

Addressing the Differences in Health Outcomes

Exploratory Spatial Data Analysis

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Prompt: The impact of social determinants in patients' readmission rates?

- Social, contextual cause

Living in a low-income neighborhood, food availability, access to general practitioner/hospital,

Collective social practices, access to green space/water facilities, employment rates etc.

- Proximate, compositional cause*

Lifestyle factors, poor diet etc.

- Clinical, acute factors

- (Need to calculate Elixhauser or Charlson Comorbidity Index with Diagnoses codes)

- Look at readmission rates by condition (Heart Failure, etc.)

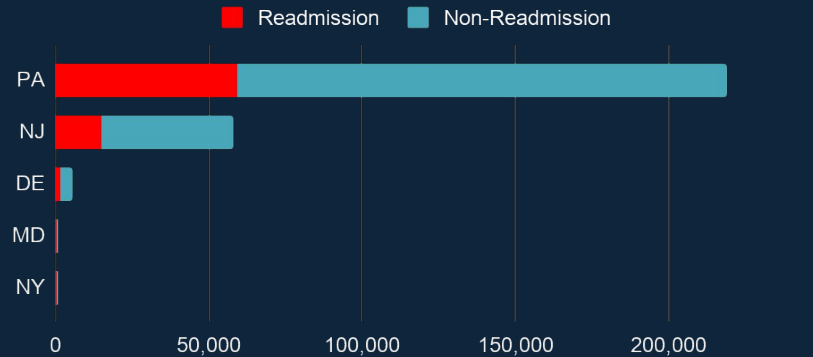
Exploratory Spatial Data Analysis

Data Wrangling

1. Created four new features, Read, Read7Days, Read30Days, NumOfRead.
2. Filled blanks in Transportation to "SELF".
3. Created variable Primary Payer Grouping for W/O Readmission dataset.
4. Collapsed Readmission dataset and W/O Readmission dataset.
5. Added Longitude and Latitude and Census Tract Data by Zip Codes to dataset.
6. Census Tract Data includes: Median Household Income, Population, Percentage of White, Percentage of Black, Percentage of Asian, **Percentage of Hispanic**.
7. Collect new features such as more granular neighborhood datasets and tobacco etc.
8. Exploratory spatial data analysis.
9. **Dual Eligible by Primary Payer Grouping**.
10. **Future Work: Spatial Join Census Tract Data with Patient Home Address**

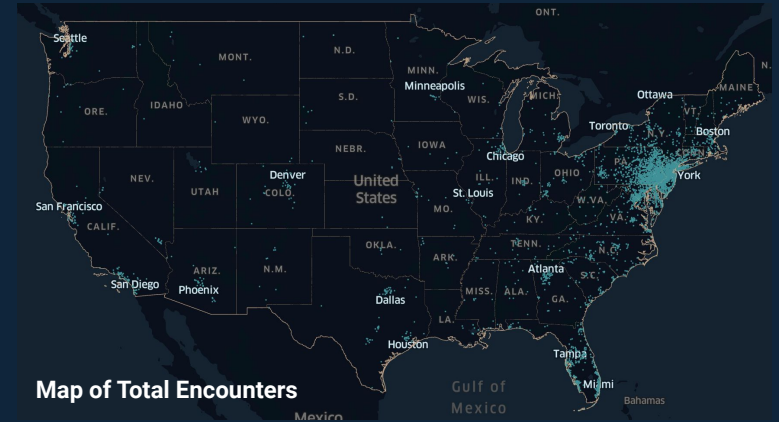
Data Review: Patients Come From PA, NJ, DE

Patient Encounters by Readmission, 2016-2019

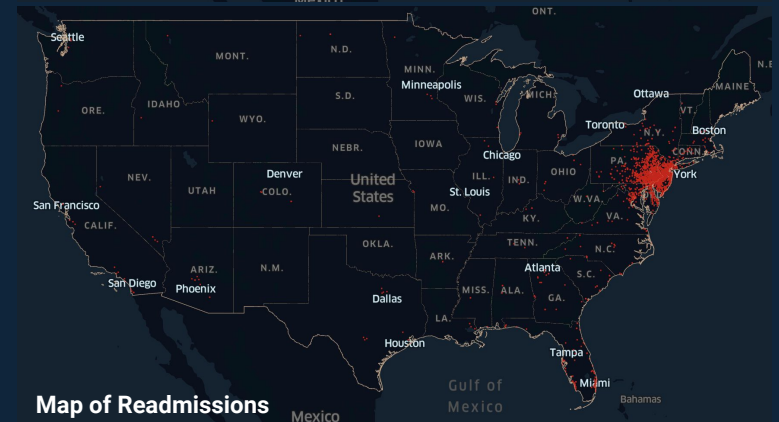


Map based on patient home state and count of patient encounters. In total 286,385 encounters with patient home state. 1215 item not found.

- Most patients come from **PA, NJ, DE**
- Most readmissions come from **PA(59,460), NJ(15,196), DE(1,651)**.
- 30-Day Readmission Rate $Y/(Y+N)$: **DE(13.21%), MD(12.92%), NJ(11.31%), PA(10.06%), NY(8.87%)**



Map of Total Encounters



Map of Readmissions

Data Review: Elderly Population (Aged 65 or Older) Has More (30-Day) Readmissions

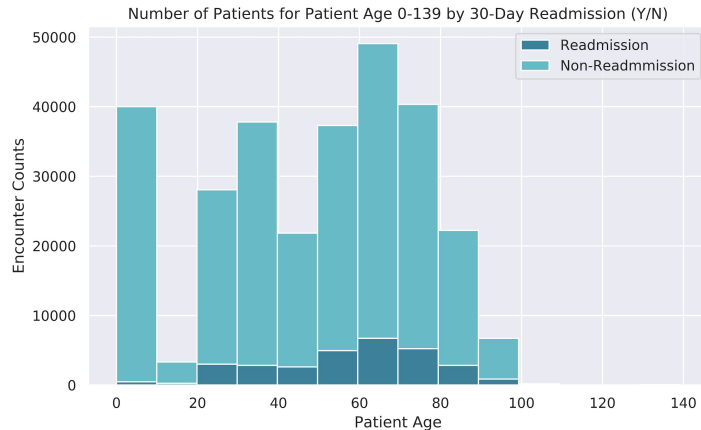
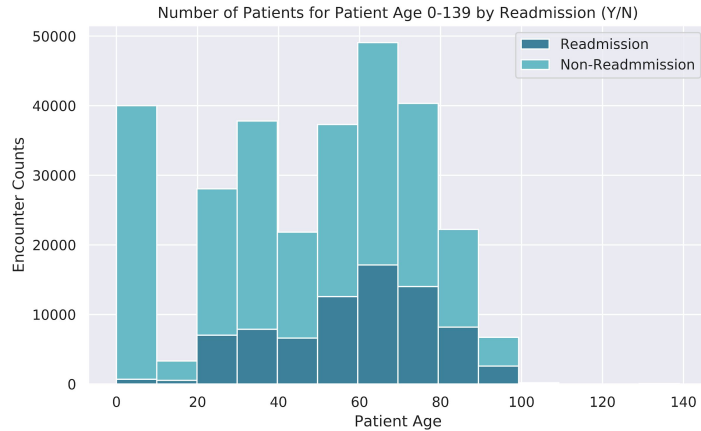


