unclear diagnosis
  • Early repol., LBBB, pericarditis, dissection


TOO COMPLICATED FOR RAPID, SYSTEMATIC IMPLEMENTATION
RACE Interventions

Regimen A – Primary PCI
Preferred if able to meet time goals
(To be used with institution specific standing orders/protocols for ST-elevation myocardial infarction patients)

ELIGIBLE PATIENTS
- Within 12 hours of symptom onset.
- ST-segment elevation > 0.2 mV in two or more contiguous leads
- Primary angioplasty is also the best option for:
  - Cardiogenic shock Killip class III or IV
  - Possible STEMI but uncertain of diagnosis
  - Contraindication to fibrinolysis
  - Physician or patient preference

Goal is to open artery with angioplasty balloon within 90 minutes of arrival to first hospital or first medical contact.

- Emergency department physician makes the decision about need for primary angioplasty, if possible. Consultation should be limited to situations of uncertainty.
- Notify PCI hospital of an STEMI in need of primary angioplasty.
- Complete STEMI form as a priority.
- Fax patient records including ECG to receiving hospital WHILE PATIENT IN TRANSFER.
- Continuous IV infusion should only be used if required for stability during transfer.

OTHER MEDICATIONS
1. Heparin: Bolus at 70 IU/kg IV bolus. No maintenance infusion during transfer.
2. Aspirin: 325 mg chewed.

PRN Medications:
1. Nitroglycerin paste 1 to 2 inches topically PRN chest pain
2. Morphine Sulfate 2-10 mg IV for chest pain unrelieved by Nitroglycerin PRN

Reperfusion Regimen B – Fibrinolysis
(To be used with institution specific standing orders/protocols for ST-elevation myocardial infarction patients)

ELIGIBLE PATIENTS
- Within 12 hours of symptom onset.
- ST-segment elevation > 1 mm or left bundle branch block.
- Absence of contraindications (see below)

FIBRINOLYTIC (tenecteplase [TNK] or reteplase [rPA])

<table>
<thead>
<tr>
<th>Tiontetrapeptide (TNK) regimen</th>
<th>Patient Weight (kg)</th>
<th>TNI (mg)</th>
<th>Volume TNI to be administered (ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 60</td>
<td>30</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>60 to 90</td>
<td>≥ 60 to &lt; 70</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>70 to 90</td>
<td>≥ 70 to &lt; 90</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>≥ 90</td>
<td>≥ 90</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

In situations where TAP, please wait 30 minutes after fibrinolytic administration.

OTHER MEDICATIONS:
1. Heparin:
   a. Bolus at initiation of TNI or rPA - 60 IU/kg IV bolus maximum 4,000 IU
   b. Maintenance 12 IU/kg/h (maximum 1,000 IU) to achieve activated partial thromboplastin time (aPTT) 1.5-2 times control, maintained for 48 hrs.
2. Aspirin: 325 mg chewed.

Absolute contraindications
- Any prior intracranial hemorrhage
- Known structural cerebral vascular lesion (for example arteriovenous malformation)
- Known malignant intracranial neoplasm (primary or metastatic)
- Ischemic stroke within 3 months EXCEPT acute ischemic stroke within 3 hours
- Suspected aortic dissection
- Active bleeding or bleeding diathesis (excluding menorrhagia)
- Significant closed head or facial trauma within 3 months

Relative contraindications
- History of chronic severe, poorly controlled hypertension
- Severe hypertensive crisis (systolic blood pressure greater than 180 mm Hg or diastolic blood pressure greater than 110 mm Hg)
- History of prior ischemic stroke greater than 3 months, dementia, or known intracranial pathology not covered in contraindications
- Traumatic or prolonged (greater than 10 minutes) CPR or major surgery (less than 3 weeks)
- Recent (within 2 to 4 weeks) internal bleeding
- Noncomissible vascular punctures
- Pregnancy
The RACE Process

- Approach non-PCI hospitals and associated EMS
  - Associated EMS
    - Stress in the field ECG
    - ECG / case reviews
    - Not always aligned with hospital
    - Under funded
    - Paramedics may not be available
    - Rural areas – truck can’t leave county
    - ECG machine may not be available
The RACE Process

- Approach non-PCI hospitals and associated EMS
  - Associated EMS
    - In the field ECG (EMT-P or EMT-I)
      - Typical symptoms over age 30
      - Atypical symptoms over age 50 (nose to naval)
    - Performing the ECG is most important
      - Carry in the door
      - Paramedic interpret
      - Transmit
        - Machine read - ***acute myocardial infarction***
  - Cath lab activation
  - Stay on the stretcher if likely transfer
  - Reperfusion checklist
The RACE Process

