DO POOR NEIGHBORHOODS HAVE SLOWER EMS TIMES?

Delphine Huang, MD, Matthew Niedzwiecki, PhD, Mary Mercer, MD, MPH, N. Clay Mann, PhD, MS, Christopher Colwell, MD and Renee Hsia, MD, MSc

UCSF, San Francisco, CA and University of Utah, Salt Lake City, UT.
1966, The National Research Council:

“Consultants returning from both Korea and Vietnam have publicly asserted that, if seriously wounded, their chances for survival would be better in the zone of combat than on the average city street”
10 AFTER KOREA. DURING VIETNAM.
These are slight semantics but the crowd are history buffs about this stuff.
Mary Mercer, 1/22/2017

11 SEE ADDITIONAL COMMENTATY
Mary Mercer, 1/22/2017
Bankruptcy of TransCare Strains New York's Emergency Services

About New York
By JIM DWYER  APRIL 14, 2016
I would not mention the NYT specifically. I would shorten the third paragraph and say something more broad, like: “Recently, the lay press has covered the effects of increased utilization of Emergency Medical Services and privatization and resource reduction of EMS.”

Mary Mercer, 1/22/2017
EMS Health Disparities

- Utilization of EMS system is broadly used by all types of patients, but most frequently, by those who are elderly, more ill, and poor.

- Patients from poor neighborhoods tend to have more comorbidities and suffer from critical illnesses, such as cardiac arrests.

- Post-survival cardiac arrests is lower in these populations.
Community Socioeconomic Status and Prehospital Times in Acute Stroke and Transient Ischemic Attack
Do Poorer Patients Have Longer Delays From 911 Call to the Emergency Department?

Dawn O. Kleindorfer, MD; Christopher J. Lindsell, PhD; Joseph P. Broderick, MD; Matthew L. Flaherty, MD; Daniel Woo, MD; Irene Ewing, RN; Pam Schmit, RN; Charles Moomaw, PhD; Kathleen Alwell, RN; Arthur Pancholi, MD; Edward Jauch, MD; Jane Khoury, MS; Rosie Miller, RN; Alexander Schneider, MD; Brett M. Kissela, MD

Effect of Socioeconomic Status on Out-of-Hospital Transport Delays of Patients With Chest Pain

Anand Govindarajan, BSc
Michael Schull, MD, MSc

From the Faculty of Medicine, University of Toronto (Govindarajan) and the Clinical Research Unit

See editorial, p. 491.

Study objective: The effect of socioeconomic status on out-of-hospital care has not been widely examined. We determine whether socioeconomic status was associated with out-of-hospital transport delays for patients with chest pain.
would try language such as "to date or to our knowledge..."

also, not sure if here (OR better the prior slide) would be a good place to put in a reference to studies pertaining to increased utilization of EMS system from low income neighborhoods compared to high income.

Mary Mercer, 1/22/2017
Objective #1
Determine whether ambulance response and transport times were longer in low-income zip codes compared to high-income zip codes for cardiac arrest patients.

Objective #2
Response times were compared to the frequently cited standard benchmarks of 4, 8 and 15 minutes for cardiac arrest patients.
I would change the wording to:
"we hypothesized that disparities in EMS response times... may serve as a marker for access to AND QUALITY of care."

Also, rather than using the first person plural, I'd be more passive. "The first objective of this study was..." instead of "our objective"

I added "AND GENERAL EMS response"

Mary Mercer, 1/22/2017
Study design

- NEMSIS, 2013
- Retrospective cross-sectional, nationwide study
- Linear, Cox proportional hazards and negative binomial regression analyses
- Income quartile based on median zip code income as the primary independent variable.
- **Outcome variables for:**
  - total EMS time (time from dispatch to hospital)
  - response time interval (time of dispatch until arrival to patient)
  - on-scene time interval (arrival of patient until left scene)
  - transport time interval (left scene to hospital)
Not sure you need to stay "this is the first nationwide study"

You could say "To our knowledge, no study has yet examined..." (But in order to save time, I'd leave it out)
Exclusion criteria

- Not transported to hospital
- Expired
- > 24 hours of transport
- > 1 patient/mass casualties

Controlled for external variables that may influence ambulance times such as:
- time of day
- day of the week
- urban setting
I think it is fine to generically refer to ambulance times if you define that term as all inclusive. Otherwise, until defined, I'd use more specific response and transport time.