Table: Chi-square Test of Differences of Association Between Age Groups and Readmissions Versus Non-Readmissions

Frequency
Percent
Row Pct
Col Pct

Table of Readmission by AgeGroup						
Readmission	AgeGroup					Total
	0-30	30-53	53-69	69-139	NA	
Non-Readmission	66505	49985	48445	44633	133	209701
	23.12	17.38	16.84	15.52	0.05	72.91
	31.71	23.84	23.10	21.28	0.06	
	87.94	73.69	65.56	64.20	18.40	
Readmission	9124	17843	25448	24894	590	77899
	3.17	6.20	8.85	8.66	0.21	27.09
	11.71	22.91	32.67	31.96	0.76	
	12.06	26.31	34.44	35.80	81.60	
Total	75629	67828	73893	69527	723	287600
	26.30	23.58	25.69	24.17	0.25	100.00

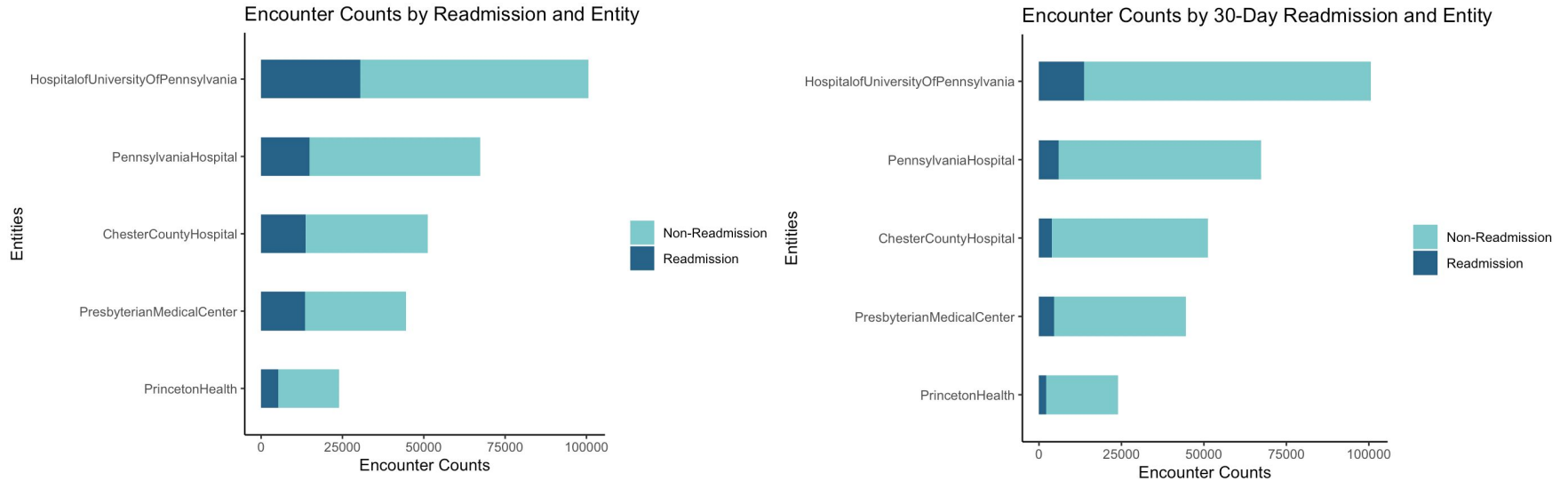
Statistics for Table of Readmission by AgeGroup

Statistic	DF	Value	Prob
Chi-Square	4	14449.3760	<.0001
Likelihood Ratio Chi-Square	4	15564.1395	<.0001
Mantel-Haenszel Chi-Square	1	12518.1711	<.0001
Phi Coefficient		0.2241	
Contingency Coefficient		0.2187	
Cramer's V		0.2241	

Sample Size = 287600

- From the Chi-Square test result, the association between Age Groups and Readmission vs. Non-Readmission is statistically significant.

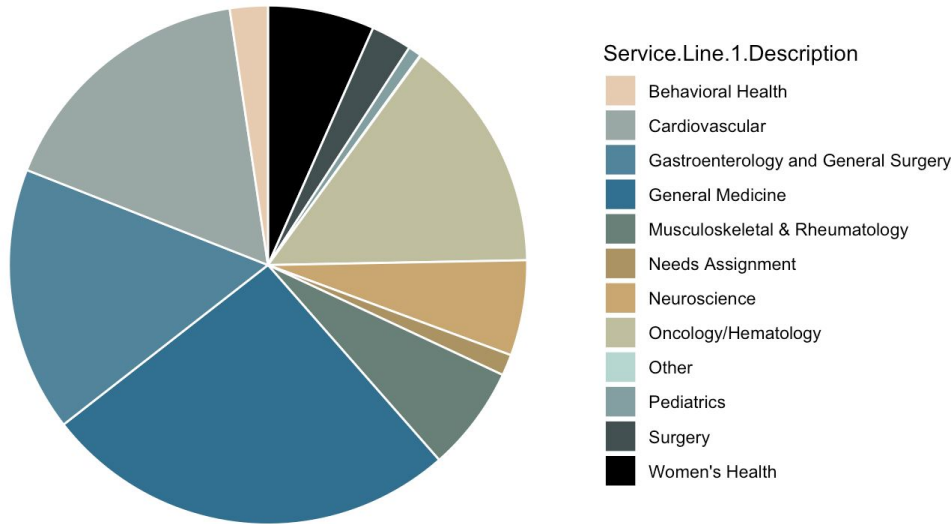
Data Review: Readmissions Mainly from HOP and Pennsylvania Hospital



- Readmissions are from Hospital of the University of Pennsylvania (39.21%), Pennsylvania Hospital (19.14%), Chester County Hospital (17.62%), Presbyterian Medical Center (17.36%), and Princeton Health (6.67%).
- 30-Day Readmissions Rate $Y/(Y+N)$: Hospital of the University of Pennsylvania (13.58%), Presbyterian Medical Center (10.41%), Princeton Health (9.31), Pennsylvania Hospital (8.78%), Chester County Hospital (7.54%).

