47th Annual New York Cardiovascular Symposium

STEMI — Clock Time of Reperfusion: Recent Update of the American, European and the Other Worldwide Studies

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Research and Consulting Relationships

• Research grants/contracts
  – NHLBI, Duke, Harvard, Astra, BMS, GSK, Merck, Portola, Regado, sanofi-aventis, TMC

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STE MI: Clock Time of Reperfusion

- Background and the basics
- Current Guidelines
- National and regional system efforts
- International efforts
- Future
Hospitalizations in the U.S. Due to Acute Coronary Syndromes (ACS)

1.57 Million Hospital Admissions - ACS

- **1.24 million** Admissions per year (UA/NSTEMI†)
- **.33 million** Admissions per year (STEMI)


*Primary and secondary diagnoses. †About 0.57 million NSTEMI and 0.67 million UA.*
Relationship Between Mortality Reduction and Extent of Salvage

The goal

Mortality reduction (%)

Time to treatment is critical

Opening the artery is primary goal (PCI > Lysis)

Extent of salvage (% of area at risk)

Hours

1 3 6 12 12-24

Modified from Gersh B, et al JAMA 2005
D2B Times and Mortality

N= 43,801 NCDR STEMI Patients 2005-2006

Primary PCI
Median D2B: 83 minutes
Overall mortality: 4.6%

P <0.001 for trend

Rathore BMJ 2009;338:1807
2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction

Developed in Collaboration with American College of Emergency Physicians and Society for Cardiovascular Angiography and Interventions

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Community Preparedness and System Goals for Reperfusion Therapy
Regional Systems of STEMI Care, Reperfusion Therapy, and Time-to-Treatment Goals

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.
Fibrinolytic Therapy When There Is an Anticipated Delay to Performing Primary PCI Within 120 Minutes of FMC
Obstacles to Rapid Transfer for Reperfusion Rx

- Delays in triage, evaluation, and diagnosis
- Fragmented and/or inadequate EMS services
- Inter-hospital competition for services
- Lack of integrated acute MI networks
- Geographic distances between hospitals
- Transportation inefficiencies
- Limitations with inclement weather
National Efforts to Improve Door-to-Balloon Time

Results From the Door-to-Balloon Alliance

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New Haven and East Hartford, Connecticut; Ann Arbor, Michigan; Rochester, Minnesota; Washington, DC; Denver, Colorado; Los Angeles, California; and Norfolk, Virginia

Objectives

The purpose of this study was to determine if enrollment in the Door-to-Balloon (D2B) Alliance, a national quality campaign sponsored by the American College of Cardiology and 38 partner organizations, was associated with increased likelihood of patients who received primary percutaneous coronary intervention for ST-segment elevation myocardial infarction (STEMI) being treated within 90 min of hospital presentation.

Background

The D2B Alliance, launched in November 2006, sought to achieve the goal of having 75% of patients with STEMI treated within 90 min of hospital presentation.

Methods

We conducted a longitudinal study of D2B times in 831 hospitals participating in the National Cardiovascular Data Registry (NCDR) CathPCI Registry, April 1, 2006, to March 31, 2008.

Results

By March 2008, >75% of patients had D2B times of ≤90 min, compared with only about one-half of patients with D2B times within 90 min in April 2005. Trends since the launch of the D2B Alliance showed that patients treated in hospitals enrolled in the D2B Alliance for at least 3 months were significantly more likely than patients treated in nonenrolled hospitals to have D2B times within 90 min, although the magnitude of the difference was modest (odds ratio: 1.16; 95% confidence interval: 1.07 to 1.27).

Conclusions

The D2B Alliance reached its goal of 75% of patients with STEMI having D2B times within 90 min by 2008. (J Am Coll Cardiol 2009;54:2423–9) © 2009 by the American College of Cardiology Foundation
Figure 3  Distributions of Hospitals by Percentage of Patients With D2B Times Within 90 Min
Implementation of a Statewide System for Coronary Reperfusion for ST-Segment Elevation Myocardial Infarction

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for the Reperfusion of Acute Myocardial Infarction in North Carolina Emergency Departments (RACE) Investigators

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 size 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 1,164 patients with STEMI (579 preintervention and 585 post intervention) 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).