Mary Mercer, 1/22/2017
<table>
<thead>
<tr>
<th>Variable</th>
<th>High income (mean)</th>
<th>Low income (mean)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>60.61</td>
<td>59.86</td>
<td>0.003</td>
</tr>
<tr>
<td>White (%)</td>
<td>67.39</td>
<td>61.78</td>
<td>0.000</td>
</tr>
<tr>
<td>Medicaid (%)</td>
<td>16.25</td>
<td>38.65</td>
<td>0.000</td>
</tr>
<tr>
<td>Driving distance (mi)</td>
<td>6.14</td>
<td>6.56</td>
<td>0.000</td>
</tr>
<tr>
<td>BLS (%)</td>
<td>10.08</td>
<td>12.53</td>
<td>0.004</td>
</tr>
<tr>
<td>ALS (%)</td>
<td>89.92</td>
<td>87.47</td>
<td>0.005</td>
</tr>
</tbody>
</table>
WE ALSO EXAMINED OTHER CO-VARIABLES THAT MIGHT INFLUENCE EMS TIMES. THESE FACTORS WERE SET A PRIORI.
Results

encounters: 50,145

highest income: 38.2 minutes

lowest income: 44.0 minutes

(+5.98 minutes, p<0.001).
I don’t understand the graphic on this page. I get it when looking along with the text. however, the large text and off-set text is distracting.

Would recommend either using animation to have the times appear as you talk or flipping the words/numbers

Mary Mercer, 1/22/2017
Income and cumulative EMS times (min)

EMS interval:
- Response to patient
- On-scene
- Transport to hospital

High Income: Blue line
Low Income: Red line

5.98 minutes increase
Difference in Total EMS Time (Low-High Income)

- Transport to hospital: 25.5%
- Response to patient: 15.9%
- On-scene: 58.6%
Distribution of Ambulance Response Times by Zip Code Median Income Quartile

- Top Income Quartile
- Lowest Income Quartile

Percentage of Responses

- < 5 min
- 5-9 min
- 9-16 min
- 16-31 min
- 31-61 min
- > 61 min
Limitations

- NEMSIS is based on EMS activations rather than individual patients.
- NEMSIS does not include outcomes data.
- Population level rather than a individual level, especially when it comes to using zip code data.
- EMS system performance metrics are not yet standardized. National benchmarks are not yet well-established.
- Determining why there this disparity in EMS times exist is most likely multi-factorial.
Conclusions

Cardiac arrest patients from the poorest zip codes had overall longer EMS times, compared to those from the wealthiest zip codes, and failed to meet standard benchmarks.

Given that survival of cardiac arrest is dependent on minutes, delay in EMS response, (even by 6 minutes) may impact patient outcomes.

Pre-hospital disparity research and reform:
Poor neighborhoods suffer the brunt of poor health outcomes.

Their worse health trajectory may be affected long before their arrival to the hospital—it may start with their 911 call.
Make an additional point (as second point), that this disparity becomes more pronounced, the longer that delays become (in the slower half of responses)

Mary Mercer, 1/23/2017
Additional slides
<table>
<thead>
<tr>
<th>outcome (time)</th>
<th>High income</th>
<th>Low income</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>time to patient</td>
<td>9.04</td>
<td>9.99</td>
<td>0.000</td>
</tr>
<tr>
<td>time on scene</td>
<td>18.87</td>
<td>22.38</td>
<td>0.000</td>
</tr>
<tr>
<td>transport time to hospital</td>
<td>10.50</td>
<td>12.03</td>
<td>0.000</td>
</tr>
<tr>
<td>time from dispatch to back in service</td>
<td>84.59</td>
<td>65.92</td>
<td>0.000</td>
</tr>
<tr>
<td>time from dispatch to hospital</td>
<td>38.42</td>
<td>44.40</td>
<td>0.000</td>
</tr>
</tbody>
</table>
ARE THE DECIMALS OFF ON THIS SLIDE?
I'M NOT UNDERSTANDING

