Feasibility of Using Geocoded Electronic Health Records for Community Health Assessment

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Aim

Location data stored in electronic health records (EHRs) provide the opportunity to identify health disparities with geographic specificity and to target public health interventions to the most at-risk communities. Our aim is to use geospatially-enabled EHRs to develop and validate community health measures at geographic levels smaller than county.

Methods

Identification and Prioritization of Potential Community Health Measures

- We compiled a preliminary list of potential community measures using indicator definitions similar to HEDIS (Healthcare Effectiveness Data and Information Set). HEDIS measures are widely used by health care providers for performance measurement. However, they typically are not reported by geographic area.
- Public health stakeholders at the Marion County Public Health Department appended the list of potential to include other desired measures.
- We measured the perceived usefulness of the potential measures via a survey of Indiana public health professionals.

Feasibility Assessment

We evaluated the feasibility of generating each potential community measure based on:

1. Likelihood of electronic capture in an EHR system,
2. Availability within an information system accessible to public health,
3. Percent health care providers contributing data (indicating potential to represent population health based on proportion of health care providers contributing related data),
4. Disease prevalence (indicating potential statistical stability at small geographic scales) , and
5. Highest degree of geographic granularity available (enabling use at small scales).

Evaluation of the Representativeness of the EHR Data

- For a three-year period (2011-2013), we identified all unique patients in Marion County, Indiana whose records were captured in the Indiana Network for Patient Care (INPC).
- We calculated and mapped the ratio of unique INPC patients to total 2010 census population at the census tract level.

Results

We received survey responses from a cross-section of professionals in the public health field (See: ***Figure 1**: Organization Type of Respondents* and ***Table 1**: Public Health Role(s) of Respondents).*

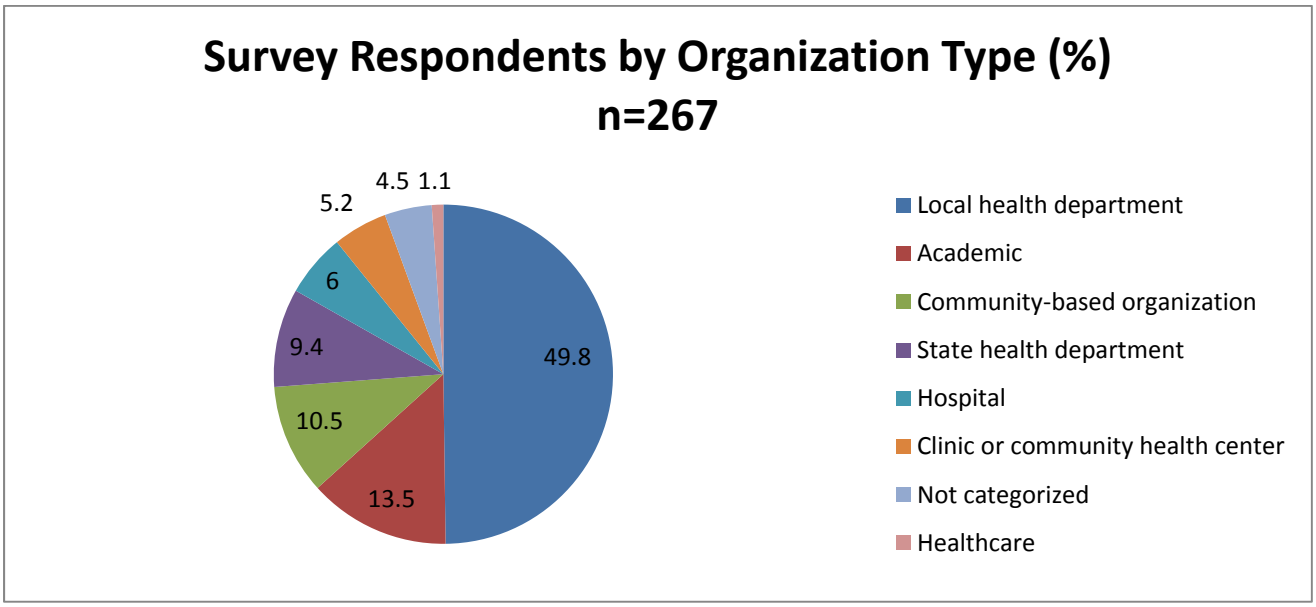

***Figure 1:** Organization Type of Survey Respondents*

As shown in Table 1, the most common public health roles of survey respondents were health communication/education and senior administration. Environmental health and epidemiology/data analysis were also well represented roles.