Interventions Early diagnosis and the most expedient coronary reperfusion method at each point of care: emergency medical systems, emergency department, catheterization laboratory, and transfer. Within 5 regions, PCI hospitals agreed to provide single catheterization laboratory activation by emergency medical personnel, accept patients regardless of bed availability, and improve STEMI care for the entire region regardless of hospital affiliation.

Main Outcome Measures Reperfusion times and rates decreased by July 2005 and 3 months after (January to March 2007), a year-long implementation.

Results Median reperfusion times significantly improved according to first-door-to-device (presenting to PCI hospital 65 to 74 minutes, P < .001; transferred to PCI hospital 165 to 128 minutes, P < .001), door-to-needle in non-PCI hospitals (35 to 29 minutes, P = .002), and door-in to door-out for patients transferred from non-PCI hospitals (120 to 71 minutes, P < .001). Nonreperfusion rates were unchanged (16%) in non-PCI hospitals and decreased from 23% to 11% in the PCI hospitals. For patients presenting to or transferred to PCI hospitals, clinical outcomes including death, cardiac arrest, and cardiogenic shock did not significantly change following the intervention.

Conclusions A statewide program focused on regional systems for reperfusion for STEMI can significantly improve quality of care. Further research is needed to ensure that programs that result in improved application of reperfusion treatments will lead to reductions in mortality and morbidity from STEMI.
Expansion of a Regional ST-Segment–Elevation Myocardial Infarction System to an Entire State

James G. Jollis, MD; Hussein R. Al-Khalidi, PhD; Lisa Monk, RN, MSN; Mayme L. Roettig, RN, MSN; J. Lee Garvey, MD; Akinyele O. Aluko, MD; B. Hadley Wilson, MD; Robert J. Applegate, MD; Greg Mears, MD; Claire C. Corbett, MMS; Christopher B. Granger, MD; on behalf of the Regional Approach to Cardiovascular Emergencies (RACE) Investigators

Circulation 2012; 126:189-195

Implementation of a Statewide System for Coronary Reperfusion for ST-Segment Elevation Myocardial Infarction

James G. Jollis; Mayme L. Roettig; Akinyele O. Aluko; et al.


http://jama.ama-assn.org/cgi/content/full/298/20/2371
Focus on **SYSTEMATIC BARRIERS** to care

- STEMI team – hospital administration, ED, EMS, nursing, cardiology
- Prespecified reperfusion plan for hospital and region
- Prehospital ECGs, interpretation, and earliest activation
- Emergency physician (or paramedic) able to activate the cath lab
- Intense education with focus on EMS and EDs
Is Primary PCI for all STEMI Patients in the United States a realistic possibility?

The adage “a picture is worth a thousand words” emphasizes the ability of an image to convey complex data set into a more comprehensible format that may subsequently stimulate further innovation. For example, the advent of coronary angiography more than 50 years ago allowed physicians to visualize coronary anatomy, which subsequently led to the creation of modern day percutaneous coronary interventions (PCI). Similarly, geospatial information systems (GIS) maps can provide a “sky-view” that comprehensively defines the “anatomy” of all regional ST-elevation myocardial infarction (STEMI) systems within each state. Defining the anatomy of each network is the critical first step for implementing regional or statewide quality improvement (QI) “interventions.” Hence, the primary aims of this brief report include (1) a description of prior mapping efforts, (2) methods used for the current STEMI networks GIS mapping project, and (3) potential future directions.

The American Heart Association (AHA) Mission: Lifeline (http://maps.heart.org/ml/) currently contains a first-generation (v1.0) interactive state-based map (with zoom features to the county-level) that simply displays PCI-capable versus non-PCI-capable hospitals. These v1.0 maps are based on 2010 data from the American Hospital Association, which unfortunately lack sufficient granularity to precisely classify the specific role of each hospital within a regional STEMI network. In addition, 2 prior GIS publications ignored the contribution of non-PCI hospitals to each state’s STEMI system, as both studies focused on the proportion of the nation’s population living within a 60-minute drive time to a PCI-capable hospital.

