Racial Disparities in the Regionalization of Care for Patients with ST-Segment Elevation Myocardial Infarction (STEMI)

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This work is supported in part by NIH grants R01HL114822 and R01HL134182
Presentation Overview

- Background and objectives
- Data
- Methods
- Results
- Discussion
Background on CA STEMI Regionalization

STEMI regionalization

Improved door-to-balloon times

Improved mortality
Background on CA STEMI Regionalization

Non-minority community

STE MI regionalization

Improved door-to-balloon times

Improved mortality

Minority community

STE MI regionalization

Improved door-to-balloon times

Improved mortality

=?
Research Objectives

1. Has STEMI regionalization policy widened or narrowed disparities in access, treatment, and outcomes for patients with STEMI between minority and non-minority communities when both are exposed to regionalization?

2. Are White and minority patients from the same type of community have similar experience when both are exposed to STEMI regionalization policy?
Data Sources

- California STEMI policy protocol database
  - Effective starting date
  - Protocol details (pre-hospital, inter-hospital)

- California non-public patient discharge data
  - Both inpatient and emergency department

- Vital statistics

- California’s Office of Statewide Health Planning and Development (OSHPD) facility utilization data
  - Annual total volume of selected procedures
Patient Cohort

- Patients with STEMI: principal diagnosis is 410.x0, 410.x1 but exclude 410.7x (nSTEMI)
- Between Jan 2006 to September 2015
  - Mortality data ends in Dec 2013
- All patients regardless of insurance/payer type
Empirical definition of regionalization

Based on class I recommendations from the American College of Cardiology and American Heart Association. A county is regionalized on and after the year that at least 50% of its EMS jurisdiction met either of the following:

1. EMS that direct pre-hospital transport to bypass the nearest hospitals that do not offer emergent PCI to facilities that offer emergent PCI for patients with STEMI; and

2. have inter-hospital transfer protocols specifically for patients with STEMI

Sensitivity analysis further categorized regionalization status to finer categories
Definition of minority status

- Community level
  - defined at ZIP code level
  - considered minority if its share of the Black or Hispanic population is at the top tertile of the overall California distribution, based on 2000 Census data

- Individual level
  - based on race/ethnicity group on the patient discharge data
    - White, Black, Hispanic, Asian, others
Outcomes

- **Access**
  - Whether a patient was admitted to a PCI capable hospital

- **Treatment**
  - Whether a patient received PCI on the day of admission
  - Whether a patient received PCI during the care episode

- **Health outcomes**
  - 30-day, 90-day, and 1-year mortality
  - 30-day readmission
Proportion of patients by community minority status and county regionalization status 2006–2015
Model 1: Linear probability model with county fixed effects

\[ Y_{ijkt} = \alpha_t + \beta_1 MC_k + \beta_2 D_{jt} + \beta_3 D_{jt} \times MC_k + \beta_4 X_{ijkt} + Z_j + \epsilon_{ijkt} \]

- \( Y_{ijkt} \) = Outcome of patient \( i \) residing in county \( j \) community \( k \) who had STEMI in year \( t \)
- \( \alpha_t \) = time trend
- \( MC_k = 1 \) if community \( k \) is a minority community
- \( D_{jt} = 1 \) on and after county \( j \) is exposed to regionalization policy
- \( D_{jt} \times MC_k \) = interaction term between exposure to regionalization policy and minority community status.
- \( X_{ijkt} \) = individual race/ethnicity groups, other demographics, insurance, comorbid conditions
- \( Z_j \) = county fixed effects
### Model 1 Results on Admission and Treatment Outcomes

