Integrating ACS Data into a Population Health Profiler to Improve Clinical Practice

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American Academy of Family Physicians
American Community Survey Data Users Group
2019 DATA USERS CONFERENCE
Chronic Disease Management

• Six in ten Americans live with at least one chronic disease
• Chronic diseases are the leading causes of death and disability in the U.S., and are a leading driver of health care costs¹
• Chronic Disease Management (CDM) is ongoing care and support for individuals with a chronic health condition, which has pieces at several levels:
  – Patient
  – Provider panel
  – Practice
  – Population

¹ https://www.cdc.gov/chronicdisease/index.htm
Social Determinants of Health and Chronic Disease

• The close association between chronic disease and patients’ social determinants of health (SDOH) adds to the complexity of treating and preventing these disorders
• SDOH are the conditions in which we are born, grow, live, work, and age

3 http://www.who.int/social_determinants/en/

Taking SDOH Into Consideration

Public Law
114th Congress

To amend title XVIII of the Social Security Act, Social Security Amendments of 1965, to increase the growth rate of the Medicare Program, and for other purposes.

Be it enacted by the United States Congress:

SECTION 1. Short title.

(a) Title XVIII Access and Coverage Act.
(b) Title XVIII Expansion and Enhancement Act.

SECTION 2. Increase in the growth rate.

Payment reform is the process of changing the current, predominantly volume-based payment system to alternative payment models (APMs) that more closely link provider and health system payments to outcomes, and align financial incentives with providing value.
Capturing SDOH in EHRs

IOM/NAM SDOH Domains

Domains include:
- Sexual Orientation
- Race/Ethnicity
- Country of Origin
- Education
- Employment
- Financial Resource Strain (Food and Housing Insecurity)
- Health Literacy
- Stress
- Negative Mood and Affect (Depression and Anxiety)
- Psychological Assets
- Dietary Patterns
- Physical Activity
- Tobacco Use and Exposure
- Alcohol Use
- Social Connections and Social Isolation
- Exposure to Violence
- Neighborhoods/Community Compositional Characteristics
SDOH Data Source?

- IOM/NAM suggests collecting individual level SDOH and supplementing with neighborhood characteristics
  - Will patients provide honest answers to these questions?
  - How good will the data be if the questions are not consistently asked the same way?
  - How good will the data be if we use different methods (PRAPARE, Minnesota, AAFP?)
  - Will the quality of the data collected via this extra data burden outweigh what can already be found in community level data?
Integrating SDOH into Primary Care

Small Area Estimation - Background

• Local level health data typically not available through national surveys
• Demand for public health data for small geographies is on the rise
• Small areas - Estimates from national surveys
  o large variance
  o not reliable
  o privacy and confidentiality issues
• Therefore, Small Area Estimation (SAE) is the key to develop local area level health measures
Small Area Estimation - Background

SAE methods can be broadly classified into

• Design-based – design-based distribution
• **Model-based** – estimation solely depends on the model specified
• Multilevel regression and poststratification (MRP) is a model-based SAE
• CDC researchers developed MRP to estimate census tract level health measures for 500 cities
• HealthLandscape and the Robert Graham Center - ZCTA level prevalence of select chronic diseases and health behaviors
### Small Area Estimation – Data Sources

<table>
<thead>
<tr>
<th>Variable Type</th>
<th>Data Source</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome</td>
<td>BRFSS/National database</td>
<td>Health Behavior/Chronic Disease</td>
</tr>
<tr>
<td>Independent</td>
<td>BRFSS/National database</td>
<td>Age (13 groups)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sex (male, female)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Race/Ethnicity (8 categories)</td>
</tr>
<tr>
<td>ACS</td>
<td>County level – Percent population &lt;150% FPL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tract level – Percent population &lt;150% FPL</td>
<td></td>
</tr>
<tr>
<td>Census 2010</td>
<td>Block level population (for each of the 208 combinations)</td>
<td></td>
</tr>
</tbody>
</table>

## Small Area Estimation - Measures

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Race/Ethnicity</th>
<th>Poverty</th>
<th>County</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-24</td>
<td>Male</td>
<td>NH, White</td>
<td>County level &lt;150% FPL</td>
<td>Sampled</td>
<td>Sampled</td>
</tr>
<tr>
<td>25-29</td>
<td>Female</td>
<td>NH, Black</td>
<td>Census Tract &lt;150% FPL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td></td>
<td>American Indian/Alaska Native</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td></td>
<td>Asian</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td></td>
<td>Native Hawaiian /Pacific Islander</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td></td>
<td>Other, Single Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-54</td>
<td></td>
<td>Two or More Races</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55-59</td>
<td></td>
<td>Hispanic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60-64</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>65-69</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>70-74</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>75-79</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80+</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Small Area Estimation - Methodology

- Multilevel Regression Model
- Bayesian Smoothing & Merge ACS/Census data and beta coefficients
- Post-Stratification and Monte Carlo Simulation

Small Area Estimation - Methodology

First Step

• Multilevel logistic regression models for each outcome - 13 categories of age, sex, 8 groups race/ethnicity and county level poverty (<150% FPL)
• Used SAS Proc GLIMMIX
• Fixed effects for age, sex, race/ethnicity and county level poverty
• County and state random effects

Equation

\[ p_{ijkcs}^{b}(y_{ijkcs} = 1) = \frac{\exp(\alpha_i + \beta_j + \gamma_k + x'_b\eta + \mu_c + v_s)}{1 + \exp(\alpha_i + \beta_j + \gamma_k + x'_b\eta + \mu_c + v_s)} \]