The overarching goals of this ongoing second-generation (v2.0) STEMI network map project are to accurately categorize every hospital within each state, document existing interhospital transfer relationships and associated transport strategies, and highlight remaining gaps in system coverage. The v2.0 mapping strategy starts with a comprehensive list of US hospitals from the Center for Medicare and Medicaid Services (CMS), followed by categorization of each hospital’s STEMI-care strategy by knowledgeable regional authorities. This approach is best described as “targeted crowdsourcing” and uses a national database platform to synthesize the collective knowledge of local stakeholders across each state.

For the v2.0 GIS maps, the national CMS hospital list was chosen over the Hospital Association list. Although both allow geocoding via unique hospital identification numbers, the CMS Web site provides free public access downloads into Excel format, convenient filter options to easily sort hospitals by state and county, and searches that can be restricted to acute care hospitals. Minor issues with the CMS data set include the occasional existence of one CMS identification number for two “sister-hospitals” located on separate campuses, and rare omission of rural critical access hospitals when cross-checked against the Rural Assistance Center Web site.

Consistent with nomenclature in the Mission: Lifeline v1.0 maps and current Guidelines, the v2.0 maps start with two broad hospital category types (PCI-capable vs. non-PCI-capable), followed by further subcategorization to identify each hospital’s reperfusion strategy and exact role within a region as summarized in the Table. Any PCI-capable hospital should already be in compliance with applicable state laws regarding cardiac surgery on-site.

Key steps in GIS map development are detailed in chronological order below:

1. A comprehensive list of all CMS-registed hospitals within a chosen state (sorted alphabetically by county) was downloaded in Excel format. For simplicity, only key identifiers of each hospital were retained, including 9-digit CMS hospital number, official hospital name, city, state, zip code, and county (phone numbers and other general descriptors were deleted).
2. The Excel list was distributed by e-mail to knowledgeable stakeholders via email to state’s leadership structure (eg, Department of Health or State EMS directors) or existing oversight committee (eg, local AHA STEMI task force or EMS authorities). An associated instruction sheet asked each stakeholder to perform 3 tasks on the Excel list:
   a. Verify hospital list accuracy in their county(s). Add hospital names (on a separate Excel row) if 2 sister-hospitals shared the same CMS number but had 2 different campus locations, or if a critical access hospital was missing.
   b. Accurately categorize each hospital into 1 of 7 designations as listed in Table 1.
   c. For Referral Hospitals, designate the associated STEMI Receiving Center(s) and principal mode of interhospital transfer (ground ambulance vs. air transport). If an air transport strategy was selected, ground transport was assumed to be the default option during periods of inclement weather.
3. Each PCI-capable hospital was subcategorized using the 3 choices given below:
   a. STEMI Receiving Center: provides 24/7 primary PCI, formally designated by regional EMS authorities via destination policies, generally expected to participate in a regional and/or national QI registry(s), and accepts all STEMI patients identified by EMS in their catchment area regardless of insurance status, emergency department (ED) crowding level, or patient bed availability (only closest to internal disaster). STEMI centers can also provide PCI for associated Referral Hospitals via organized interhospital transfer protocols.
   b. Daytime primary PCI and after-hours transfer: These hospitals are located within a regional STEMI network, but generally do not receive any STEMI patients from EMS
Geographic Distance to Nearest PCI Hospital In Relation to Disease Prevalence
Mission: Lifeline
STEMI Networks
Geospatial Information Systems (GIS) Maps,
Critical Pathways in Cardiology, in press.

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Original Article

Fibrinolysis or Primary PCI in ST-Segment Elevation Myocardial Infarction

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Mission: Lifeline™ Launched 2007

Mission: Lifeline™ is a national community-based multidisciplinary initiative

**Overarching Goal**: Improve the mortality and morbidity and quality of care for the AMI population, specifically through the development of STEMI systems of care

**Guiding principle**: Patient centric, addressing the continuum of care for STEMI patients from symptom onset into the point of entry into the healthcare system, touching each aspect of the system, and return the patient back to the local community and physician

Mission: Lifeline STEMI Systems Coverage

As of 11/29/2012 (656 Systems; 65.0% Population Coverage)
Door-to-Balloon Time and Mortality among Patients Undergoing Primary PCI

Daniel S. Menees, M.D., Eric D. Peterson, M.D., Yongfei Wang, M.S., Jeptha P. Curtis, M.D., John C. Messenger, M.D., John S. Rumsfeld, M.D., Ph.D., and Hitinder S. Gurm, M.B., B.S.
Figure 2. Mortality According to Door-to-Balloon Time, 2005 to 2009.