Readmissions Mainly From General Medicine, Cardiovascular, and Gastroenterology

Pie Chart of Readmissions by Service Line 1 Description

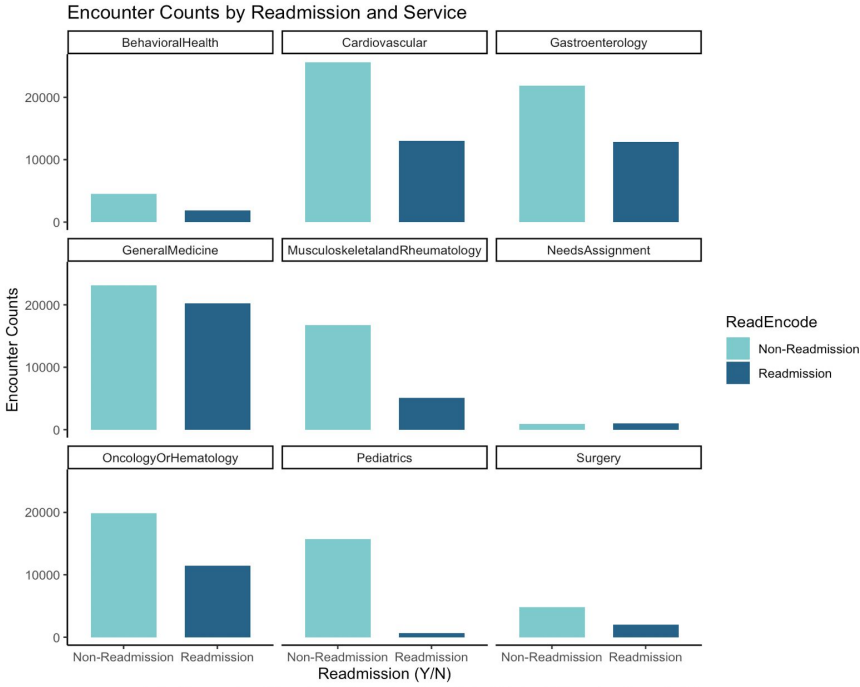


Percentage of Readmissions by Service Line 1 Description

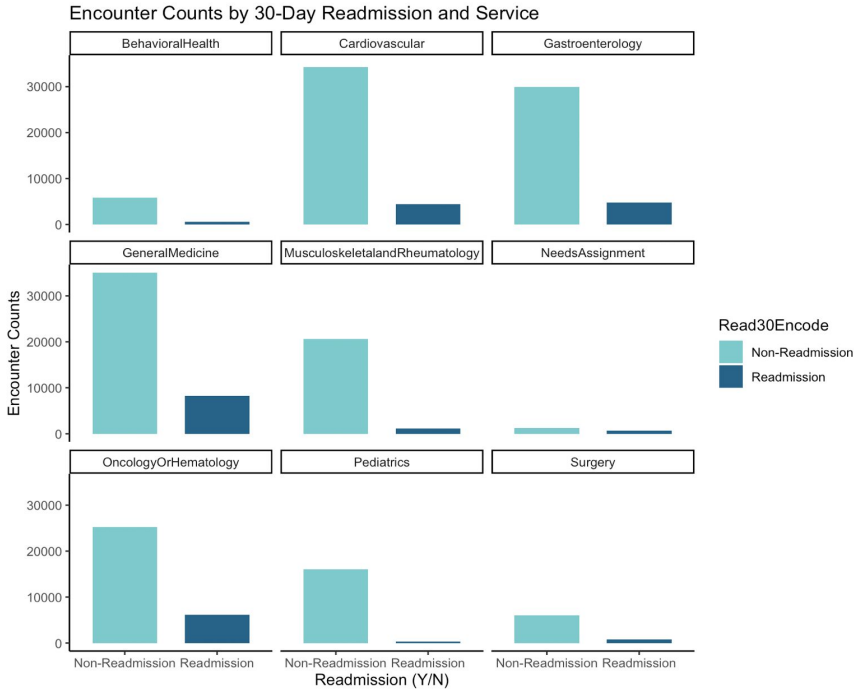
Service line / Readmission	Readmission N(%)	Non-Readmission N(%)
Needs Assignment	1,024 (53%)	920 (47%)
General Medicine	20,211 (47%)	23,090 (53%)
Gastroenterology and General Surgery	12,854 (37%)	21,838 (63%)
Oncology/Hematology	11,415 (36%)	199,03 (64%)
Cardiovascular	12,983 (34%)	25,611 (66%)
Surgery	1,970 (29%)	4,799 (71%)
Behavioral Health	1,845 (29%)	4,501 (71%)
Other	34 (29%)	85 (71%)
Musculoskeletal & Rheumatology	5,108 (23%)	16,712 (77%)
Neuroscience	4,629 (23%)	15,096 (77%)
Women's Health	5,183 (8%)	61409 (92%)
Pediatrics	634 (4%)	15,737 (96%)

- Readmissions mainly from Service Line General Medicine (26%), Cardiovascular (17%), and Gastroenterology and General Surgery (17%).

Services: Readmissions Mainly From General Medicine, Cardiovascular, Gastroenterology, and Oncology/Hematology



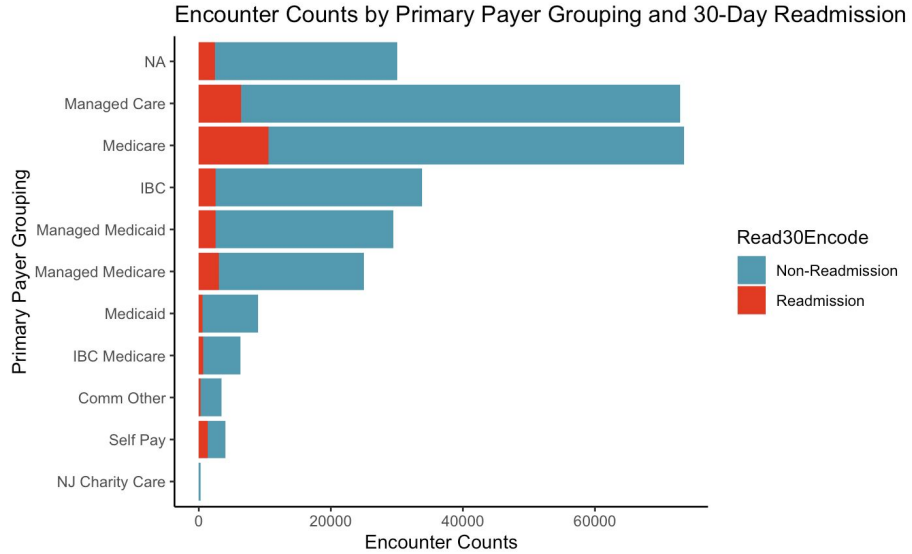
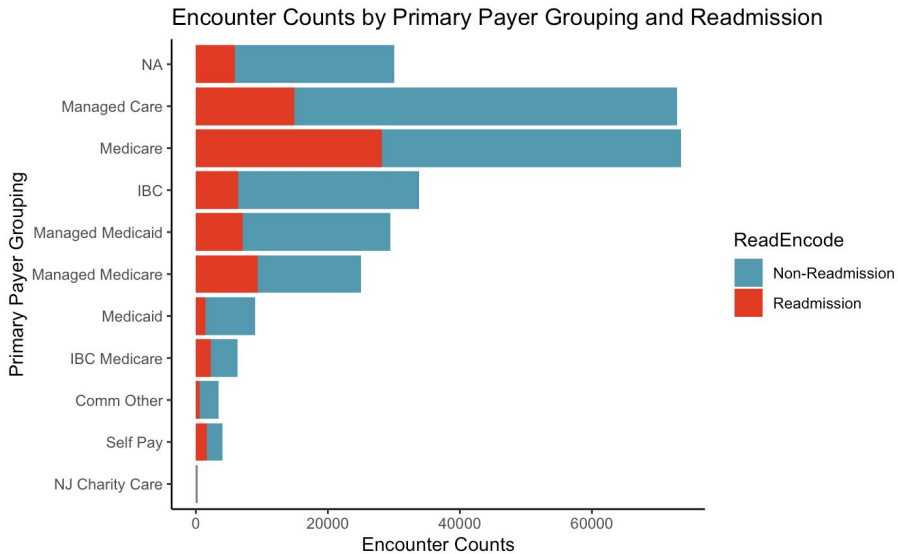
Left out two services: Women's Health (very low Readmission Rate) and Others (very few patients).