- Approach non-PCI hospitals and associated EMS
  - Associated EMS
    - ECG interpretation courses
      - Emphasize ST elevation MI and related ECG’s (early repolarization, pericarditis, bundle branch block...)
  - Routine case review with EMTs including ECG, playback of call, hospital findings and course
RACE
Interventions

24-28 hour return feedback
The RACE Process

• Political sensitivities
  – EMS
    • Competing with school teachers, etc for funding at county / city level
    • Most engaged if ED actually uses their ECG / data
    • Turnover – need for continuous training
The RACE Process

• Political sensitivities
  – Hospital
    • Medicare reimburse may drop if STEMI’s transferred, jeopardizing financial solvency
    • Competing hospitals
  – Emergency physician / staff
    • Overwhelmed – quick disposition / single plan is greatly appreciated
  – Cardiology
    • Competing groups
The RACE Process

• Political sensitivities
  – Government
  • County / City
    – Tough budget choices
    – Authority of state agencies / boards, interests of key lobbies including hospital association

• National
  – HHS-EMTALA, NHTSA, EMT registry, competing professional organizations,
How to build a regional STEMI system

- Funding
- Data
- Organization
  - Leadership, Oversight, Steering committee
  - Regional coordinator
  - An inclusive model
- The RACE process
- What has worked
What has worked

• Publicize importance of myocardial infarction relative to motor vehicle accidents:
  – Heart disease – 1 death every hour
  – Death from heart attack 3 time more common than death from motor vehicle accidents.
RACE Interventions

The SYSTEM is as important as the regimen.

- Parallel processes
  - "It only takes 5 minutes" not an acceptable delay
  - $6 \times 5$ minute steps = $30$ minutes
  - $18 \times 5$ minute steps = $90$ minutes
What has worked

Overcome systematic barriers – *change the model*

- Move care forward – empower EMS and ED physician and staff
- In the field ECG by all EMT-I and P (not just paramedics)
- “Leave patient on the stretcher”
- Single, simple reperfusion regimen
- Avoid drips
  - ASA, heparin bolus for transfer
What has worked

- **Strong** local and regional leadership
  - Emergency medicine, EMS directors, nurses, cath lab supervisors, key hospital administrators, Blue Cross Foundation, cardiology.
RACE
What has worked

• Agnostic system
  – Each participating institution rightly claims RACE process as their own
  – Minimal branding
• Altruistic “patient–centered” approach
• Quality feedback loop to referring MD, ED, transport team, EMS agency
RACE
What has worked

• Guidelines based

• Regional consensus

• Flexibility to local resources
RACE
What has worked

• DATA
  – Drives change
  – Use existing data resources
  – Simple
  – Feedback rapidly
  – No release of institution specific data
  – No patient identifiers / PHI
Summary and Conclusions

- RACE represents the largest regional STEMI reperfusion system in the United States.
- We focused on moving care forward: enabling EMS to diagnose and ED personnel to initiate treatment, with improved communication, integration, and data feedback.
- All times – door-to-balloon at PCI centers, door-in to door out in non-PCI centers, 1st door-to-balloon in transfer patients, and door-to-needle for fibrinolysis – were significantly improved (see optional slides).
- Improved application of reperfusion care on a broad scale is possible and should be a high national priority.
RACE Phase 3  RACE -ER

Maintain current regions

Organize new regions

Funding

Focus on EMS

ALL Centers

Data Collection

2007

New PCI center recruitment

2008

3 New Regional Launches

New PCI Center Training

2009

Non-PCI Center & EMS Recruitment

-ER
100 emergency departments

21 primary PCI labs

5,240 paramedics

18,000 EMTs

100 EMS systems

100 emergency departments
RACE Org Structure

ALL 100 Acute Care Hospitals

21 PPCI Centers

RACE System Teams

100 Counties +CN ~900 EMS Agencies

21 PCI RACE System Coordinators

Regional Steering Teams

West RC

NE RC

SE RC

West State RACE Leader

East State RACE Leader

RACE Central

Medical Directors of RACE

Executive Director of RACE
Integrated, Systematic AMI Care
Original 5 RACE Regions
Adding 2 New Regions in RACE-ER
10+ new PCI Centers

