Place Really Does Matter: Using Area-Based Measures to Investigate Associations between Poverty and Low Birth Weight in Arizona (CSTE Health Disparities Pilot Project)

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Outline

• Introduction

• Methods

• Results

• Conclusions
Introduction

• Health data collection and surveillance in the U.S. does not typically monitor SES patterns\textsuperscript{1,2}
• Race/ethnicity typically used as a proxy for SES\textsuperscript{3-5}
• SES indicators (e.g. income, education, poverty) are shown to be related to health outcomes, including birth outcomes\textsuperscript{6-10}
• Arizona has unique geographic position in the nation (rural, reservations, U.S.-Mexico border)
Methods

• Geocoding to assign tract numbers & poverty to births
  – AZ Dept of Health Services Office of Vital Records Birth records from 2000 and 2010
  – ESRI ArcGIS and Centrus Desktop
  – Manual geocoding with Google Earth

• Poverty: estimated percent of residents living below 100% of the Federal Poverty Level within each census tract
  – 2000: 2000 Decennial Census Long Form
  – 2010: 2006-2010 American Community Survey
  – 4 level $\rightarrow$ 0-4.9%, 5.0-9.9%, 10.0-19.9%, $\geq$20%
  – 6 level $\rightarrow$ 0-4.9%, 5.0-9.9%, 10.0-19.9%, 20.0-29.9%, 30.0-39.9%, $\geq$40%
Methods

• Study population
  – Singleton births
  – Mothers ages 15-55 years
  – Arizona residents

• Exclusions
  – Ungeocoded records
  – Missing census tract poverty data
  – Missing maternal age, plurality information, race/ethnicity (only excluded from analyses using race/ethnicity)
  – Missing/improbable birth weight (<150 g)
Methods

• Geocoding
  – 2000 – 82,600/84,865 (97.3%) geocoded by software and manually
  – 2010 – 85,242/87,053 (97.9%) geocoded by software and manually

• Final datasets (with exclusions)
  – 2000 – 80,126 births
  – 2010 – 82,648 births
Methods

• Low birth weight: <2500 grams
• Premature: <37 weeks gestation
• Race/Ethnicity
  – Birth record dataset includes one race and one ethnicity collected separately
  – Race/ethnicity assignments
    • Any race + Hispanic ethnicity → Hispanic
    • Any race + non-Hispanic ethnicity → race chosen
Methods

• Border Status
  – Traditional method: La Paz Agreement and United States-Mexico Border Health Commission → 100 km distance from U.S.-Mexico border
    • Typically includes **counties** if any of their geographies lie within the 100 km border zone
  – Novel method (created and used for this project): **Census tracts** with geographic centroid within 100 km of U.S.-Mexico border
Methods

Arizona Border Counties with 100 Km Boundary Line

2010 Border Census Tracts with Percent Below Poverty

Legend
- 100 Km Border Buffer
- U.S.-Mexico Border
- Non-Border Counties
- Border Counties

2010 Tracts
Percent Below Poverty
- 0 - 4.9
- 5.0 - 9.9
- 10.0 - 19.9
- 20.0 - 29.9
- 30.0 - 39.9
- 40.0 - 100.0
Methods

• Data Analysis (SAS 9.3)
  – Cross-tabs and rates
  – Chi-square statistics for associations
  – Cochran-Armitage test for trends among poverty levels
# Results

### Distribution of Population by Census Tract (CT) Poverty Level, Race/Ethnicity, and Other Demographics

**Arizona, 2000 & 2010**

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of Total Pop.</td>
<td>% Distribution by CT Poverty Level</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>0.0-4.9%</td>
</tr>
<tr>
<td>Total Births</td>
<td>80126</td>
<td>19.8</td>
</tr>
<tr>
<td>Mother's Race/Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>37399</td>
<td>32.7</td>
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<tr>
<td>Hispanic</td>
<td>32920</td>
<td>6.7</td>
</tr>
<tr>
<td>American Indian/Alaska Native</td>
<td>4575</td>
<td>3.2</td>
</tr>
<tr>
<td>Black</td>
<td>2477</td>
<td>12.7</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>1908</td>
<td>35.4</td>
</tr>
<tr>
<td>Border Status</td>
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<td></td>
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<tr>
<td>Border</td>
<td>13388</td>
<td>6.0</td>
</tr>
<tr>
<td>Non-Border</td>
<td>66738</td>
<td>22.5</td>
</tr>
</tbody>
</table>