Shown are the percentages of patients for whom the door-to-balloon time was 90 minutes or less (Panel A) and those for whom the door-to-balloon time was longer than 90 minutes (Panel B), as well as the unadjusted in-hospital mortality for both subgroups, for the period from July 2005 through June 2009. The P values are for the comparison between findings in 2005–2006 and those in 2008–2009.
Relation between door-to-balloon times and mortality after primary percutaneous coronary intervention over time: a retrospective study


Summary

Background Recent reductions in average door-to-balloon (D2B) times have not been associated with decreases in mortality at the population level. We investigated this seemingly paradoxical finding by assessing components of this association at the individual and population levels simultaneously. We postulated that the changing population of patients undergoing primary percutaneous coronary intervention (pPCI) contributed to secular trends toward an increasing mortality risk, despite consistently decreased mortality in individual patients with shorter D2B times.

Methods This was a retrospective study of ST-elevation myocardial infarction (STEMI) patients who underwent pPCI between Jan 1, 2005, and Dec 31, 2011, in the National Cardiovascular Data Registry (NCORD) CathPCI Registry. We looked for catheterisation laboratory visits associated with STEMI. We excluded patients not undergoing pPCI, transfer patients for pPCI, patients with D2B times less than 15 min or more than 3 h, and patients at hospitals that did not consistently report data across the study period. We assessed in-hospital mortality in the entire cohort and 6-month mortality in elderly patients aged 65 years or older matched to data from the Centers for Medicare and Medicaid Services. We built multilevel models to assess the relation between D2B time and in-hospital and 6-month mortality, including both individual and population-level components of this association after adjusting for patient and procedural factors.

Findings 423 hospitals reported data on 150,116 procedures with a 55% increase in the number of patients undergoing pPCI at these facilities over time, as well as many changes in patient and procedural factors. Annual D2B times decreased significantly from a median of 86 min (IQR 65–109) in 2005 to 63 min (IQR 47–80) in 2011 (p<0.0001) with a concurrent rise in risk-adjusted in-hospital mortality (from 4.7% to 5.3%; p=0.06) and risk-adjusted 6-month mortality (from 12.9% to 14.4%; p=0.001). In multilevel models, shorter patient-specific D2B times were consistently associated with lower in-hospital mortality (adjusted OR for each 10 min decrease 0.92; 95% CI 0.91–0.93; p<0.0001) and 6-month mortality (adjusted OR for each 10 min decrease 0.94; 95% CI 0.93–0.95; p=0.0001). By contrast, risk-adjusted in-hospital and 6-month mortality at the population level, independent of patient-specific D2B times, rose in the growing and changing population of patients undergoing pPCI during the study period.

Interpretation Shorter patient-specific D2B times were consistently associated with lower mortality over time, whereas secular trends suggest increased mortality risk in the growing and changing pPCI population. The absence of association of annual D2B time and changes in mortality at the population level should not be interpreted as an indication of its individual-level relation in patients with STEMI undergoing primary PCI.
Figure 2: Predicted in-hospital and 6-month mortality from the multilevel model over a range of patient-specific D2B times
All other covariates were held constant, including secular trends at the population level.
Figure 3: Predicted in-hospital and 6-month mortality across years related to secular trends at the population-level
Predicted in-hospital mortality. (B) Predicted 6-month mortality. All other covariates were held constant, including patient-specific D2B time.
Lower Hospital Volume Is Associated With Higher In-Hospital Mortality in Patients Undergoing Primary Percutaneous Coronary Intervention for ST-Segment–Elevation Myocardial Infarction

A Report From the NCDR

Michael C. Kontos, MD; Yongfei Wang, MS; Sarwat I. Chaudhry, MD; George W. Vetrovec, MD; Jeptha Curtis, MD; John Messenger, MD; on behalf of the NCDR

**Background**—Current guidelines recommend >36 primary percutaneous coronary interventions (PCIs) per hospital per year. Whether these standards remain valid when routine coronary stenting and newer pharmacological agents are used is unclear.

