Nashville REACH 2010

Paper 1004
Geographic Clustering of Obesity, Diabetes, and Hypertension in Nashville, Tennessee

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Abstract

• **Purpose:** To describe and map the spatial clustering of obesity, diabetes, and hypertension in Nashville, Tennessee.

• **Method:** Data from two random community phone surveys was geocoded and combined into a single dataset. Data was aggregated by census tract, and those tracts with 10 or more interviews (129 of 144, 7,606 cases) were included.

• **Results:** Obesity, hypertension, and diabetes prevalence in the 129 census tracts showed clear geographic clustering when mapped using GIS software. Linear regression analysis shows that spatial distribution of risk factors clusters with diabetes, hypertension, and obesity prevalence. Geographic clusters were similar for the health access, health behaviors, neighborhood safety, demographics, socioeconomic status, and neighborhood contextual measures obtained from census data.

• **Conclusion:** Analysis of geographic clustering can be used to identify high-risk neighborhoods and may be useful in planning and targeting public health interventions.
Overview

• Nashville REACH 2010 project
• Survey and data collection
• Maps of prevalence
• Clustering of prevalence across census tracts
• Associations with Health Behaviors
• Associations with Environmental Characteristics
Nashville’s Goal

• To reduce and eventually eliminate disparities in diabetes and cardiovascular disease among African Americans living, working, or going to school in North Nashville, Tennessee.
Summary of Nashville REACH 2010 Project

• Population
  – African American’s living in North Nashville

• Health Disparities
  – Diabetes
  – Cardiovascular disease

• Intervention Targets
  – Tobacco
  – Health Care Access
  – Screening
  – Wellness (eating and exercise behaviors)

• Methods
  – Increase readiness to change
  – Modify environmental conditions
  – Create behavioral support systems
Data Sets

• Two random telephone surveys were conducted by the Metropolitan Health department using similar methodology.
• REACH 2010 baseline survey was conducted during 2000-2001.
• BRFSS survey was conducted during 2001.
• Commercial phone lists were obtained and numbers sampled at random using stratified random sampling.
• Participant addresses could be geocoded
Elements of Survey

- SF-12
- Hypertension (BRFS)
- Diabetes (BRFS)
- CVD (BRFS)
- Tobacco (BRFS)
- Alcohol (BRFS)
- Weight Control (BRFS)
- Eating Patterns
- Eating Problems
- F&V barriers
- Low-fat barriers
- Activity & exercise
- Exercise barriers
- Social context and demographic
- Health access and barriers
- Religion/Spirituality
Common Variables

- Diagnosed hypertension
- Diagnosed high cholesterol
- Diagnosed diabetes
- Currently smokes
- Trying to lose weight
- Is physically active
- Neighborhood safe
- Stage of change dietary fat
- Stage of change fruits and vegetables
- BMI (kg/m$^2$)
Residential and Economic Segregation in Nashville

Percent Black versus Wealth

Legend:
- Streets
- CLASS
- 1
- 2
- 3
- 4
- 5
- 6
- Water

Census Tracts
- Percent African American
- 0.000000 - 0.024255
- 0.024256 - 0.059453
- 0.059454 - 0.092211
- 0.092212 - 0.125447
- 0.125448 - 0.171319
- 0.171320 - 0.248273
- 0.248274 - 0.344611
- 0.344612 - 0.551772
- 0.551773 - 0.751252
- 0.751253 - 0.980952

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Distribution of Health Problems

• Take the surveys and group by census tract
• Keep those with at least 10 surveys
• Calculate mean values or percentages across people within census tracts
• 129 census tracts with 10 or more surveys
• Total sample size = 7,606
Number of Observations per Census Tract
North Nashville Highlighted

Legend
CLASS
1
2
3
4
5
6
Streets
Water
Census Tracts
Sample Size
10 - 20
21 - 29
30 - 35
36 - 45
46 - 57
58 - 69
70 - 89
90 - 129
130 - 211
212 - 315

Percent Black by Sample Size

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Geographic Distribution of Health Problems

• BMI = body mass index m/kg^2
  – Normal < 25
  – 25 ± Overweight < 30
  – Obese ≥ 30

• Have you been told by a doctor that you have
  – Diabetes
  – Hypertension or high blood pressure
Percent Diagnosed with Hypertension
There is Clustering of Chronic Health Problems

<table>
<thead>
<tr>
<th></th>
<th>percent black</th>
<th>BMI</th>
<th>diabetes</th>
<th>hypertension</th>
</tr>
</thead>
<tbody>
<tr>
<td>percent black</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>0.54</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>diabetes</td>
<td>0.46</td>
<td>0.45</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>hypertension</td>
<td>0.53</td>
<td>0.51</td>
<td>0.45</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Pearson Correlation across 129 Census Tracts: Chronic conditions cluster with each other and show racial disparities exist.
Three Behaviors

- Stage of Change for Dietary Fat
- Have you been physically active in the past month?
- Do you regularly smoke cigarettes?
Dietary Fat Stage of Change
1 = precontemplation
5 = Maintenance
Physically Active in Past Month
Percent Who Smoke

Smoking by Wealth

Legend

Streets
CLASS
1
2
3
4
5
6
Water

Census Tracts
Percent Smokers
0.04 - 0.13
0.14 - 0.18
0.19 - 0.21
0.22 - 0.24
0.25 - 0.26
0.27 - 0.28
0.29
0.30 - 0.32
0.33 - 0.38
0.39 - 0.63

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## Behaviors Cluster with Health Problems

<table>
<thead>
<tr>
<th></th>
<th>Fat Stage</th>
<th>Active</th>
<th>Smokes</th>
</tr>
</thead>
<tbody>
<tr>
<td>percent black</td>
<td>-0.40</td>
<td>-0.49</td>
<td>0.34</td>
</tr>
<tr>
<td>bmi</td>
<td>-0.31</td>
<td>-0.62</td>
<td>0.22</td>
</tr>
<tr>
<td>diabetes</td>
<td>-0.16</td>
<td>-0.33</td>
<td>0.22</td>
</tr>
<tr>
<td>hypertension</td>
<td>-0.28</td>
<td>-0.48</td>
<td>0.21</td>
</tr>
</tbody>
</table>

Pearson Correlation across 129 Census Tracts:
Behaviors cluster with chronic disease
Plus evidence for racial disparities
Do these Health Behaviors and Chronic Disease Cluster with Environmental Characteristics?