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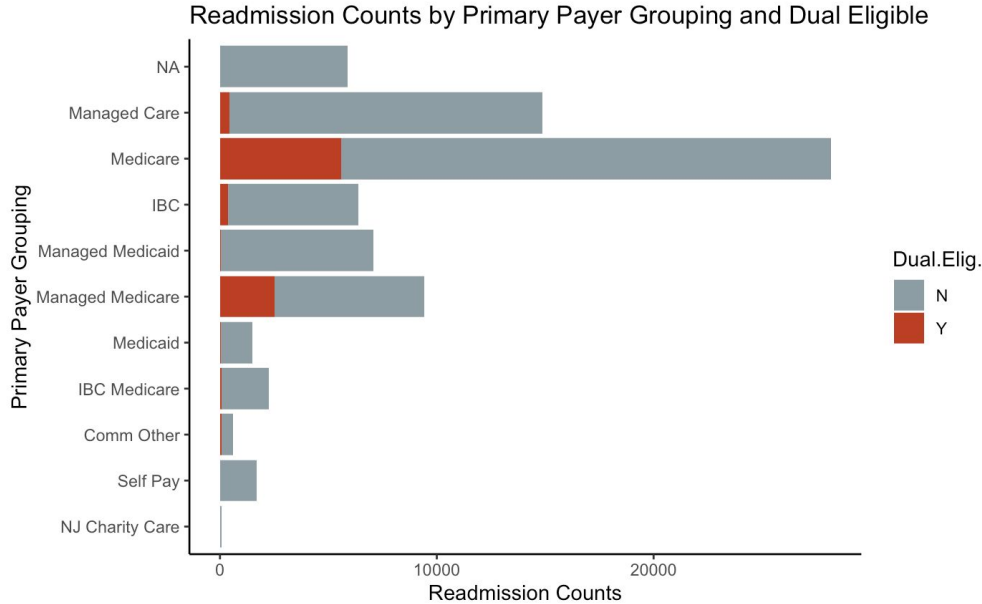
- Readmissions mainly come from General Medicine, Cardiovascular, Gastroenterology, Oncology/Hematology.
- Left out two services Women's Health and Others. Women's Health has very low readmission rate and Others has very few encounters.

Primary Payor: Self Pay, Medicare, and Managed Medicare as Primary Payer have higher 30-day Readmission Rate

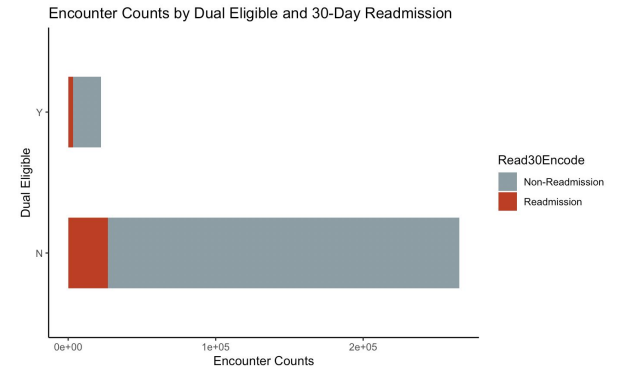
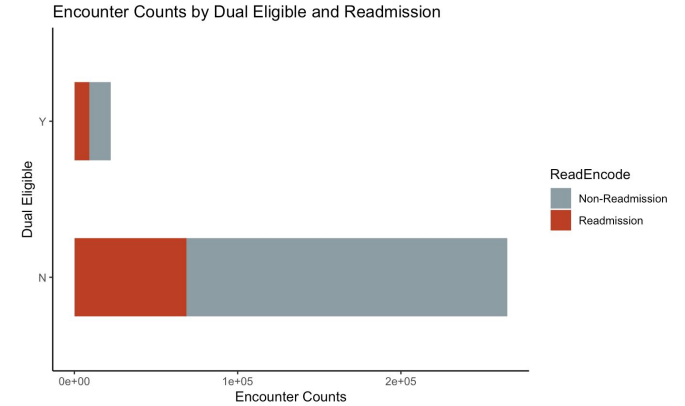


- Higher 30-Day Readmission Rate $Y/(Y+N)$: Self Pay (34.51%), Medicare (14.32%), Managed Medicare (12.21%)
- Lower 30-Day Readmission Rate $Y/(Y+N)$: Medicaid (5.91%), IBC (7.42%), Comm Other (8.04%)

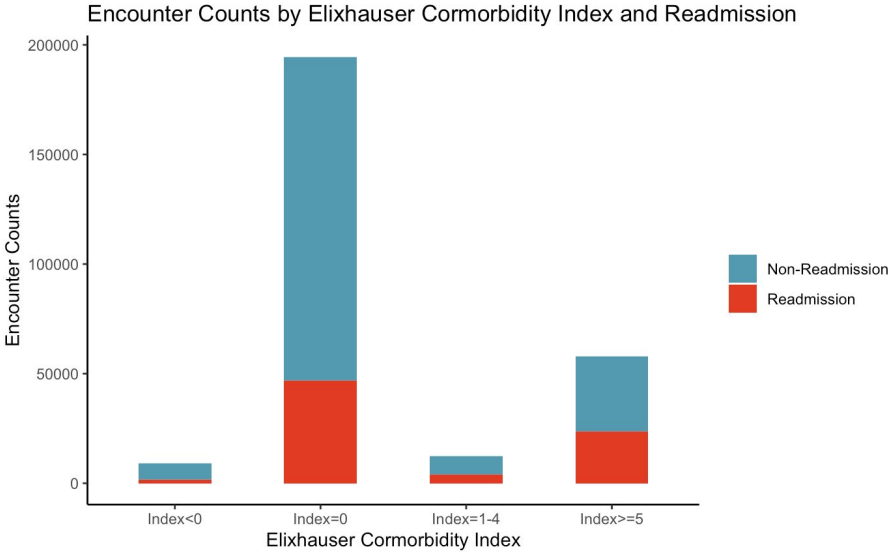
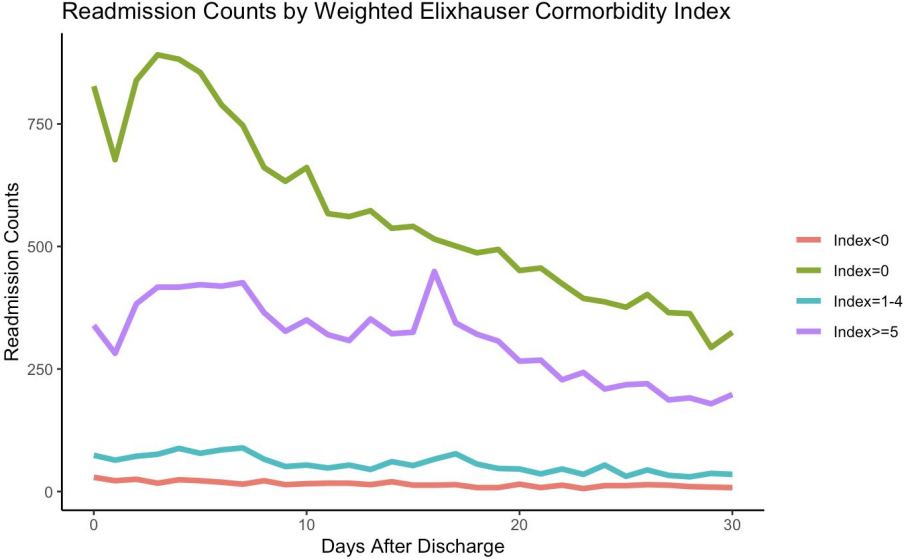
Dual Eligible: Patients Who Are Dual Eligible Have Higher Readmission Rates



- Medicare and Managed Medicare have more patients dual eligible.
- Patients who are dual eligible have higher readmission rates.



