Characterization of patterns of social determinants of health and health outcomes using area-based socioeconomic measures

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BACKGROUND

- Health care "hotspotting" is the strategic use of data to reallocate resources to a small subset of high-needs, high-cost patients through multi-dsiciplinary, coordinated care
- Enhancing care coordination across communities is necessary to improve population health and reduce costs.
- Health outcomes such as premature mortality among others are more strongly associated with geographical location than with health care access and genetics.
- Health disparities also vary geographically.
- Understanding these patterns is critical to designing effective solutions to improve community health.

RESEARCH QUESTION

- What is the relationship between social, economic, and geographic factors, healthcare utilization, and healthcare outcomes among the communities of Abbott Northwestern Hospital (ANWH), Minneapolis, MN patients?

HYPOTHESIS

- Healthcare outcomes will vary according to the geographic location of patients' residences.

OBJECTIVES

- Create geocoded maps to visualize and study the health challenges prevalent among the communities of ANWH patients
- Explore associations between the geographic location of patients and population-level social and economic indicators that are known to contribute to health outcomes.
- Use the geocoded maps to identify and address location specific challenges that serve as the root cause of healthcare disparities.

LONG TERM GOALS

- Improve health outcomes of ANWH patients in local communities
- Reduce needless hospital utilization and associated costs

METHODS

Study Design

- Retrospective observational study
- **Inclusion criteria:** consenting adults ≥ 18 years old who had at least one inpatient or Emergency Department (ED) visit to ANWH during July 1, 2015 – July 1, 2017
- **Exclusion criteria:** non-consenting adults ≥ 18 years old, individuals < 18 years old
- Studied electronic health record (EHR) data from ~ 180,000 adult patients
- ANWH patient addresses were standardized to match US Postal Service address file formatting, and then input into ArcGIS software to obtain corresponding latitude and longitude coordinates.
- Geocoded data were linked to patient-level and location-based exposure and outcome data collected by the U.S. Census Bureau, the National Center for Health Statistics, and the Minnesota Department of Health, and Allina Health's EHR.
- Geographic locations were categorized into census units (block groups)
- Geographic "hot spots" were identified to understand the landscape of health across patients' communities.
- A series of maps were created that visualized the association between EHR data and US Census data
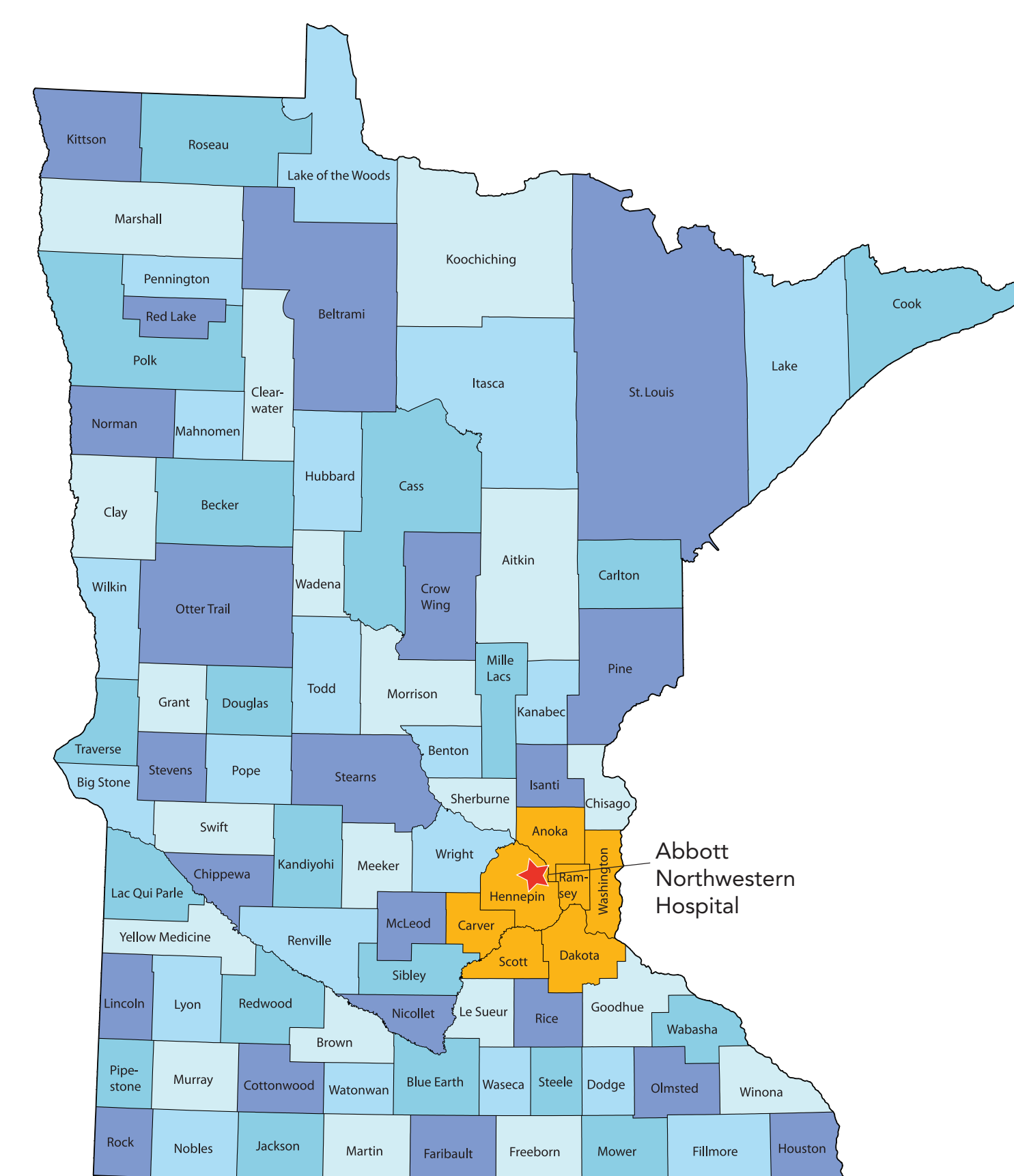- Analytic epidemiologic analyses will be performed on the collected data

