Health Data Visualization
With Ring Maps

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“Maps are the workbench on which ideas are fashioned in a manner that permits them to be argued and, often, tested.” ---- Tom Koch
Ring Mapping

South Carolina Population Diversity, Percent Medicaid Low Birth Weight Babies and Percent Women of Childbearing Age with Hispanic Ethnicity

Ring Key
- Outer Ring: 2017 Diversity Index, 2012 Diversity Index
- Inner Ring: Medicaid Low Birth Weight Babies

Quartile Ranking
- Low
- Medium Low
- Medium High
- High

% Hispanic Women
- Low – Medium
- High

County Indicator Ranges
- Percent Hispanic Women (Low-Medium 1-6, High 6-15)
- Percent Medicaid Low Birth Weight Babies (12.8 to 40.7)
- 2012 Diversity Index (27.6 to 69.8)
- 2017 Diversity Index (32.3 to 71.7)

Notes:
-
Percent Hispanic Women of Childbearing Age is the percent of the total estimated female population ages 15 to 44 with Hispanic ethnicity.

The Diversity Index is based on ESRI analysis and projections which represent the likelihood that two persons, chosen at random from the same area, belong to different race or ethnic groups (3 represents no diversity and 500 represents complete diversity).

A Ring Map…
shows geospatially referenced data in multiple rings around a base map of interest.
Ring Mapping Introduced: 
*ArcUser*, Winter 2008

**Advantages**

- Multivariate data visualization
- Nominal, ordinal, interval, and ratio data
- Temporal and non-temporal data
- Single, visually engaging graphic
Python Tool to Generate Ring Maps: ArcUser Fall 2013

• Generates simple ring maps
• Potential bias: symbolization units are larger in outer ring compared to inner ring—i.e., there is unequal graphic representation of variables
Ring Map Applications in Population Health Research

- Socioeconomic context of HIV/AIDS (Lòpez-De Fede, et al., 2011)
- Diabetes and the socioeconomic and built environment (Stewart, et al., 2011)
- Risk of developing diabetes (Noble, et al., 2012)
- Dengue vector analysis (Sarfranz, et al., 2012)
- Geovisualization of multidimensional cardiovascular disease data (Zhao, et al., 2013)
Ring Mapping
at the USC Institute for Families in Society
Division of Medicaid Policy Research (MPR)

- Custom JavaScript generates rings
- Base map created using ArcGIS
- Ring map graphic components integrated using Adobe Illustrator
MPR Custom Script Options

• # of Geospatial Units (e.g., counties, states) represented in Rings
• # of Rings
• Ring spacing
• Color
MPR Ring Map Applications to...

- Identify High Risk/High Need Areas and Populations
- Evaluate Health Care Provider Accessibility
- Evaluate Health Care Quality
- Inform State and Local Health Services Planning and Policy
Highlighting Health Disparities

Diagnosis Rate of HIV/AIDS in South Carolina Counties by Race and Gender

Diagnosis Rate (Cases per 100,000)

- < 11.0
- 11.0 to 13.9
- 14.0 to 22.9
- 23.0 to 44.0
- > 44.1
- No Data

Ring Key

Outer Ring
- African American
- White

Inner Ring
- Male
- Female

Total Population

Base map serves solely as a locator map
Identifying County-Level Chronic Disease Burden

Prevalence of Top 5 Statewide Chronic Conditions Among Adult Medicaid Recipients by County, FY 2014.

Ring Key
- Outer Ring: COPD, Obesity, CVD, Diabetes, Hypertension
- Inner Ring:其余条件

Quartile Ranking
- Low
- Medium Low
- Medium High
- High
- County in Highest 2 Quartiles For All 5 Conditions

Statewide Prevalence (per 1,000)
- Hypertension: 202.1 (County Range = 132.7 to 354.8)
- Diabetes: 194.5 (County Range = 75.5 to 231.2)
- CVD: 75.6 (County Range = 48.3 to 130.8)
- Obesity: 63.6 (County Range = 31.4 to 89.9)
- COPD: 59.1 (County Range = 31.4 to 106.2)

Notes:
- Data: SC MINES, FY 2014 (June 2014 as of September 2014).
- Adult Medicaid recipients include those aged 19 or older.
- Created by the University of South Carolina, Institute for Families in Society, Division of Medicaid Policy-Research. October 2014.