azdhs.gov
## Results

### Distribution of Population by Census Tract (CT) Poverty Level, Race/Ethnicity, and Other Demographics

**Arizona, 2000 & 2010**

<table>
<thead>
<tr>
<th></th>
<th>2000</th>
<th></th>
<th>2010</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>% of Total Pop.</td>
<td>N</td>
<td>% of Total Pop.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.0-4.9% 5.0-9.9% 10.0-19.9% 20.0-29.9% 30.0-39.9% ≥40.0%</td>
<td></td>
<td>0.0-4.9% 5.0-9.9% 10.0-19.9% 20.0-29.9% 30.0-39.9% ≥40.0%</td>
</tr>
<tr>
<td><strong>Total Births</strong></td>
<td>80126</td>
<td>100.0</td>
<td>82648</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Mother's Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-19</td>
<td>11242</td>
<td>14.0</td>
<td>8889</td>
<td>10.8</td>
</tr>
<tr>
<td>20-24</td>
<td>22529</td>
<td>28.1</td>
<td>21187</td>
<td>25.6</td>
</tr>
<tr>
<td>25-29</td>
<td>21869</td>
<td>27.3</td>
<td>23731</td>
<td>28.7</td>
</tr>
<tr>
<td>30-34</td>
<td>15397</td>
<td>19.2</td>
<td>18322</td>
<td>22.2</td>
</tr>
<tr>
<td>35-39</td>
<td>7370</td>
<td>9.2</td>
<td>8598</td>
<td>10.4</td>
</tr>
<tr>
<td>40-44</td>
<td>1557</td>
<td>1.9</td>
<td>1805</td>
<td>2.2</td>
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<tr>
<td>45-55</td>
<td>162</td>
<td>0.2</td>
<td>116</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Gender of Infant</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boy</td>
<td>40937</td>
<td>51.1</td>
<td>42126</td>
<td>51.0</td>
</tr>
<tr>
<td>Girl</td>
<td>39186</td>
<td>48.9</td>
<td>40521</td>
<td>49.0</td>
</tr>
</tbody>
</table>
Results

Distribution of All Live Births by Poverty Level

Percent of Live Births

Census Tract Percent Below Poverty

0-4.9% 5-9.9% 10-19.9% 20-29.9% 30-39.9% ≥40%

2000 2010
Results

Low Birth Weight Rate by Poverty

<table>
<thead>
<tr>
<th>Census Tract Percent Below Poverty</th>
<th>2000</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4.9%</td>
<td>4.27</td>
<td>4.44</td>
</tr>
<tr>
<td>5-9.9%</td>
<td>5.14</td>
<td>5.12</td>
</tr>
<tr>
<td>10-19.9%</td>
<td>5.7</td>
<td>5.66</td>
</tr>
<tr>
<td>20-29.9%</td>
<td>6.19</td>
<td>6.2</td>
</tr>
<tr>
<td>30-39.9%</td>
<td>6.2</td>
<td>6.38</td>
</tr>
<tr>
<td>≥40%</td>
<td>6.84</td>
<td>6.62</td>
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</table>
## Results

### Risk Ratios (RR): Low Birth Weight by Poverty Level

<table>
<thead>
<tr>
<th>Census Tract Percent Below FPL</th>
<th>2000 RR</th>
<th>2010 RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0-4.9% (ref.)</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>5.0-9.9%</td>
<td>1.20</td>
<td>1.15</td>
</tr>
<tr>
<td>10.0-19.9%</td>
<td>1.33</td>
<td>1.27</td>
</tr>
<tr>
<td>20.0-29.9%</td>
<td>1.45</td>
<td>1.40</td>
</tr>
<tr>
<td>30.0-39.9%</td>
<td>1.45</td>
<td>1.44</td>
</tr>
<tr>
<td>≥40.0%</td>
<td>1.60</td>
<td>1.49</td>
</tr>
</tbody>
</table>
Results

Low Birth Weight Rate by Race/Ethnicity

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>2000</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian/Pacific Islander</td>
<td>6.5</td>
<td>7.02</td>
</tr>
<tr>
<td>White</td>
<td>4.98</td>
<td>4.87</td>
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<tr>
<td>Black</td>
<td>10.54</td>
<td>9.41</td>
</tr>
<tr>
<td>American Indian/Alaska Native</td>
<td>4.94</td>
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<tr>
<td>Hispanic</td>
<td>5.59</td>
<td>5.73</td>
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</tbody>
</table>
Results

2000 LBW Rate by Poverty and Race/Ethnicity

- White*
- Hispanic*
- American Indian/Alaska Native
- Black
- Asian/Pacific Islander

2010 LBW Rate by Poverty and Race/Ethnicity

- White*
- Hispanic*
- American Indian/Alaska Native
- Black
- Asian/Pacific Islander