Percent range	Public Health Role (% Respondents), n=209
30-40%	Health communication/education (36.8%) Senior administration/executive (33%)
15-25%	Environmental health (22.5%) Epidemiological analysis/data analysis/statistics (18.2%)
7-10%	Community benefit (10%) Public health nursing (9.1%) Vital records (7.2%) Management (7.2%) Vital records (7.2%)
<5%	Social work (4.3%), Research (3.8%), Marketing (3.3%), Admin support (2.9%), Med Technology (1.9%), Physician (1.4%), Geographic information analysis (1.4%)

***Table 1:** Public Health Role(s) of Survey Respondents*

Prioritization of Potential Community Health Measures

One hundred eighty six (186) respondents scaled the potential community health measures from "Very useful" to "Not at all useful". Associated scores were applied as follows: Very useful = 4; Somewhat useful = 2; Not very useful = 1; Not at all useful = 0

Based on the average score of each measure, we prioritized the preliminary list of twenty-four (24) potential community health measures into four tiers (see ***Table 2****: Prioritization of Potential Community Health Measures based on Average Usefulness Score*).

Average Usefulness Score n=209	**Potential Community Health Measure**
Tier 1: Most Useful 2.4 – 2.6	– Prevalence of diabetes – Prevalence of hypertension and other common cardiovascular diseases – Prevalence of substance abuse – Prevalence of asthma and chronic obstructive pulmonary disease – Vaccination coverage for school age children – Flu vaccination coverage
Tier 2: More Useful 2.0 – 2.3	– Hemoglobin A1c testing for patients with diabetes – Cholesterol screening for patients with cardiovascular conditions – Breast cancer screening – Incidence of various cancers – Prevalence of depression – Incidence of chlamydia, gonorrhea, and syphilis – HIV screening – Prevalence of hepatitis B and/or hepatitis C – HPV vaccination coverage – Evidence of violence/trauma (e.g., domestic violence)
Tier 3: Less Useful 1.5 – 1.9	– Hemoglobin A1c controlled at <8% for patients with diabetes – Emergency room utilization for people with asthma – Cholesterol levels < 100 mg/dL for patients with cardiovascular conditions – Chlamydia screening
Tier 4: Least Useful 1.3 – 1.4	– Prevalence of asthma among those with attention deficit hyperactivity disorder / impact of co-morbidity on emergency department visits – Emergency room utilization by people with dental pain/infections – Prevalence of dental caries

Table 2: *Prioritization of Potential Community Health Measures based on Average Usefulness Score*

Some respondents (n=69) identified additional community measures needed by public health professionals. Most of these were in the categories of built environment/community resources, access to care, health behaviors, health outcomes, or mental health. Measures of socio-economic condition, maternal child health, and obesity were also suggested.

While seventy-five percent (75%, 201/269) reported using or working with community health data, sixty-three percent (63%) of respondents either do not have access to sub-county measures of community health (99/211) or were unsure of whether they had access to such measures (33/211). Of those reporting access to and use of sub-county statistics (n=69), the most frequent uses were community health needs assessment, targeting of interventions, identification of high-risk groups, and identification of disparities. See: ***Table 3****: Reported Use of Sub-County Measures*.

Percent range	Reported Use of Sub-County Data n=69
55-70%	For community health needs assessment (65.7%) To target interventions to appropriate populations (64.3%) To identify high-risk groups (61.4%) To identify disparities (58.6%)
40-50%	For health improvement planning (47.1%) For program evaluation (42.9%)
25-30%	For improvement of routine public health functions (28.6%)
<6%	Do not use available sub-county data (5.7%)

Table 3: *Reported Use of Sub-County Data*

Feasibility of Community Health Measures

We deemed all fourteen of the proposed HEDIS-based measures and six of ten additional measures requested by our public health partners as feasible (See ***Table 4****: Feasibility Matrix,* on following page). All proposed measures met the criteria for geographic granularity, with geographic (X,Y) coordinates and block IDs available. These spatial attributes are generated on a daily basis for all clinical records entering and stored in INPC using a secure geocoding service that uses street address as the input location data. The more limiting criteria were electronic capture and percentage of HCPs contributing related data.