Weighted Elixhauser Comorbidity Index (Van Walraven) 0, >=5: More Readmissions Within 30 Days



- Weighted Elixhauser Comorbidity Index (Van Walraven) by Secondary Diagnostic Code.
- Patients with Weighted Elixhauser Comorbidity Index (Van Walraven) =0 and >=5 have more readmissions within 30 Days.
- Patients Readmission Rate by Weighted Elixhauser Comorbidity Index (Van Walraven): Index <0 (18.82%), Index = 0 (24.03%), Index 1-4 (33.96%), Index >=5 (41.13%).

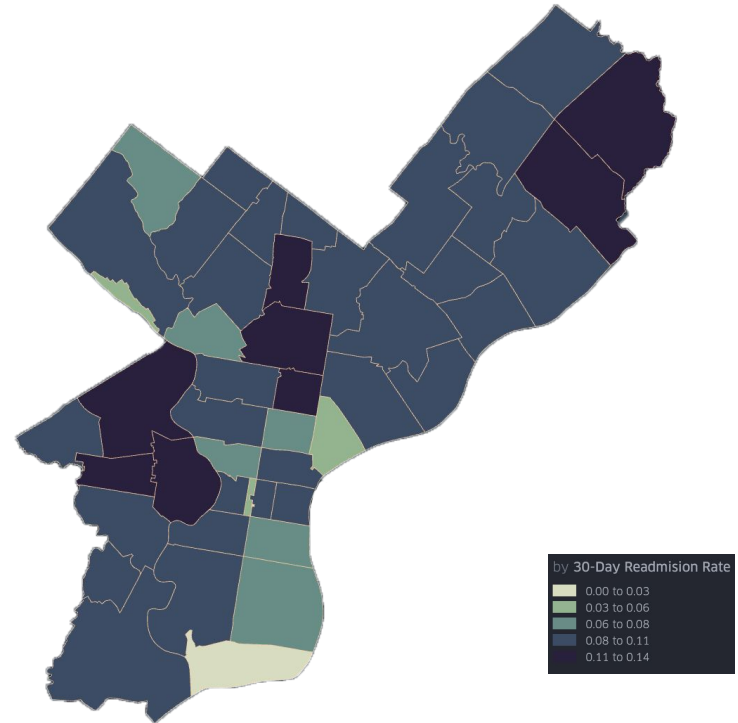
Reference Map Versus 30-Day Readmission Rates by Zip Codes, Philadelphia

Zip Codes in Philadelphia

Use the reference map below to orient you to subsequent maps illustrating neighborhood disparities.

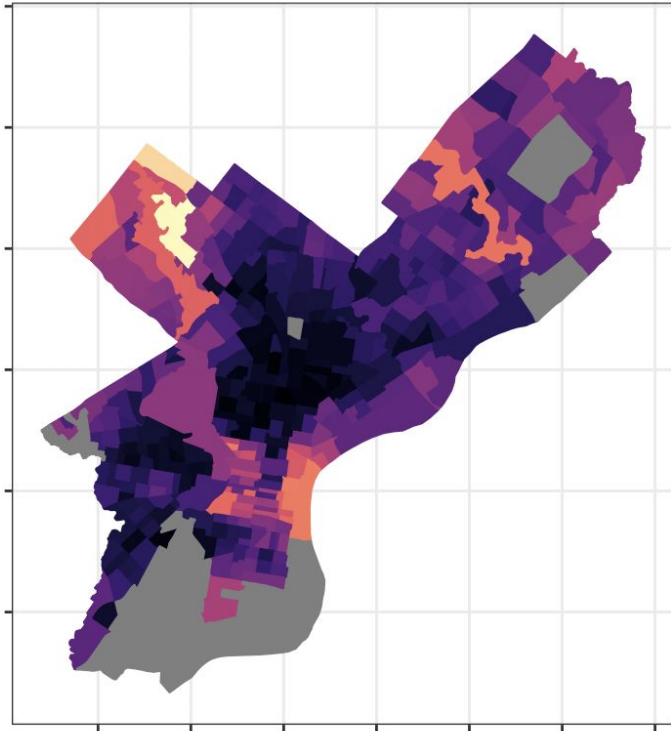


30-Day Readmission Rate by Zip Codes, Philadelphia

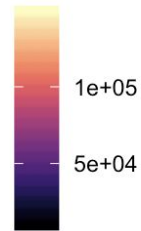


Median Household Income by Census Tracts Versus 30-Day Readmission Rates by Zip Codes

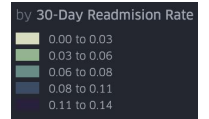
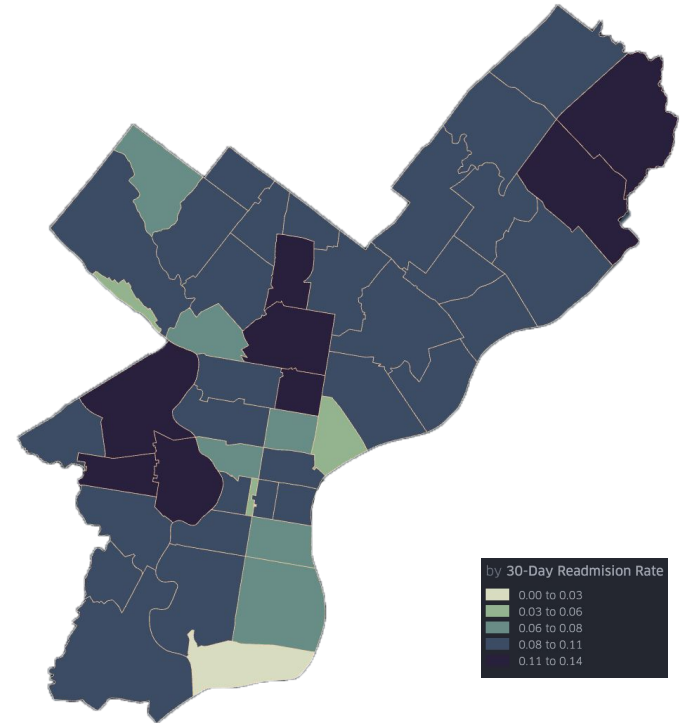
Philadelphia County
American Community Survey