Phase 2 PCI Hospitals
New PCI hospitals
<table>
<thead>
<tr>
<th><strong>EMS</strong></th>
<th><strong>Emergency Medicine</strong></th>
<th><strong>Cardiology</strong></th>
<th><strong>Payers / Govt.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical leadership</td>
<td>Waiting room delays</td>
<td>30 minute activation</td>
<td>Financial incentives / disincentives</td>
</tr>
<tr>
<td>Destination plans</td>
<td>Lack of ECG space</td>
<td>Simultaneous STEMI</td>
<td>National standards for STEMI</td>
</tr>
<tr>
<td>Limited resources</td>
<td>Cardiology consult</td>
<td>False activation</td>
<td>Quality measures</td>
</tr>
<tr>
<td>Multiple / private EMS providers</td>
<td>Multiple STEMI plans</td>
<td>Freestanding PCI</td>
<td>EMS needs</td>
</tr>
<tr>
<td>Rural areas</td>
<td>Who owns the patient</td>
<td>Diagnostic cath.</td>
<td>Competition</td>
</tr>
<tr>
<td>EMT STEMI standards</td>
<td>Registration</td>
<td>STEMI data</td>
<td>Medical dispatch</td>
</tr>
<tr>
<td>Data collection</td>
<td>EMTALA</td>
<td>Data feedback</td>
<td>Certificate of need</td>
</tr>
<tr>
<td>Hospital follow up</td>
<td>Shock patients</td>
<td>Parking</td>
<td>Trauma system for STEMI / other cardiovascular “scenes”</td>
</tr>
<tr>
<td>Training officer needs</td>
<td>Transfer</td>
<td>Call rooms</td>
<td></td>
</tr>
<tr>
<td>False activation</td>
<td></td>
<td>Experience</td>
<td></td>
</tr>
</tbody>
</table>
"Wow, we should have looked on the other side of the tree weeks ago!"
• Will not cover RACE entire results next slides for reference only
Implementation of a Statewide System for Coronary Reperfusion for ST-Segment Elevation Myocardial Infarction

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Joseph D. Babb, MD
Peter B. Berger, MD
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Sidney M. Fletcher, MD
J. Lee Garvey, MD
William R. Hathaway, MD

Context  Despite 2 decades of evidence demonstrating benefits from prompt coronary reperfusion, registries continue to show that many patients with ST-segment elevation myocardial infarction (STEMI) are treated too slowly or not at all.

Objective  To establish a statewide system for reperfusion, as exists for trauma care, to overcome systematic barriers.

Design and Setting  A quality improvement study that examined the change in speed and rate of coronary reperfusion after system implementation in 5 regions in North Carolina involving 65 hospitals and associated emergency medical systems (10 percutaneous coronary intervention [PCI] hospitals and 55 non-PCI hospitals).

Patients  A total of 1164 patients with STEMI (579 preintervention and 585 postintervention) eligible for reperfusion were treated at PCI hospitals (median age 61 years, 31% women, 4% Killip class III or IV). A total of 925 patients with STEMI (518 preintervention and 407 postintervention) were treated at non-PCI hospitals (median age 62 years, 32% women, 4% Killip class III or IV).
Patient Flow Diagram

1164 patients at PCI Centers and 925 at non-PCI centers

10 PCI Centers
- Pre-intervention
  - July to Sept 2005
    - n= 579
  - Presented directly: 39%
  - Transferred from non-PCI: 61%
- Post-intervention
  - Jan to Mar 2007
    - n= 585
  - Presented directly: 47%
  - Transferred from non-PCI: 53%

55 Non-PCI Centers
- Pre-intervention
  - Jul 05 to Mar 06
    - n= 518
  - Lytic treated: 40%
  - Transferred for 1° PCI: 45%
  - No reperfusion: 15%
- Post-intervention
  - Jan to Mar 2007
    - n= 407
  - Lytic treated: 39%
  - Transferred for 1° PCI: 46%
  - No reperfusion: 15%
## RACE results

### Patient features

<table>
<thead>
<tr>
<th>Feature</th>
<th>PCI hospital</th>
<th>Non-PCI hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>n</td>
<td>579</td>
<td>585</td>
</tr>
<tr>
<td>Age (years, median)</td>
<td>60</td>
<td>61</td>
</tr>
<tr>
<td>≥ 75 years</td>
<td>20%</td>
<td>19%</td>
</tr>
<tr>
<td>Female</td>
<td>33%</td>
<td>28%</td>
</tr>
<tr>
<td>Chest pain at presentation</td>
<td>93%</td>
<td>96%</td>
</tr>
<tr>
<td>Killip III/IV</td>
<td>4.7%</td>
<td>4.3%</td>
</tr>
<tr>
<td>Initial reperfusion strategy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No reperfusion</td>
<td>23%</td>
<td>11%</td>
</tr>
<tr>
<td>Fibrinolysis</td>
<td>28%</td>
<td>25%</td>
</tr>
<tr>
<td>Primary PCI</td>
<td>48%</td>
<td>63%</td>
</tr>
<tr>
<td>CABG</td>
<td>1.7%</td>
<td>1.5%</td>
</tr>
</tbody>
</table>
# RACE results
## Arrival and transfer features