**Methods and Results**—We analyzed patients who underwent primary PCI from July 2006 through June 2009 included in the CathPCI Registry. Hospitals were separated into 3 groups: low (≤36 primary PCIs/y, current guideline recommendation), intermediate (>36–60 primary PCIs/y), and high volume (>60 primary PCIs/y). In-hospital mortality and door-to-balloon time were examined for each group. A total of 87,324 patient visits for 86,044 patients from 738 hospitals were included. There were 278 low- (38%), 236 (32%) intermediate-, and 224 (30%) high-volume hospitals. The majority of patients with primary PCI (54%) were treated at high-volume hospitals, with 15% at low-volume hospitals. Unadjusted mortality was significantly higher in low-volume hospitals compared with high-volume hospitals (5.6% versus 4.8%; P<0.001), which was maintained after multivariate adjustment (1.20; 95% confidence interval, 1.08–1.33; P=0.001). In contrast, mortality was not significantly different between intermediate-volume and high-volume hospitals (4.8% versus 4.8%; adjusted odds ratio, 1.02; 95% confidence interval, 0.94–1.11; P=0.61). Door-to-balloon times were significantly shorter in high-volume hospitals compared with low-volume hospitals (median, 72 minutes; interquartile range, [53–91] versus 77 [57–100] minutes; P<0.0001).

**Conclusions**—Higher annual hospital volume of primary PCI continues to be associated with lower mortality, with higher mortality in hospitals performing ≤36 primary PCIs/y. *(Circ Cardiovasc Qual Outcomes. 2013;6:659-667.)*
Off-hour presentation and outcomes in patients with acute myocardial infarction: systematic review and meta-analysis

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Adil Ahmed senior research fellow
Stephanie R Starr consultant physician
Kristine M Thompson consultant physician
Darcy A Reed consultant physician
Larry Prokop reference librarian
Nilay D Shah senior associate consultant
M Hassan Murad consultant physician
Henry H Ting consultant physician

OPEN ACCESS
Systematic Review and Meta-analysis of the Benefits of Out-of-Hospital 12-Lead ECG and Advance Notification in ST-Segment Elevation Myocardial Infarction Patients

Julian Nam, MSc; Kyla Caners, MD; James M. Bowen, BScPhm, MSc; Michelle Welsford, MD, ABEM, FRCP; Daria O’Reilly, PhD, MSc
Defining Unavoidable Delays in Primary Percutaneous Coronary Intervention: Discordance Among Patients Excluded From National Cardiovascular Quality Registries

James M. McCabe, MD; Kevin F. Kennedy, MS; Robert W. Yeh, MD, MSc

Background—The Centers for Medicaid and Medicare Services (CMS) and the National Cardiovascular Data Registry (NCDR) track primary percutaneous coronary intervention (PCI) performance in the form of door-to-balloon time. For quality assessment, exceptions are made for patients with “unavoidable delays” in both registries, yet it remains unclear how consistently such patients are identified.

Methods and Results—All primary PCI patients at 3 Massachusetts hospitals (Brigham and Women’s, Massachusetts General, and North Shore Medical Center) from 2009 to 2011 were evaluated for CMS inclusion/exclusion and NCDR nonsystems delay (NSD) status. We subsequently analyzed patient characteristics and outcomes based on these strata. Among 456 total patients, 128 (28%) were excluded from CMS reporting, whereas 56 (12%) were listed in the NCDR registry as having an NSD. Forty of 56 (71%) patients with NSD were also excluded from CMS reporting, whereas 312 of 400 (78%) patients reported without NSD were included in CMS reports. Between-registry agreement on patients with unavoidable delays was modest (κ=0.32). Among CMS-included patients without NSD, 94% received PCI within 90 minutes compared with 29% of CMS-excluded patients with NSD (P<0.001). Likewise, CMS-included patients without NSD had a 4-fold better 1-year mortality rate compared with CMS-excluded patients with NSD (P<0.001).