Mary Mercer, 1/22/2017
<table>
<thead>
<tr>
<th>outcomes (benchmarks)</th>
<th>High income</th>
<th>Low income</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMS arrived at patient in less than 4 min</td>
<td>10.03%</td>
<td>11.71%</td>
<td>0.000</td>
</tr>
<tr>
<td>EMS arrived at patient in less than 8 min</td>
<td>56.93%</td>
<td>51.34%</td>
<td>0.000</td>
</tr>
<tr>
<td>EMS arrived at patient in less than 15 min</td>
<td><strong>93.30%</strong></td>
<td><strong>88.14%</strong></td>
<td>0.000</td>
</tr>
<tr>
<td>EMS arrived at patient in less than 30 min</td>
<td>99.47%</td>
<td>98.54%</td>
<td>0.000</td>
</tr>
<tr>
<td>EMS arrived at patient in less than 60 min</td>
<td>99.98%</td>
<td>99.92%</td>
<td>0.011</td>
</tr>
</tbody>
</table>
This slide is important to show. As it demonstrates the challenge for upfront care is relatively equally shared for the first 50% of patients (those can get response within 8 minutes)... But the disparities start to become more pronounced in the second half of patients in each cohort. As the clock ticks on.

Mary Mercer, 1/22/2017

Another note for Matt and you-- I'd love to see these mapped out on a curve I think that would be a powerful image.

Mary Mercer, 1/22/2017
## Cox regression

<table>
<thead>
<tr>
<th>Time interval</th>
<th>Cox</th>
<th>Means</th>
<th>Cox *Means (min) difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to patient</td>
<td>-0.07</td>
<td>9.04</td>
<td>0.63</td>
</tr>
<tr>
<td>On-scene</td>
<td>-0.18</td>
<td>18.87</td>
<td>3.24</td>
</tr>
<tr>
<td>Transport</td>
<td>-0.04</td>
<td>10.50</td>
<td>0.42</td>
</tr>
<tr>
<td>Total</td>
<td>-0.18</td>
<td>38.42</td>
<td>6.91</td>
</tr>
</tbody>
</table>
## Linear Regression

Controls (No patient-level controls - urban, time, day of week, region)

<table>
<thead>
<tr>
<th></th>
<th>time to scene</th>
<th>time on scene</th>
<th>transport time</th>
<th>time from dispatch to hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>zip code income quartile 1 (poorest)</td>
<td>0.37**</td>
<td>2.37**</td>
<td>0.33*</td>
<td>3.08**</td>
</tr>
<tr>
<td></td>
<td>0.09</td>
<td>0.17</td>
<td>0.13</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>[0.21,0.54]</td>
<td>[2.03,2.71]</td>
<td>[0.07,0.60]</td>
<td>[2.59,3.57]</td>
</tr>
<tr>
<td>zip code income quartile 2</td>
<td>0.60**</td>
<td>-1.63**</td>
<td>-0.40**</td>
<td>-1.43**</td>
</tr>
<tr>
<td></td>
<td>0.1</td>
<td>0.18</td>
<td>0.13</td>
<td>0.27</td>
</tr>
<tr>
<td>zip code income quartile 3</td>
<td>[0.41,0.79]</td>
<td>[-1.98,-1.28]</td>
<td>[-0.66,-0.14]</td>
<td>[-1.97,-0.90]</td>
</tr>
<tr>
<td></td>
<td>0.46**</td>
<td>-0.31**</td>
<td>0.61**</td>
<td>0.77**</td>
</tr>
<tr>
<td></td>
<td>0.06</td>
<td>0.11</td>
<td>0.09</td>
<td>0.16</td>
</tr>
<tr>
<td>N</td>
<td>50145</td>
<td>50145</td>
<td>50145</td>
<td>50145</td>
</tr>
</tbody>
</table>
Negative binomial regression

<table>
<thead>
<tr>
<th></th>
<th>time1_nbreg</th>
<th>time2_nbreg</th>
<th>time3_nbreg</th>
<th>sumtime_nb</th>
</tr>
</thead>
<tbody>
<tr>
<td>b/se/ci95</td>
<td>1.03**</td>
<td>1.13**</td>
<td>1.06**</td>
<td>1.09**</td>
</tr>
<tr>
<td></td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
</tbody>
</table>