Median household income

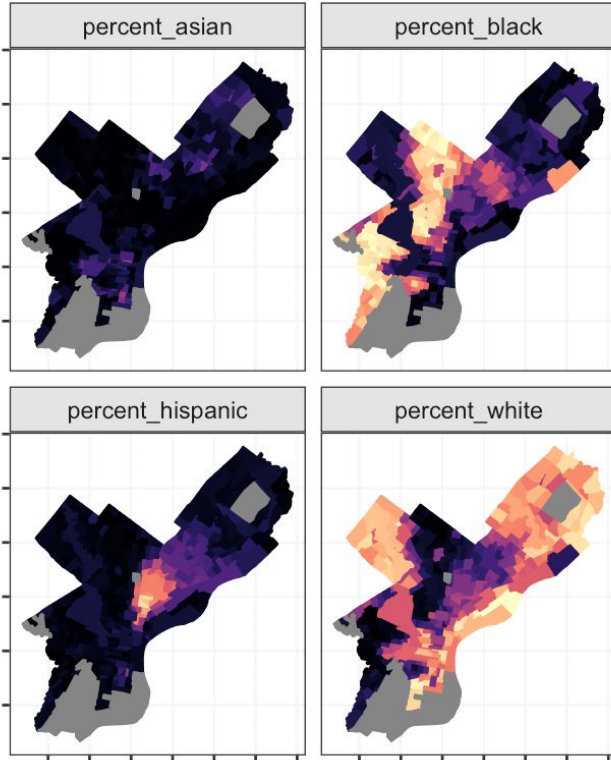


30-Day Readmission Rate by Zip Codes, Philadelphia



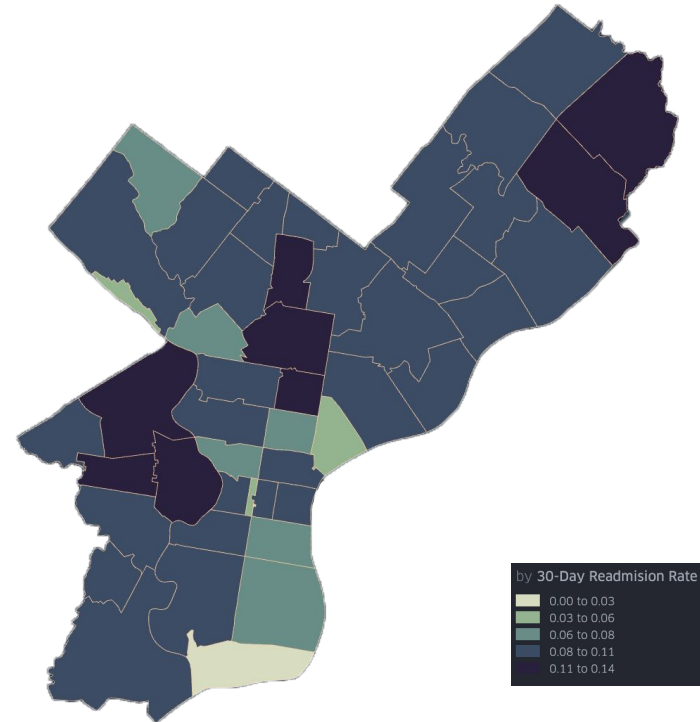
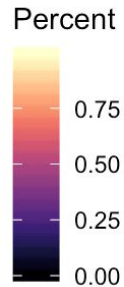
Percentage of Race by Census Tracts Versus 30-Day Readmission Rates by Zip Codes

Philadelphia County
American Community Survey



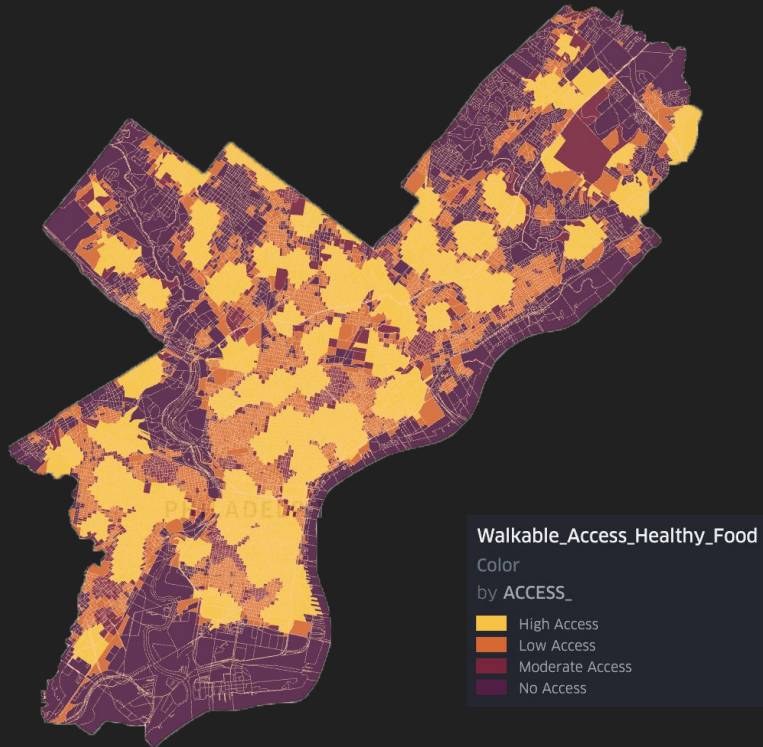
Map of Percentage of Racial Groups by Census Tracts

30-Day Readmission Rate by Zip Codes, Philadelphia

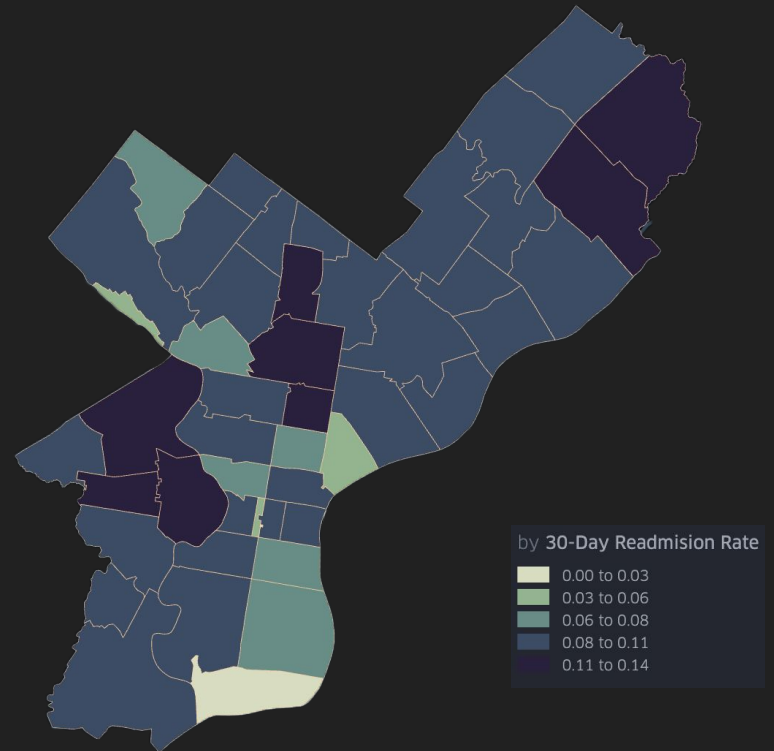


Walkable Access to Food Versus 30-Day Readmission Rates by Zip Codes, Philadelphia