<table>
<thead>
<tr>
<th>Level</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>State</td>
<td>$S$</td>
</tr>
<tr>
<td>County</td>
<td>$c$</td>
</tr>
<tr>
<td>Person</td>
<td>$$ Poverty  $b$</td>
</tr>
<tr>
<td>Age</td>
<td>$i$</td>
</tr>
<tr>
<td>Gender</td>
<td>$j$</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>$k$</td>
</tr>
</tbody>
</table>

Small Area Estimation - Methodology

Second Step
• Bayesian Spatial Smoothing with adjacent county random effects for counties not sampled in BRFSS
• Merged this dataset with census tract level poverty (<150% FPL) and Census block level population for each of the 208 age, sex and race combinations

Third Step
• Solved the regression equation
• Post-stratification with census demographics
• Monte Carlo simulations (1000) Model-based
Validated against survey-based estimates (correlations)

Small Area Estimation - Purpose

• public health prevention program planning
• resource allocation
• health policy formulation
• health care decision-making and delivery
Small Area Estimation - Limitations

• Geographic context – is critical to evaluate the relationship between the health outcomes and demographic characteristics
• Area-level poverty indicator used and not the individual-level poverty
• Different independent variables may need to be included in the multilevel models to estimate different health outcomes
• Cannot track trends
• Cannot evaluate the effectiveness of intervention unless intervention variables included in the source survey
References


About HealthLandscape

• HealthLandscape develops, administers, and markets geospatial analysis software tools and professional services
• HealthLandscape is a division of the American Academy of Family Physicians (AAFP)
• HealthLandscape is an interdisciplinary, closely-knit team with extensive experience in GIS applications relating to health centers and primary care
About the Community Vital Signs Application Suite

• While the research value of appending community characteristics to the clinical record is well established in academic literature, it’s equally important to be able to summarize this information in a practical and actionable way that can be integrated into clinical practice.

• The Community Vital Signs℠ application suite aligns with HealthLandscape’s goal of advancing the science of integrating social determinants of health (SDoH) into clinical practice.

• **This Population Health Profiler, part of the Community Vital Signs℠ application suite, is designed to demonstrate the ease of using SDoH for health and well-being.**
CVS Population Health Profiler Overview

Access via the HealthLandscape website:
https://www.healthlandscape.org/PopHealthProfiler/

- The welcome screen lists all the tools available on the site
CVS Population Health Profiler Welcome Screen

When you open the tool, a welcome screen appears and includes:

- Getting started instructions
- Downloadable sample data
- Detailed “How to Use” instructions
- Background information
Upload Your Data

• Upload patient counts by ZIP Code using file as shown
• CVS Population Health Profiler will convert data to ZIP Code Tabulation Area (ZCTA) and display a service area based on user data
• Dataset must include at least two columns, left-most in the spreadsheet, titled ZIP and PatientCount
  – Column headers should not have spaces
  – If there are other columns, those data will be ignored
Upload File

Drag and drop or browse to select your dataset
**View Data**

- The ZIP Codes have been converted to ZCTAs
  - A ZCTA with fewer than 10 patients will NOT be shown
  - ZIP without a direct ZCTA match will be collapsed into the ZCTA that best matches the ZIP Code location

- Data table will be displayed
- Map will zoom to area and service area will be displayed
- ZCTAs with any pink/red color are within the entire service area (100%)
- ZCTAs with diagonal lines comprise the core service area (70%)
- By default, pink/red represent patient count in each ZCTA
Change Theme

- Theme refers to the data layer that is initially colored pink/red

- Click the down arrow in the Select Your Theme box to view social determinants of health or other data for your patient service area
Adjust Service Area

- Service area is initially based on a 70% core calculation
  - All ZCTAs are ranked based on number of patients
  - ZCTAs are added to the service area starting at the top of the list with the ZCTA that has the most patients
  - ZCTAs are then added until 70% of patients are accounted for

- Use the slider to adjust service area size
Change the Way the Map Looks

- The **Style** tab options allow you to change the way the data are displayed and include:
  - Color Scheme - change based on the type of data (default is quantitative)
  - Categories - change the number of data breaks (default is 5)
  - Distribution - change how the data are broken into categories (default is natural breaks)
  - Threshold - remove ZCTAs from the map based on upper or lower limits of the dataset (default is entire dataset)
  - Palette - change the colors on the map (default is pink/red)

- Changes are reflected on the map and in the key in the lower portion of the tool.
Tooltips

- Click on a ZCTA to see a box, or tooltip, with information about the ZCTA
- Click on the Pop-Ups tab to specify the information that appears in the tooltip
Optional Layers

- Click on the bottom icon (looks like a stack of cards) to add other layers to the map.
  - Options include ZIP Code Tabulation Areas, other boundaries, and other health facilities.

- Click the eye icon to add labels to any layer.
Data Table

- All available data can be downloaded in table form
- To access the file, click the round button in the upper right corner of the map
- Then, click the word Table near the top of the pop-up box
- When data table appears, click Download CSV in the upper left of the table to download the data
Population Health Profile

- Click the blue **Create Population Health Profile** button on the left of the map to print the map and data table.

- Edit the title in the map header, if desired.

- Add notes below the map, if desired.

- Click the printer icon to export a community profile PDF.
Population Health Profile
Questions or Comments?

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• www.HealthLandscape.org/PopHealthProfiler