RESULTS

- Of the 80,665 ANWH patients included in the study, 76,930 lived in Minnesota and data from 74,053 patients were geocoded for analysis
- Baseline characteristics of the ANWH patients whose data were geocoded included age, gender, race, ethnicity, preferred language, marital status, and insurance status **(Table 1)**
- The majority of ANWH patients (46,344 patients, 60.2%) had street addresses in the seven-county Twin Cities metro region **(Figure 1)**
- In the Twin Cities metro region, census units with ≥ 75 ANWH patients who had at least one inpatient or ED visit were geographically located closer to ANWH than those census units with ≤ 25 ANWH patients/census unit **(Figure 2)**
- ANWH patients with the lowest per household income or highest percent poverty per block group (> 19% poverty) lived in counties surrounding ANWH **(Figure 3)**

Table 1. Baseline characteristics of ANWH patients living in Minnesota with addresses that were geocoded, n = 74,053

Variable	Factor	Frequency	Percent
Age (years)	18 - 39	29,090	39.3
	40 - 64	24,298	32.8
	65 - 75+	20,665	27.9
Sex	Male	29,591	40.0
	Female	44,432	60.0
Race	American Indian or Alaska Native	1,801	2.4
	Asian	1,627	2.2
	Black or African American	14,448	19.5
	Native Hawaiian or Other Pacific Islander	190	0.3
	White	54,595	73.7
Ethnicity	Hispanic	2,648	3.6
Primary Language	English	69,324	93.6
	Somali	2,711	3.7
	Spanish	939	1.3
	Arabic	71	0.1
	Others	975	1.3
Marital Status	Single	3,8978	52.6
	Married/Partner	34,817	47.0
Insurance	Private	19,376	26.2
	Public	25,243	34.1
	Missing	29,434	39.7

Figure 1. Geographic locations of residences of the majority of Abbott Northwestern Hospital (ANWH) patients and hospital location in Minnesota

Anoka County	Ramsey County
Carver County	Scott County
Dakota County	Washington
Hennepin County	County