<table>
<thead>
<tr>
<th>Sample mean at baseline (%)</th>
<th>Admitted to PCI hospital (%)</th>
<th>Received PCI on the same day (%)</th>
<th>Received PCI during the episode (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Changes in outcome after non-minority county is regionalized</strong></td>
<td><strong>6.3</strong>&lt;sup&gt;**&lt;/sup&gt;</td>
<td><strong>5.1</strong>&lt;sup&gt;**&lt;/sup&gt;</td>
<td><strong>5.0</strong>&lt;sup&gt;**&lt;/sup&gt;</td>
</tr>
<tr>
<td>95% CI</td>
<td>[5.5, 7.1]</td>
<td>[4.2, 6.1]</td>
<td>[4.2, 5.9]</td>
</tr>
<tr>
<td><strong>Additional change in outcome in minority communities relative to non-minority</strong></td>
<td><strong>-1.8</strong>&lt;sup&gt;**&lt;/sup&gt;</td>
<td><strong>-3.4</strong>&lt;sup&gt;**&lt;/sup&gt;</td>
<td><strong>-4.3</strong>&lt;sup&gt;**&lt;/sup&gt;</td>
</tr>
<tr>
<td>95% CI</td>
<td>[-2.8, -0.8]</td>
<td>[-4.5, -2.2]</td>
<td>[-5.3, -3.2]</td>
</tr>
<tr>
<td>N</td>
<td>135579</td>
<td>139257</td>
<td>139257</td>
</tr>
</tbody>
</table>
## Model 1 Results on Health Outcomes

<table>
<thead>
<tr>
<th></th>
<th>30-day mortality</th>
<th>90-day mortality</th>
<th>1-year mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample mean at baseline (%)</strong></td>
<td>13.6%</td>
<td>16.6%</td>
<td>21.4%</td>
</tr>
<tr>
<td><strong>Changes in outcome after non-minority county is regionalized</strong></td>
<td>-0.5</td>
<td>-0.6</td>
<td>-0.6</td>
</tr>
<tr>
<td><strong>95% CI</strong></td>
<td>[-1.3,0.2]</td>
<td>[-1.3,0.2]</td>
<td>[-1.4,0.2]</td>
</tr>
<tr>
<td><strong>Additional change in outcome in minority communities relative to non-minority</strong></td>
<td>0.2</td>
<td>0.4</td>
<td>0.7</td>
</tr>
<tr>
<td><strong>95% CI</strong></td>
<td>[-0.6,1.0]</td>
<td>[-0.5,1.3]</td>
<td>[-0.2,1.6]</td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>117896</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Model 2: Differentiated by Individual and Community Minority Status

\[ Y_{ijkt} = \alpha_t + \beta_1 MC_k + \beta_2 WN_{ijkt} + \beta_3 MN_{ijkt} + \beta_4 WM_{ijkt} + \beta_5 MM_{ijkt} + \beta_6 X_{ijkt} + Z_j + \epsilon_{ijkt} \]

- \( WN_{ijkt} = 1 \) on and after a White patient \( i \) in non-minority community \( k \) from county \( j \) is exposed to regionalization policy
- \( MN_{ijkt} = 1 \) if Black or Hispanic patient in non-minority community
- \( WM_{ijkt} = 1 \) if White patient in minority community
- \( MM_{ijkt} = 1 \) if Black or Hispanic patient in minority community
Regression-adjusted Percentage Point Changes in Outcomes After Exposure to Regionalization

- White in non-minority comm
- Black or Hispanic in non-minority comm
- White in minority comm
- Black or Hispanic in minority comm

<table>
<thead>
<tr>
<th>admitted to PCI facility</th>
<th>30-day mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 24 28 32 36 40 44 48 52 56 60 64</td>
<td>20 24 28 32 36 40 44 48 52 56 60 64</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>received PCI same day</th>
<th>90-day mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 24 28 32 36 40 44 48 52 56 60 64</td>
<td>20 24 28 32 36 40 44 48 52 56 60 64</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>received PCI during care episode</th>
<th>1-year mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 24 28 32 36 40 44 48 52 56 60 64</td>
<td>20 24 28 32 36 40 44 48 52 56 60 64</td>
</tr>
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</table>
Additional analysis

- Limiting observations to counties with similar pre-regionalization mortality trend

- Finer gradient of regionalization scope:
  - Partial: 50%-94% of jurisdiction met one of the criteria but not both
  - Substantial: 50%-94% of jurisdiction met both criteria
  - Complete: at least 95% met both criteria

- Excluding patients with STEMI whose principal diagnostic code is 410.9x
Patients of any race/ethnicity in minority communities with STEMI derived smaller benefits from cardiac care regionalization than those in non-minority communities.

White patients in non-minority communities experienced a mortality improvement when exposed to regionalization, but other groups had little or no improvement when exposed to regionalization.

Potential mechanisms
- Pre-hospital factors
- Practice pattern and resource differences across hospitals serving non-minority and minority communities
Are there spillover effects of STEMI regionalization on NSTEMI patients?

Is racial disparity also present in other technology expansions?
  - Case of stroke certification programs