*Statistically significant trend as census tract poverty increases
Results

Low Birth Weight Rate by Border Status

Year

2000
2010

Rate per 100 Live Births

Border
Non-Border

6.34
5.73

5.33
5.55

4.8
5
5.2
5.4
5.6
5.8
6
6.2
6.4
6.6
Results

2000 LBW Rates by Border and Poverty Levels

2010 LBW Rates by Border and Poverty Levels

§Statistically significant trend of LBW as census tract poverty increases
## Results

**Risk Ratios (RR): Preterm Birth by Poverty Level**

<table>
<thead>
<tr>
<th>Census Tract Percent Below FPL</th>
<th>2000 RR</th>
<th>2010 RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0-4.9% (ref.)</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>5.0-9.9%</td>
<td>1.14</td>
<td>1.04</td>
</tr>
<tr>
<td>10.0-19.9%</td>
<td>1.09</td>
<td>1.14</td>
</tr>
<tr>
<td>20.0-29.9%</td>
<td>1.18</td>
<td>1.25</td>
</tr>
<tr>
<td>30.0-39.9%</td>
<td>1.10</td>
<td>1.30</td>
</tr>
<tr>
<td>≥40.0%</td>
<td>1.25</td>
<td>1.43</td>
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</table>
Results

Comparing Risks between 2000 and 2010: Low Birth Weight and Preterm Births by Poverty Level

<table>
<thead>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>0.0-4.9% (ref.)</td>
<td>1.00 ($RR_{2010}/RR_{2000}$)</td>
<td>1.00 ($RR_{2010}/RR_{2000}$)</td>
</tr>
<tr>
<td>5.0-9.9%</td>
<td>0.96</td>
<td>0.92</td>
</tr>
<tr>
<td>10.0-19.9%</td>
<td>0.95</td>
<td>1.05</td>
</tr>
<tr>
<td>20.0-29.9%</td>
<td>0.97</td>
<td>1.06</td>
</tr>
<tr>
<td>30.0-39.9%</td>
<td>0.99</td>
<td>1.18</td>
</tr>
<tr>
<td>≥40.0%</td>
<td>0.93</td>
<td>1.14</td>
</tr>
</tbody>
</table>
Conclusions

• LBW and premature births are associated with census tract poverty level
  – Women living in tracts with high poverty are more likely to have a LBW baby than women in low poverty tracts
  – Similar findings for premature births
  – This stays true for both 2000 and 2010
  – However...
Conclusions

• However...not when examined by race/ethnicity
  – Blacks, American Indians/Alaska Natives, and Asians/Pacific Islanders (in 2000) do not display the increasing trend of LBW as poverty increases

• Overall, Blacks experience the largest LBW disparity at almost every poverty level and during each year
  – Asians experience the second largest LBW disparity
Conclusions

• By Border, inconsistent association between LBW and Border status
• Inconsistent trend for poverty and LBW for women living in border region
Conclusions

• LBW – magnitude of disparity across poverty levels has remained similar over time

• Prematurity – magnitude of disparity across poverty level varies over time
Conclusions

• Strengths
  – State-wide analysis of two years of data
  – Large proportion of all births geocoded
  – Near complete race/ethnicity information

• Limitations
  – Overrepresentation of American Indian/Alaska Natives in records unable to be geocoded
  – Community level SES proxy (census tract poverty) rather than individual level
  – Exclusions for this analysis prevent comparisons between these findings and the Arizona Health Status and Vital Statistics book
Conclusions

• Additional Implications
  – Using census tract poverty as proxy for SES is simple and accessible, making it ideal for public health use, especially for basic surveillance and analyses
  – Better targeted programs/interventions could be designed using at-risk populations identified by census tract poverty analysis
  – Local and state agencies within Arizona and in states with similar distributions of American Indians/Alaska Natives should take note of geocoding challenges identified here
Acknowledgements

• CSTE – Health Disparities Committee
• Wes Kortuem
• Dyanne Herrera
• Zipatly Mendoza
• Sarah Henry
References

Questions?

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602-542-2910
Dissemination of Findings

• We plan to use our presentation and posters for local conferences/meetings and planning purposes
  – May 2013 USPHS Conference – 2 posters presented; 1 poster awarded First Place, Civilian Division

• We would like to have these findings published in a peer-reviewed journal
  – Either in a collective report or a collection of short reports from the CSTE disparities project
  – We have begun brainstorming with analysts at Multnomah County who also analyzed low birth weight records

• We would like CSTE to develop and post its own monograph summarizing the findings