Proposed Community Health Measure	Feasibility Decision	1. Likelihood of Electronic Capture	2. System Accessibility	3. % Providers Contributing Data	4. Geographic granularity	5. Prevalence
	Based on Items 1-5	10 (very likely) – 1 (very unlikely)	10 (very likely) – 1 (very unlikely)	% of INPC providers	10 (very granular) – 1 (no granularity)	per 1000, in Marion County, IN
Tier 1 - Most Useful						
Prevalence of diabetes*	Yes	10	9	85%	10	93
Prevalence of hypertension and other common cardiovascular diseases*	Yes	10	9	85%	10	319
Prevalence of substance abuse	Maybe	7	5	60%	10	
Prevalence of asthma and COPD*	Yes	10	9	85%	10	91
Vaccination coverage for school age children	Maybe	7	5	60%	10	
Flu vaccination coverage	No	7	5	30%	10	341
Tier 2 – More Useful						
Prevalence of depression*	Yes	10	9	85%	10	138
Prevalence of chlamydia, gonorrhea, and syphilis*	Yes	10	10	90%	10	10.7, 3.5, 0.2
Prevalence of various cancers*	Yes	10	7	85%	10	49.1
Breast cancer screening*	Yes	10	7	75%	10	721.8
Colorectal cancer screening*	Yes	10	5	50%	10	565.2
HbA1c testing for patients with diabetes*	Yes	10	10	95%	10	
LDL-C screening for patients with cardiovascular conditions*	Yes	10	9	95%	10	
HIV screening	Yes	10	10	90%	10	
HPV vaccination coverage	No	7	3	10%	10	97.2(M)/384.3(F)
Prevalence of viral hepatitis – HBV and (especially) HCV	Yes	10	10	95%	10	
Evidence of violence/trauma (e.g., domestic violence)	No	3	3	60%	11.5	11.5
Tier 3 – Less Useful						
LDL-C Levels < 100 mg/dL for patients with cardiovascular conditions*	Yes	10	9	95%	10	
Emergency room utilization for people with asthma*	Yes	10	10	95%	10	48.8
HbA1c controlled at <8% for patients with diabetes *	Yes	10	10	95%	10	
Chlamydia screening *	Yes	10	10	90%	10	
Tier 4 - Least Useful						
Prevalence of dental caries	Maybe	10	7	40%	10	
Prevalence of asthma among those with ADHD; impact on ED visits	Maybe	5	6	85%	10	
Emergency room utilization by people with dental pain/infections	Yes	7	7	95%	10	

**HEDIS measure*

Table 4: *Feasibility Matrix*

Validation of the Representativeness of the EHR Patient Population Using Spatial Attributes

The ratio of unique EHR patients to 2010 total population is not consistent across Marion County census tracts, but rather demonstrates a geographic pattern, with the lowest ratios occurring in the northern portion of the county and the highest ratios in the central part of the county. See ***Figure 2****: Ratio of INPC Patients to Total Population for Marion County Census Tracts*.