Walkable Access to Healthy Food, Philadelphia

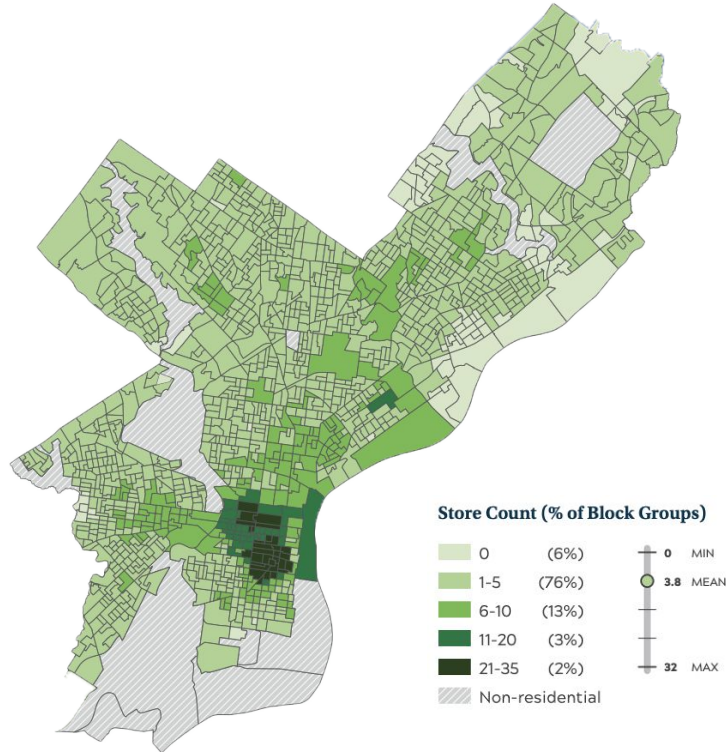


30-Day Readmission Rate by Zip Codes, Philadelphia

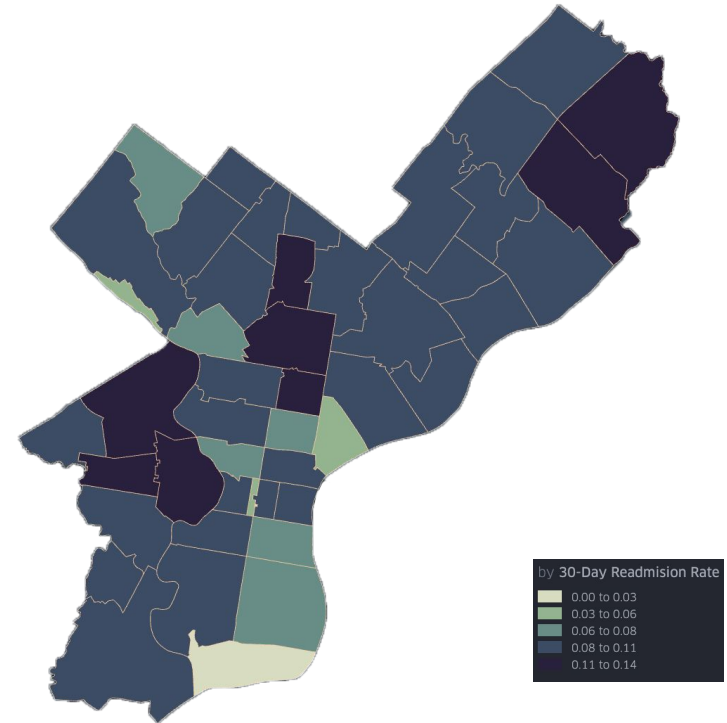


High Produce Supply by Block Groups Versus 30-Day Readmission Rates by Zip Codes

Stores With High Produce Supply Per 1,000 People



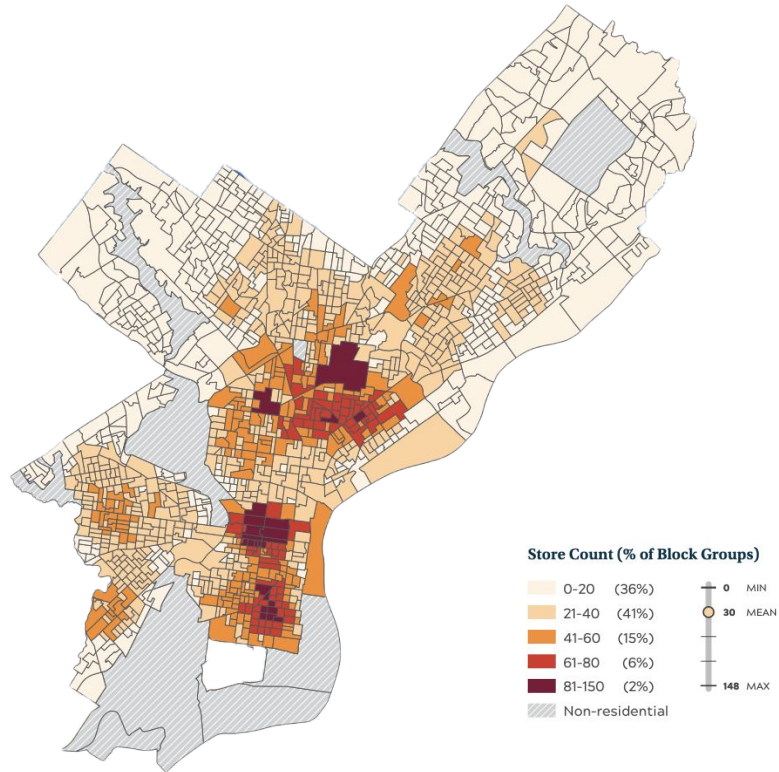
30-Day Readmission Rate by Zip Codes, Philadelphia



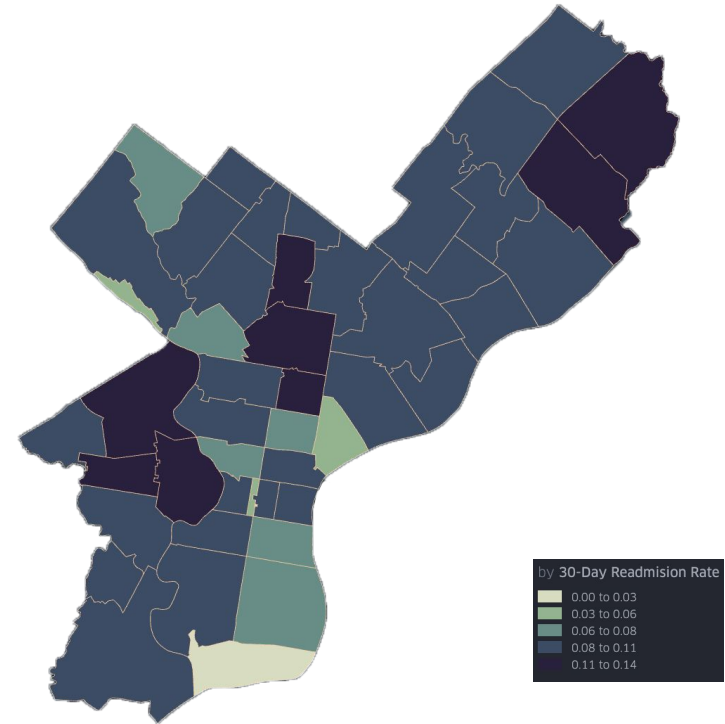
Note: High-Produce Stores are stores with more healthier food.