Conclusions—More than twice as many primary PCI patients are excluded from CMS quality analyses compared with NCDR. With the use of currently available cardiovascular quality registries, it is unclear how many patients truly require unavoidable delays during primary PCI. Patients with NSD had the worst outcomes regardless of CMS status. (J Am Heart Assoc. 2014;3:e000944 doi: 10.1161/JAHA.114.000944)
Relationship of the Distance Between Non-PCI Hospitals and Primary PCI Centers, Mode of Transport, and Reperfusion Time Among Ground and Air Interhospital Transfers Using NCDR’s ACTION Registry-GWTG

A Report From the American Heart Association Mission: Lifeline Program

Benjamin D. Nicholson, BA; Harinder S. Dhindsa, MD; Matthew T. Roe, MD; Anita Y. Chen, MS; James G. Jollis, MD; Michael C. Kontos, MD

Background—ST-segment myocardial infarction patients frequently present to non-percutaneous coronary intervention (PCI) hospitals and require interhospital transfer for primary PCI. The effect of distance and mode of transport to the PCI center and the frequency that recommended primary PCI times are met are not clear.

Methods and Results—Data from the ACTION Registry®-GWTG™ were used to determine the distance between the Non-PCI and PCI center and first door time to balloon time based on transfer mode (ground and air) for patients having interhospital transfer for primary PCI. From July 1, 2008, to December 31, 2012, 17,052 ST-segment myocardial infarction patients were transferred to 413 PCI hospitals. The median distance from the non-PCI hospital to the primary PCI center was 31.9 miles (Q1, Q3: 19.1, 47.9; ground 25.2 miles; air 43.9 miles; P<0.001). At distances <40 miles, ground transport was the primary transport method, whereas at distances >40 miles air transport predominated. Median first door time to balloon time for patients transferred for primary PCI was 118 minutes (Q1, Q3: 95.1, 150), with time for patients transported by air significantly longer (median 124 versus 113 minutes; respectively, P<0.001) than for patients transported by ground. Fifty-three percent of patients had a first door time to balloon time ≤120 minutes, with only 20% ≤90 minutes. A first door time to balloon time ≤120 minutes was more likely in ground than in air transport patients (57.0% versus 45.6%; P<0.001).

Conclusions—Interhospital transfer for primary PCI is associated with prolonged reperfusion times. These delays should prompt increased consideration of fibrinolytic therapy, emergency medical services hospital bypass protocols, and improved systems of care for ST-segment myocardial infarction patients requiring transfer. (Circ Cardiovasc Interv. 2014;7:00-00.)
Final Results of the Regional Systems of Care Demonstration Project: Mission: Lifeline™

**STEMI Accelerator Study**

Matthew W Sherwood, Hussein R Al-Khalidi, James G Jollis, Mayme L Roettig, Peter B Berger, Claire C Corbett, Harold L Dauerman, Kathleen Fox, J Lee Garvey, Timothy D Henry, Ivan C Rokos, B Hadley Wilson, Christopher B. Granger for the Accelerator Project
Objective

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

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

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

23,809 STEMI Patients with Symptoms <12 Hours

Goal: Improve the % patients reaching guideline goals
Intervention

OPERATIONS MANUAL
Optimal system specifications by point of care

- 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
- Pittsburgh
- Columbus
- Louisville
- Atlanta
- San Antonio
- Houston
- Tampa
- Hartford
- New York City
- Northern New Jersey
- Wilkes-Barre/Scranton

Duke Clinical Research Institute
## Patient characteristics

<table>
<thead>
<tr>
<th></th>
<th>Direct</th>
<th>Transfer</th>
<th>Overall</th>
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<tbody>
<tr>
<td></td>
<td>EMS</td>
<td>Self</td>
<td></td>
</tr>
<tr>
<td>Symptom onset to first medical contact (median)</td>
<td>47</td>
<td>114</td>
<td>89</td>
</tr>
<tr>
<td>PCI</td>
<td>90%</td>
<td>90%</td>
<td>89%</td>
</tr>
<tr>
<td>Eligible untreated</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
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ED time and Risk-adjusted in-hospital mortality
Direct EMS patients