- Linked with Census long form data
- Too many variables
- Selected Variables
- Did a Cluster analysis
- Formed 12 groups of variables
- Computed z-score on each variable for each census tract
- Added z-scores within clusters
Clusters of Census Variables
12 Clusters

- Poverty
- Crowding
- urban core
- low SES
- aging residential
- family residential
- born outside TN
- immigrants,
- rental units
- rental costs
- Intelligentsia
- accumulated wealth
# Poverty Cluster

<table>
<thead>
<tr>
<th>Poverty Cluster</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>poverty</td>
<td># living in poverty</td>
</tr>
<tr>
<td>POVERTY</td>
<td># of poor children</td>
</tr>
<tr>
<td>CHILDPOO</td>
<td>single mothers in poverty</td>
</tr>
<tr>
<td>SFCHLD</td>
<td>income deficit for single female families</td>
</tr>
<tr>
<td>INCDEFSF</td>
<td>% single mothers</td>
</tr>
<tr>
<td>PERSMOT</td>
<td>% single mothers</td>
</tr>
</tbody>
</table>
## Accumulated Wealth

<table>
<thead>
<tr>
<th>Accumulated Wealth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOMVALLQ</td>
<td>Housing value lower quartile</td>
</tr>
<tr>
<td>HOMVALMD</td>
<td>Housing value median</td>
</tr>
<tr>
<td>HOMVALUP</td>
<td>Housing value upper quartile</td>
</tr>
<tr>
<td>MEDHINC</td>
<td>Median household income</td>
</tr>
<tr>
<td>MEDROOM</td>
<td>Median Rooms per house</td>
</tr>
<tr>
<td>HINCOME</td>
<td>% of population making over $100k</td>
</tr>
<tr>
<td>PERCAP</td>
<td>Percapita income</td>
</tr>
<tr>
<td>MONCSTMO</td>
<td>Monthly housing costs with mortgage</td>
</tr>
<tr>
<td>MONCSTNM</td>
<td>Monthly housing costs without a mortgage</td>
</tr>
</tbody>
</table>
Crowding Cluster
## Correlations between Health measures and Census Clusters

<table>
<thead>
<tr>
<th>Cluster</th>
<th>%Hypertension</th>
<th>Mean BMI</th>
<th>%Diabetes</th>
<th>Mean Health Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poverty</td>
<td>0.38</td>
<td>0.5</td>
<td>0.48</td>
<td>0.36</td>
</tr>
<tr>
<td>Crowding</td>
<td>0.47</td>
<td>0.4</td>
<td>0.38</td>
<td>0.26</td>
</tr>
<tr>
<td>Urban Core</td>
<td>0.14</td>
<td>0.27</td>
<td>0.16</td>
<td>0.25</td>
</tr>
<tr>
<td>Low SES</td>
<td>0.46</td>
<td>0.6</td>
<td>0.52</td>
<td>0.64</td>
</tr>
<tr>
<td>Older neighborhood</td>
<td>0.33</td>
<td>0.25</td>
<td>0.34</td>
<td>0.21</td>
</tr>
<tr>
<td>Suburban residential</td>
<td>0.08</td>
<td>0.11</td>
<td>0.21</td>
<td>0.09</td>
</tr>
<tr>
<td>Cluster</td>
<td>%Hypertension</td>
<td>Mean BMI</td>
<td>%Diabetes</td>
<td>Mean Health Rating</td>
</tr>
<tr>
<td>--------------------</td>
<td>---------------</td>
<td>----------</td>
<td>-----------</td>
<td>--------------------</td>
</tr>
<tr>
<td>US born</td>
<td>-0.45</td>
<td>-0.37</td>
<td>-0.24</td>
<td>-0.42</td>
</tr>
<tr>
<td>Immigrants</td>
<td>-0.17</td>
<td>0.01</td>
<td>0</td>
<td>0.07</td>
</tr>
<tr>
<td>Rental market</td>
<td>-0.28</td>
<td>-0.1</td>
<td>-0.03</td>
<td>-0.04</td>
</tr>
<tr>
<td>Rental costs</td>
<td>-0.47</td>
<td>-0.59</td>
<td>-0.54</td>
<td>-0.52</td>
</tr>
<tr>
<td>Intelligentsia</td>
<td>-0.4</td>
<td>-0.6</td>
<td>-0.45</td>
<td>-0.66</td>
</tr>
<tr>
<td>Accumulated wealth</td>
<td>-0.26</td>
<td>-0.49</td>
<td>-0.34</td>
<td>-0.55</td>
</tr>
<tr>
<td>Mean absolute value</td>
<td>0.32</td>
<td>0.36</td>
<td>0.31</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Correlations between Health measures and Census Clusters
Conclusions

• Geographic analysis can help identify neighborhoods with high rates of Chronic illness.

• Behavioral, demographic, and physical characteristics of neighborhoods are associated with the health and health behavior of its residents.

• Census data may be useful in identifying areas where the residents face excess risk of chronic disease.

• More research is needed to understand cause and effect relationships between neighborhood characteristics, health behaviors, and health outcomes.
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