Low Produce Supply by Block Groups Versus 30-Day Readmission Rates by Zip Codes

Stores With Low Produce Supply Per 1,000 People



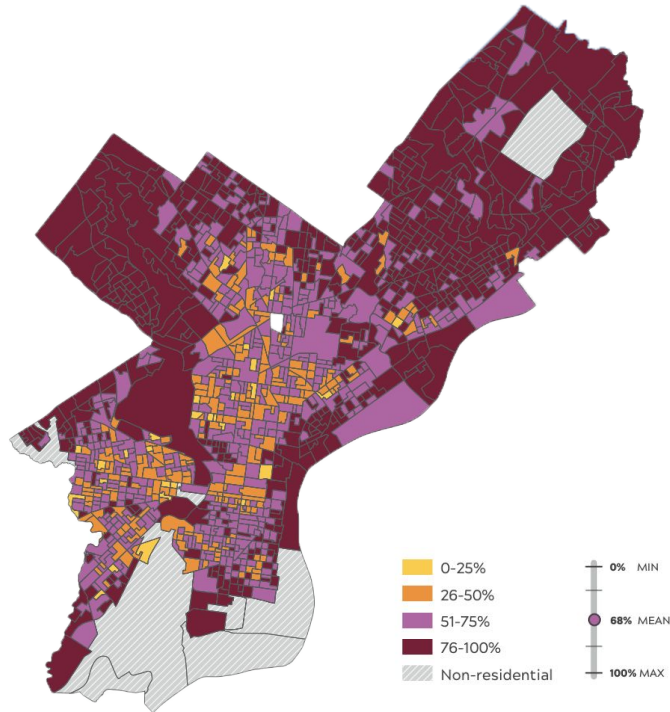
30-Day Readmission Rate by Zip Codes, Philadelphia



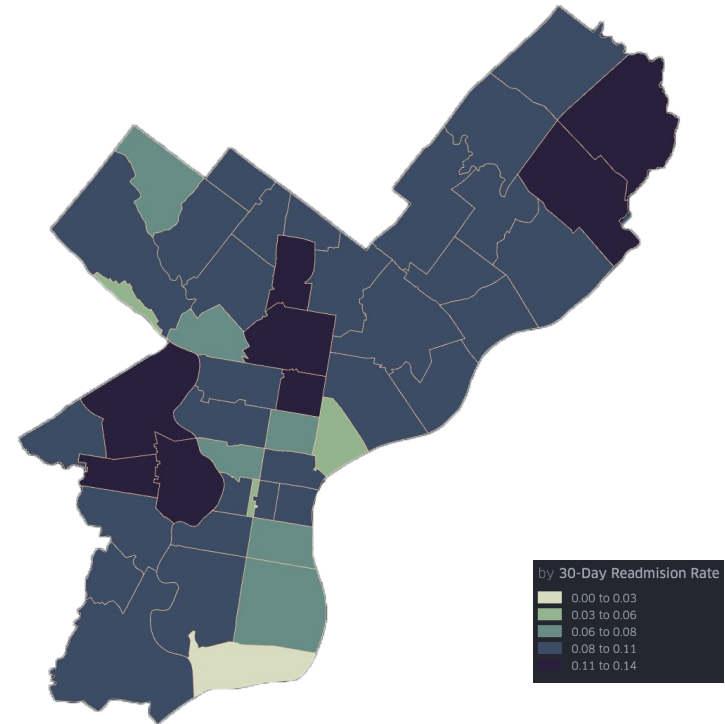
Note: Low-Produce Stores are stores that sell mostly unhealthy food options).

Vehicle Availability by Block Groups Versus 30-Day Readmission Rates by Zip Codes

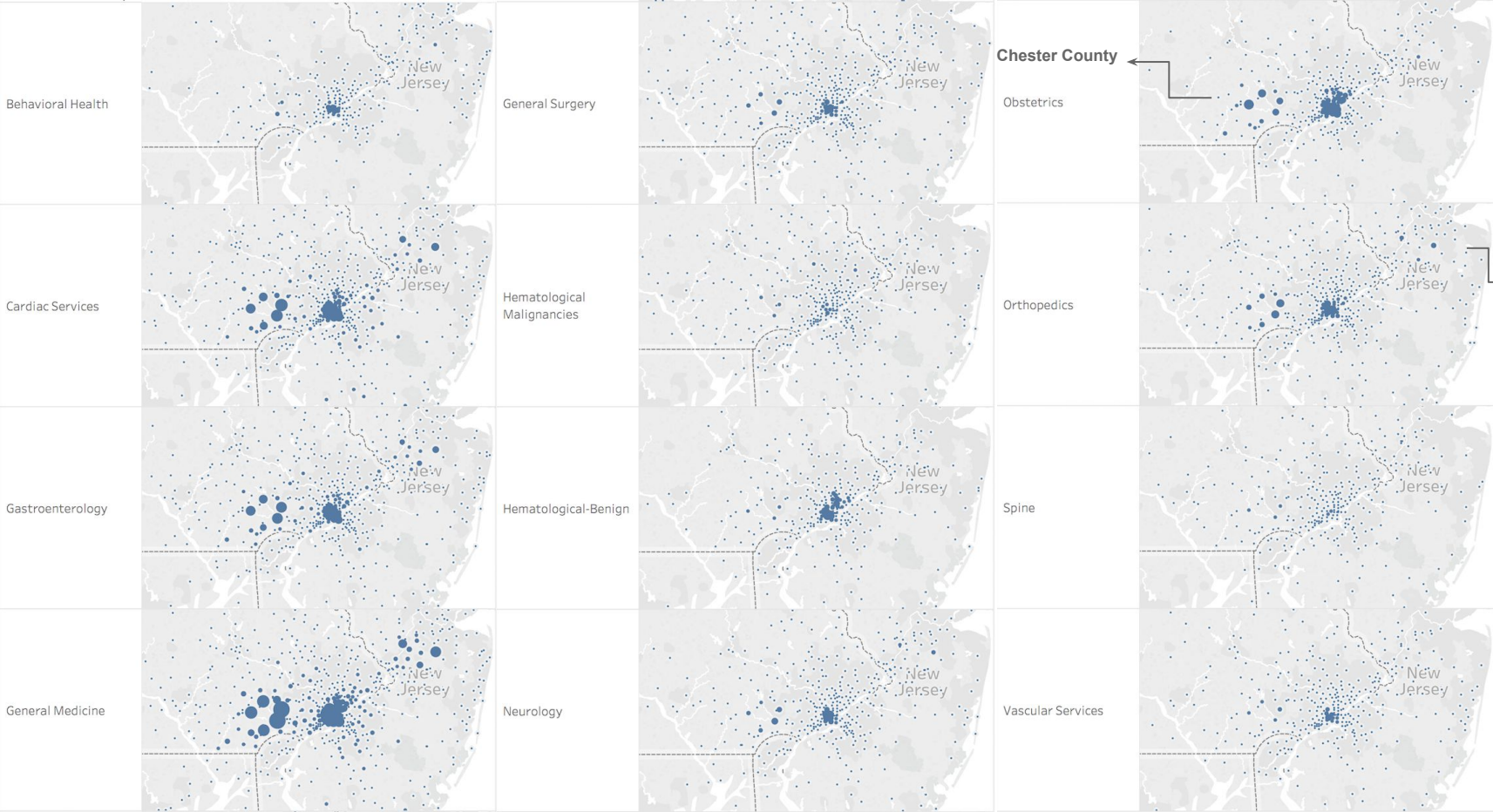
Vehicle Availability by Block Groups, Philadelphia



30-Day Readmission Rate by Zip Codes, Philadelphia



Spatial Clustering of Services Line 2 Description



Map based on Latitude and Longitude broken by Service Line 2 Description. Size shows sum of count. The data is filtered on Read, which keeps Y. The view is filtered on Service Line 2 Description, which keeps 12 out of 49 members.