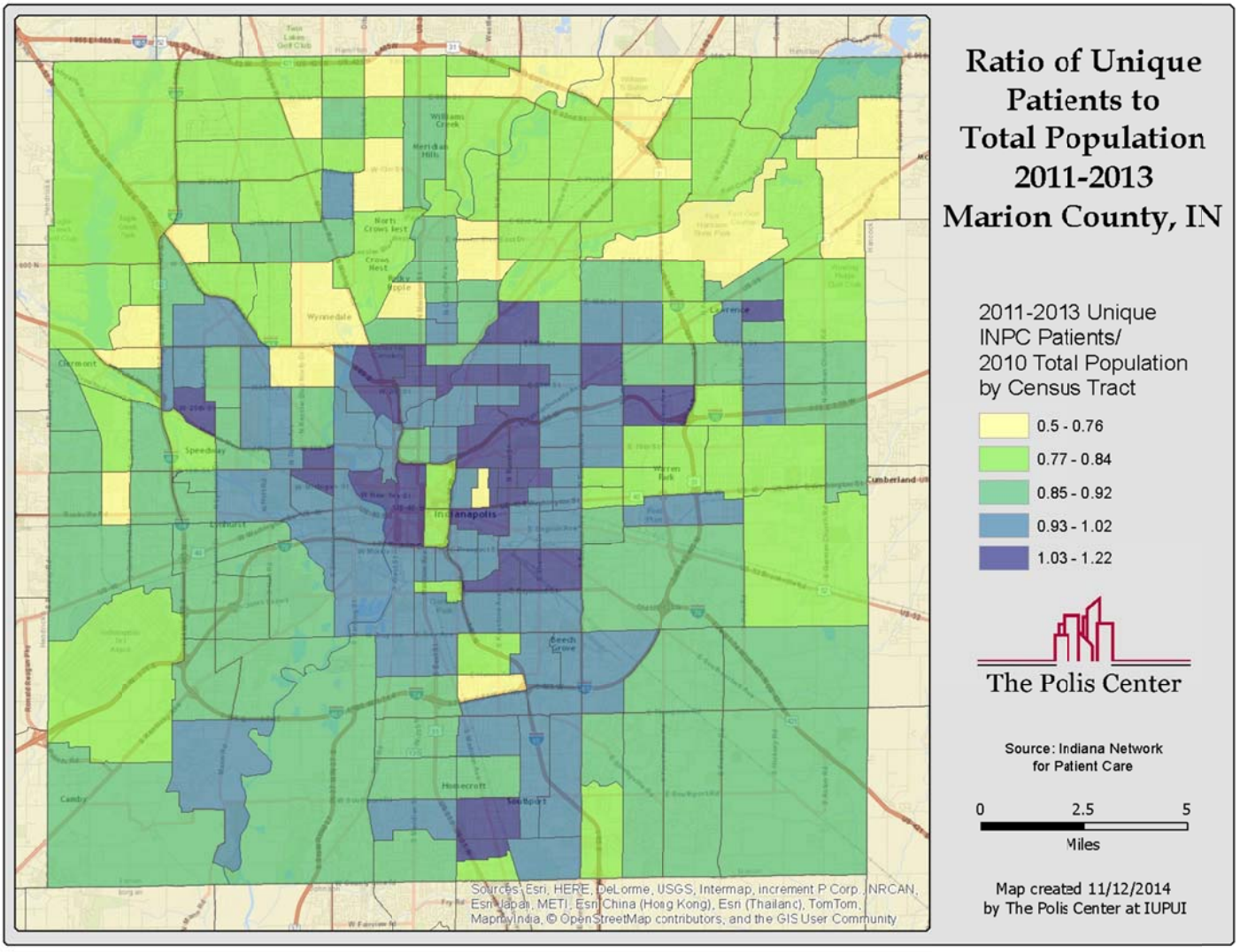

Figure 2: *Ratio of INPC Patients to Total Population for Marion County Census Tracts*

Discussion

Of the six measures determined to be the most useful to the public health community, we deemed three to be very likely feasible:

1. prevalence of diabetes,
2. prevalence of hypertension and other common cardiovascular diseases, and
3. prevalence of substance abuse.

EHRs appear to be geographically-biased. Further investigation is needed to determine the cause for this. Potential explanations for the apparent bias include:

1. Areas where residents have relatively short housing tenures will appear to have more people, since the patient counts from clinical data include data from spans of time during which several families might move in and out of a single address.

2. Lower patient counts may tend to occur in areas where residents are more likely to use healthcare providers whose data is less completely captured in an EHR.

3. In our study area, the EHR system has good capture of data from systems serving the uninsured and people with Medicaid, but has less complete outpatient data from those with private insurance.

4. Some residential addresses are associated with a central delivery location among scattered residences, as may happen with trailer parks and large apartment complexes, and as such can be incorrectly assigned to census geographies.

Next Steps

- Investigation of possible factors not related to health that are affecting patient counts.
- Exploration of whether the same pattern of patient ratios exist at other levels of geographic specificity, such as ZIP code and political boundaries.
- Development of adjustment factors to account for non-health factors affecting patient counts.
- Prototype measure development of the feasible, higher priority measures.

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Project Partners

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