<table>
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<tr>
<th>Emergency department time</th>
<th>In hospital mortality</th>
</tr>
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<tbody>
<tr>
<td>&lt;= 30 min</td>
<td>3.6% (n=4939)</td>
</tr>
<tr>
<td>30 - 45 min</td>
<td>7.0% (n=2575)</td>
</tr>
<tr>
<td>&gt; 45 min</td>
<td>10.8% (n=3054)</td>
</tr>
</tbody>
</table>

P < 0.001
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**

25%  56%  53%  55%  55%  57%  59%  61%  77%

N=4,208

*P<0.05  **P<0.01
Regional examples

New York City

DIRECT REFERRAL TO THE CATH LAB

Inclusion Criteria
- Ongoing chest discomfort or upper body discomfort felt to be ischemic in origin
- Symptom duration of less than 12 hours
- ST elevation of at least 2 mm in two or more contiguous leads
- Absence of other issues believed to require further evaluation and treatment (see exclusions)

Exclusions
- LBBB
- Intubated
- Respiratory failure or CHF requiring intubation
- Cardiac arrest
- DNR/DNI
- On-going Hospice care
- Obvious active severe bleeding
- Head or other serious trauma (meets trauma center criteria)

Protocol
1. EMS transmits ECG to FDNY On-Line Medical Control (OLMC) MD for evaluation
2. OLMC confirms there is ST elevation on ECG and verifies with paramedics that the patient meets the criteria for Direct Referral to the catheterization laboratory
3. Notification made by FDNY OLMC to ED, including provision of demographic information necessary for pre-registration and ECG transmitted from FDNY OLMC to ED (and secondary transmission points as identified by the PCI facility)
4. ED activates the STEMI pager and includes information that the patient qualifies as a "Direct Referral to the Cath Lab" provides the estimated time of arrival (ETA)
5. Cath lab calls ED to confirm availability to proceed with "Direct Referral to the Cath Lab"
6. Fellow, resident or member of the cath lab team greets the patient/EMS at the hospital's ED entrance and escorts them to cath lab.
Pre-hospital ECG transmission

- App can connect EMS with hospitals in areas without commercial ECG transmission systems
- Image compression and transmission is faster with app than with email
- App has been tested more than 1,500 times with Sprint, AT&T, and Verizon

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ST-segment elevation myocardial infarction in China from 2001 to 2011 (the China PEACE-Retrospective Acute Myocardial Infarction Study): a retrospective analysis of hospital data

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Summary
Background Despite the importance of ST-segment elevation myocardial infarction (STEMI) in China, no nationally representative studies have characterised the clinical profiles, management, and outcomes of this cardiac event during the past decade. We aimed to assess trends in characteristics, treatment, and outcomes for patients with STEMI in China between 2001 and 2011.

Methods In a retrospective analysis of hospital records, we used a two-stage random sampling design to create a nationally representative sample of patients in China admitted to hospital for STEMI in 3 years (2001, 2006, and 2011). In the first stage, we used a simple random-sampling procedure stratified by economic–geographical region to generate a list of participating hospitals. In the second stage we obtained case data for rates of STEMI, treatments, and baseline characteristics from patients attending each sampled hospital with a systematic sampling approach. We weighted our findings to estimate nationally representative rates and assess changes from 2001 to 2011. This study is registered with ClinicalTrials.gov, number NCT01624883.

Findings We sampled 175 hospitals (162 participated in the study) and 18,631 acute myocardial infarction admissions, of which 13,815 were STEMI admissions. 12,264 patients were included in analysis of treatments, procedures, and tests, and 11,986 were included in analysis of in-hospital outcomes. Between 2001 and 2011, estimated national rates of hospital admission for STEMI per 100,000 people increased (from 3-7 in 2001, to 8-1 in 2006, to 15-8 in 2011; pincr<0.0001) and the prevalence of risk factors—including smoking, hypertension, diabetes, and dyslipidaemia—increased. We noted significant increases in use of aspirin within 24 h (79-3% [95% CI 77.3–81.3] in 2001 vs 91.2% [90.5–91.9] in 2011, pincr<0.0001) and clopidogrel (95% CI 1.5% [90.9–2.1] in 2001 vs 80-7% [79.8–81.6] in 2011, pincr<0.0001) in patients without documented contraindications. Despite an increase in the use of primary percutaneous coronary intervention (10-2% [95% CI 8.1–12.3] in 2001 vs 27-6% [26.1–29.1] in 2011, pincr<0.0001), the proportion of patients who did not receive reperfusion did not significantly change (44.8% [95% CI 41.3–48.3] in 2001 vs 45.0% [43.3–46.7] in 2011, pincr=0.82). The median length of hospital stay decreased from 13 days (IQR 7–18) in 2001 to 11 days (7–14) in 2011 (pincr<0.0001). Adjusted in-hospital mortality did not significantly change between 2001 and 2011 (odds ratio 0-94, 95% CI 0-62–1.2, pincr=0.06).