<table>
<thead>
<tr>
<th></th>
<th>PCI hospital</th>
<th></th>
<th>Non-PCI hospital</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td><strong>n</strong></td>
<td>579</td>
<td>585</td>
<td>518</td>
<td>407</td>
</tr>
<tr>
<td><strong>Arrival mode</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-transport</td>
<td>11%</td>
<td>12%</td>
<td>57%</td>
<td>56%</td>
</tr>
<tr>
<td>Ambulance</td>
<td>71%</td>
<td>63%</td>
<td>42%</td>
<td>44%</td>
</tr>
<tr>
<td>Helicopter</td>
<td>16%</td>
<td>21%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><strong>Pre-hosp ECG</strong></td>
<td></td>
<td></td>
<td>41%</td>
<td>61%</td>
</tr>
<tr>
<td><strong>Transferred from another hosp</strong></td>
<td></td>
<td></td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><strong>Transferred to a PCI hosp</strong></td>
<td></td>
<td></td>
<td>92%</td>
<td>95%</td>
</tr>
<tr>
<td><strong>Transfer mode</strong></td>
<td></td>
<td></td>
<td>40%</td>
<td>43%</td>
</tr>
<tr>
<td>EMS ground</td>
<td>34%</td>
<td>24%</td>
<td>25%</td>
<td>43%</td>
</tr>
<tr>
<td>AMI Hotline used</td>
<td>32%</td>
<td>85%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
RACE results
Non-reperfusion rates

P<0.001
RACE results
PCI hospitals: Door to device times

<table>
<thead>
<tr>
<th>Category</th>
<th>Median Time (min)</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients</td>
<td>108</td>
<td>90</td>
<td>128</td>
</tr>
<tr>
<td>Direct presenters</td>
<td>85</td>
<td>74</td>
<td>165</td>
</tr>
<tr>
<td>All transfers</td>
<td>149</td>
<td>106</td>
<td>128</td>
</tr>
</tbody>
</table>

* Remained significant in analysis accounting for clustering

P<0.001* P<0.001 P<0.001 P=0.01
RACE results
Non-PCI hospitals: Reperfusion times

Door-in door-out, all hospitals
Pre median: 120 minutes, Post median: 71 minutes
P<0.001*

Door-in door-out, transfer hosps
Pre median: 97 minutes, Post median: 45 minutes
P<0.001

Fibrinolysis, door-to-needle
Pre median: 35 minutes, Post median: 29 minutes
P=0.002

* Remained significant in analysis accounting for clustering
RACE results
Reperfusion rates

- Pre: 57%
- Post: 72%

PCI centers
<90 minutes D2B:
Direct presenters: P<0.001

<30 minutes D2 needle:
Non-PCI centers: 35%

Post: 52%

P<0.001
<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transfer</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National*</td>
<td>150</td>
<td>143</td>
<td>7</td>
</tr>
<tr>
<td>RACE</td>
<td>165</td>
<td>128</td>
<td>37</td>
</tr>
<tr>
<td><strong>Non transfer</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National*</td>
<td>88</td>
<td>81</td>
<td>7</td>
</tr>
<tr>
<td>RACE</td>
<td>85</td>
<td>74</td>
<td>11</td>
</tr>
</tbody>
</table>

Median time in minutes

*NRMI participating hospitals
## Clinical outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Pre (n=579)</th>
<th>Post (n=585)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death* (n, (%))</td>
<td>36 (6.2%)</td>
<td>44 (7.5%)</td>
<td>0.38</td>
</tr>
<tr>
<td>Stroke (n, (%))</td>
<td>6 (1.0%)</td>
<td>1 (0.2%)</td>
<td>0.06</td>
</tr>
<tr>
<td>Cardiac arrest (n, (%))</td>
<td>24 (4.2%)</td>
<td>18 (3.1%)</td>
<td>0.33</td>
</tr>
<tr>
<td>Cardiogenic shock (n, (%))</td>
<td>46 (7.9%)</td>
<td>45 (7.7%)</td>
<td>0.88</td>
</tr>
</tbody>
</table>

*To show a 0.5% reduction (7.0 to 6.5%) with $\alpha$ 0.05, 80% power would take 80,000 randomized patients