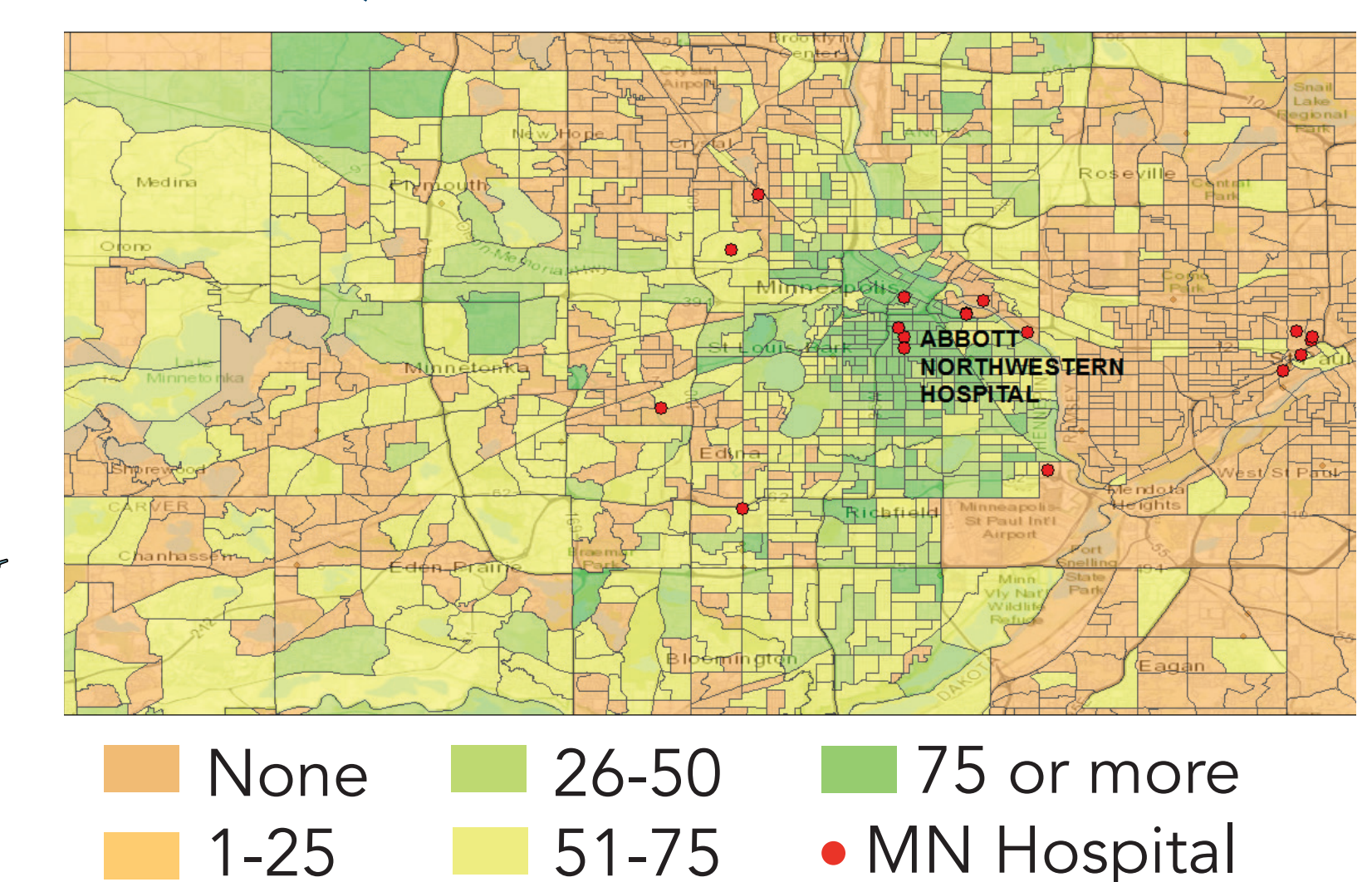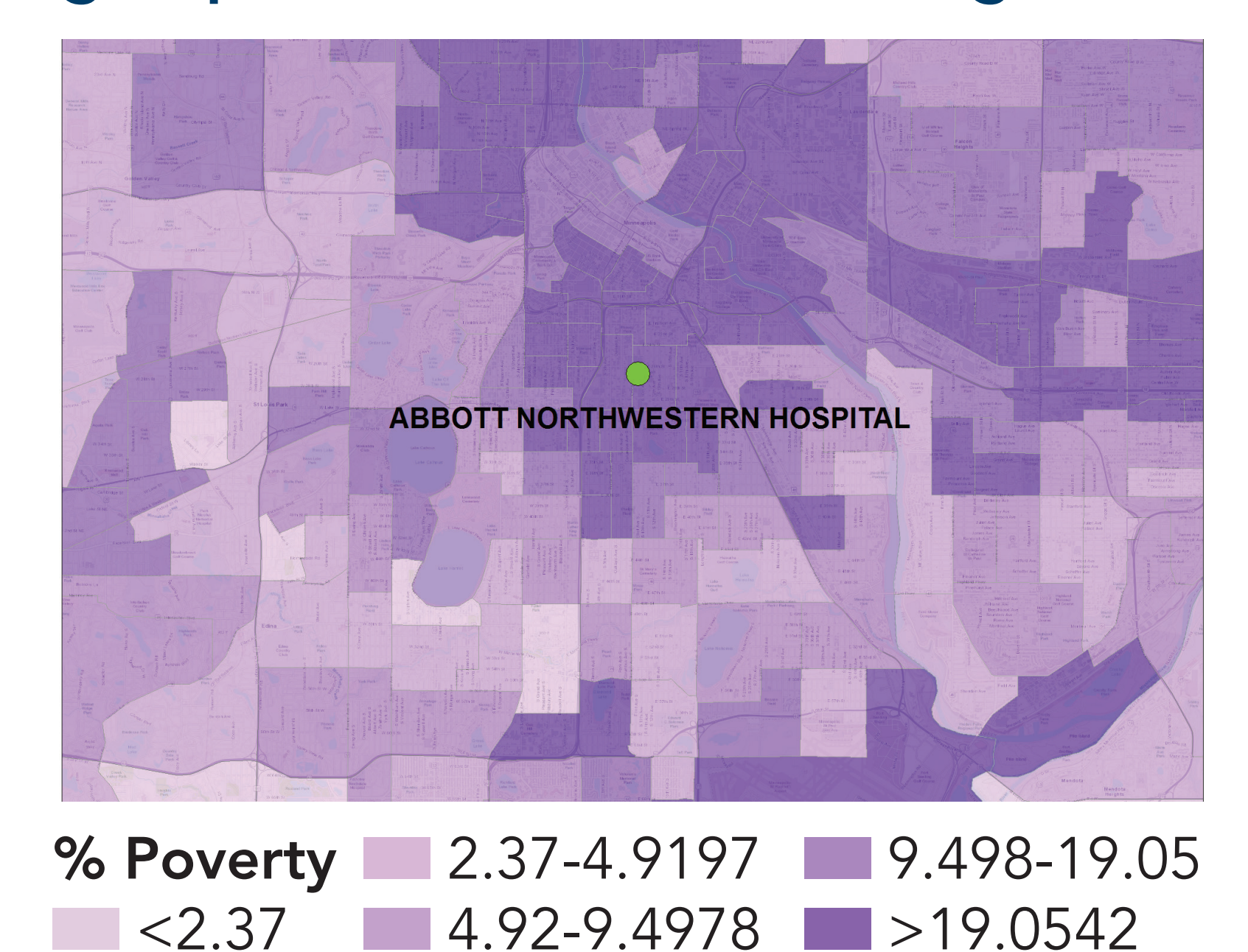**Figure 2. Patient counts per census unit in Twin Cities metro region (7 counties) in Minnesota**

- None
- 1-25
- 26-50
- 51-75
- 75 or more
- MN Hospital

Figure 3. Poverty levels of residential communities living in census block groups in counties surrounding ANWH

% Poverty
- <2.37
- 2.37-4.9197
- 4.92-9.4978
- 9.498-19.05
- >19.0542

CONCLUSIONS

- Information and methodological expertise gained from this project will be used to develop and refine innovative care models and community partnerships to address inequalities in healthcare.
- The findings can be utilized to inform and improve the care of targeted ANW patients, improve resource allocation, and develop strategic community building operations.
- ANWH (and Allina Health) will be able to identify and stratify higher risk patients based on social factors that are related to where they live and achieve and scale its capacity to realize system-wide population health goals.

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