Interpretation During the past decade in China, hospital admissions for STEMI have risen; in these patients, comorbidities and the intensity of testing and treatment have increased. Quality of care has improved for some treatments, but important gaps persist and in-hospital mortality has not decreased. National efforts are needed to improve the care and outcomes for patients with STEMI in China.

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Introduction As China has grown economically, it has experienced an epidemiological transition, with mortality due to ischaemic heart disease more than doubling during the past two decades to more than 1 million deaths per year.1,2 This trend is expected to accelerate, with the World Bank estimating that the number of individuals with myocardial infarction in China will increase to 23 million by 2030.3 Concurrent with this changing epidemiology, the Chinese medical care system has developed rapidly, implementing policies that have improved access by reducing financial barriers and increasing the numbers of hospitals and physicians.4 Despite the importance of acute myocardial infarction in China—particularly ST-segment elevation myocardial infarction (STEMI), which accounts for more than 80% of such events in the country—no nationally representative studies have defined the clinical profiles, management, and outcomes of patients with this disorder during the past decade. The scarcity of contemporary national estimates and data for changes in burden of disease, quality of care (including use of recommended treatments

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An analysis of the door-to-balloon time in STEMI patients in an underdeveloped area of China: a single-centre analysis

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Temporal Trends of System of Care for STEMI: Insights from the Jakarta Cardiovascular Care Unit Network System

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Abstract

Aim: Guideline implementation programs are of paramount importance in optimizing acute ST-elevation myocardial infarction (STEMI) care. Assessment of performance indicators from a local STEMI network will provide knowledge of how to improve the system of care.

Methods and Results: Between 2008–2011, 1505 STEMI patients were enrolled. We compared the performance indicators before (n = 869) and after implementation (n = 636) of a local STEMI network. In 2011 (after introduction of STEMI networking) compared to 2008–2010, there were more inter-hospital referrals for STEMI patients (61% vs 56%, p<0.001), more primary percutaneous coronary intervention (PCI) procedures (83% vs 73%, p = 0.005), and more patients reaching door-to-needle time ≤30 minutes (84.5% vs 80.2%, p<0.001). However, numbers of patients who presented very late (>12 hours after symptom onset) were similar (53% vs 51%, NS). Moreover, the numbers of patients with door-to-balloon time ≤90 minutes were similar (49.1% vs 51.3%, NS), and in-hospital mortality rates were similar (8.3% vs 6.9%, NS) in 2011 compared to 2008–2010.

Conclusion: After a local network implementation for patients with STEMI, there were significantly more inter-hospital referral cases, primary PCI procedures, and patients with a door-to-needle time ≤30 minutes, compared to the period before implementation of this network. However, numbers of patients who presented very late, the targeted door-to-balloon time and in-hospital mortality rate were similar in both periods. To improve STEMI networking based on recent guidelines, existing pre-hospital and in-hospital protocols should be improved and managed more carefully, and should be accommodated whenever possible.
STE AMI Care: Clock Time Therapy Challenges

• Despite enormous amount of data supporting the biological hypothesis of reperfusion, rates and timing of current reperfusion strategies are improving but still suboptimal
• Barriers to appropriate therapies are largely system related issues
• Efforts to improve MI care systems should translate into improved patient outcomes
• Best STE MI care means considering the best local approach to ensure consistent quality
• Measurement and feedback are critical
• Need more research on issues in addition to DTB time