Base map serves as a locator map and summarizes data shown in rings.
Assessing Health Care Provider Accessibility

Base map serves as a locator map, presents data not shown in rings, and summarizes data from both base map and rings.
Assessing Health Care Provider Accessibility

Number of Medicaid Licensed Independent Practitioners (LIPs) in South Carolina by Specialty by County
Also Showing Highest County Quartile: Prevalence Of Any Select Child Behavioral Condition

Notes:
- Statewide LIP Specialty Class Summary
  - Psychologists = 52
  - LMFTs = 144
  - Licensed Independent Social Workers (LISWs) = 122
  - Licensed Marriage and Family Therapists (LMFTs) = 13
  - Licensed Professional Counselors (LPCs) = 253

Date: SC MMS Directory of Enrolled LIPs, September 2013; SC MMS June 2012.
* Select conditions include ADHD, Autism, and Depression.
Evaluating Health Service Utilization
Evaluating Health Care Quality

Selected South Carolina Medicaid HEDIS Measures:
Well-Child Visits in the First 15 Months of Life,
Well-Child Visits in 3 - 6 Years of Life, and
Well-Care Visits for Adolescents

Ring Key
- Outer Ring: Well-Care: Adolescents (AWC)
- Inner Ring: Well-Child: 3 - 6 Years (W34)
- Inner Ring: Well-Child: First 15 Months (W15)

Tertile Ranking
- Low
- Medium
- High
- County in Lowest Tertile in All Three HEDIS Measures

County Indicator Ranges (%)

<table>
<thead>
<tr>
<th></th>
<th>W15</th>
<th>W34</th>
<th>AWC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>92.5 - 96.0</td>
<td>41.7 - 49.6</td>
<td>57.3 - 67.8</td>
</tr>
<tr>
<td>Medium</td>
<td>97.0 - 97.7</td>
<td>49.7 - 54.4</td>
<td>27.2 - 31.0</td>
</tr>
<tr>
<td>High</td>
<td>97.8 - 100</td>
<td>54.5 - 63.3</td>
<td>31.2 - 40.5</td>
</tr>
</tbody>
</table>

Notes:
Well-Child Visits in the First Fifteen Months of Life:
The percentage of Medicaid Recipients who turned 15 months old during the measurement year and who had at least one Well-Child visit with a Primary Care Provider.
Well-Child Visits in the Third, Fourth, Fifth and Sixth Years of Life:
The percentage of Medicaid Recipients 3 - 6 years of age who had one or more Well-Child visits with a Primary Care Provider.
Adolescent Well-Care Visits:
The percentage of Medicaid Recipients 12 - 21 years of age who had at least one comprehensive Well-Care visit with a Primary Care Provider or an OB/GYN practitioner during the measurement year.
Data: SC SMB, CY 2014/15 Census Bureau 2010,
Created by the University of South Carolina,
Institute for Families in Society, Division of
Medicaid Policy Research, April 2015.
Exploring Social Determinants of Health

Prevalence of Diabetes Among Adult Medicaid Recipients In South Carolina
And Related Socioeconomic Contextual Factors by County

Ring Key
- Outer Ring:
  - Percent Spent on Sweet Snacks
  - Percent Spent on Fast Food

- Inner Ring:
  - Convenience Stores Per 10,000 Residents
  - Percent Household Income < $15,000
  - Percent Unemployed

Basemap:
- Low
- Medium
- High
- County in Highest Tertile in At Least 4 of 5 Contextual Indicator Ranges

Tertile Ranking
- Low
- Medium
- High

County Indicator Ranges
1. Spending on Sweet Snacks as a Percent of Total Spending on Food At Home:
   - Low: 1.7% to 3.0%
   - Medium: 3.1% to 5.0%
   - High: 5.1% to 4.3%

2. Fast Food Spending as a Percent of Total Spending on Food Away From Home:
   - Low: 45.1% to 45.8%
   - Medium: 50.1% to 50.7%
   - High: 50.8% to 41.5%

3. Convenience Stores Per 10,000 Residents:
   - Low: 1.1 to 3.3
   - Medium: 3.4 to 4.3
   - High: 4.4 to 9.2

4. Percent of Households with Income < $15,000:
   - Low: 9.9% to 13.8%
   - Medium: 13.9% to 16.3%
   - High: 16.4% to 22.3%

5. Percent Unemployed:
   - Low: 3.7% to 6.6%
   - Medium: 6.7% to 7.7%
   - High: 7.8% to 12.3%

6. Prevalence of Diabetes Per 1,000 Medicaid Recipients Ages 19 and Older:
   - Low: 778 to 1096
   - Medium: 1097.5 to 1471.1
   - High: 1472.2 to 2206.5

Visualizing the Health of the Nation: U.S. Ring Map Examples
Self-Reported Hypertension Among U.S. Adults
And Related Socioeconomic Contextual Factors by State

Created by the University of South Carolina, Institute for Families in Society, Division of Medicaid Policy Research, June 2015.
Self-Reported Fair or Poor Health Among U.S. Adults
And Related Behavioral/Socioeconomic Contextual Factors by State

Created by the University of South Carolina, Institute for Families in Society, Division of Medicaid Policy Research, June 2015.
Ring Mapping Caveats

• Legibility limits
  – Number of geospatial units represented in rings
  – Number of rings

• Geospatial topology diminished or lost in rings

• Irregularly shaped base geography may require elliptical or other ring configuration
Questions?

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