Impact of Social Determinants of Health on Stroke Severity in Northwest Indiana

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Background

- Stroke and cerebrovascular diseases are the 5th leading cause of death in the United States, with a national average of 41.4 deaths per 100k.[1]
- Indiana is located within the "Stroke Belt" region, where the mortality rates of stroke are 2-4 times higher than the national average.[2]
- From 2019-2021, stroke mortality rate in Lake County, IN averaged 79 deaths per 100k and was highest among black patients at 123 per 100k.[3]
- Such health disparities seen within Northwest Indiana warrants investigation of contributing social determinants of health (SDOH).

Goals

1. Investigate the social and demographic determinants of health associated with stroke severity
2. Emphasize the role of surveying patient data to mitigate health disparities and inform preventative care

Figure 1. Census Data ZIP Code Heatmaps

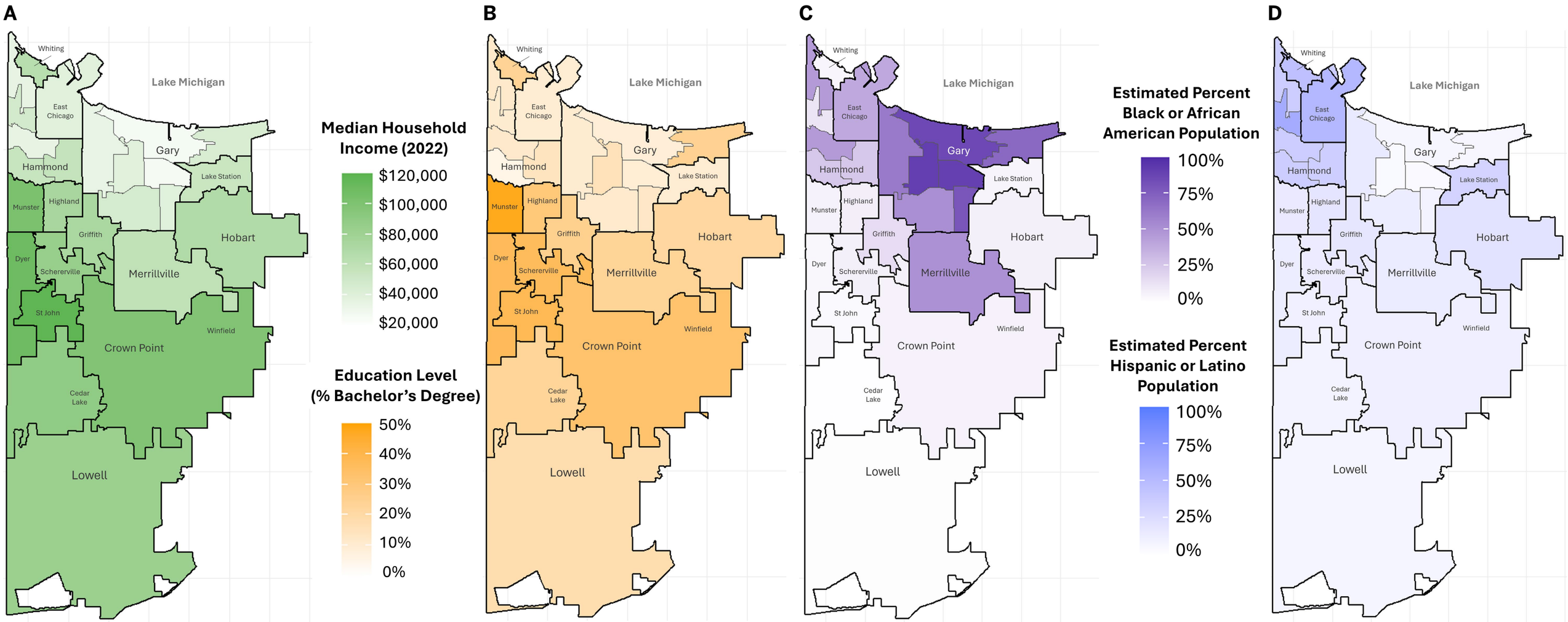
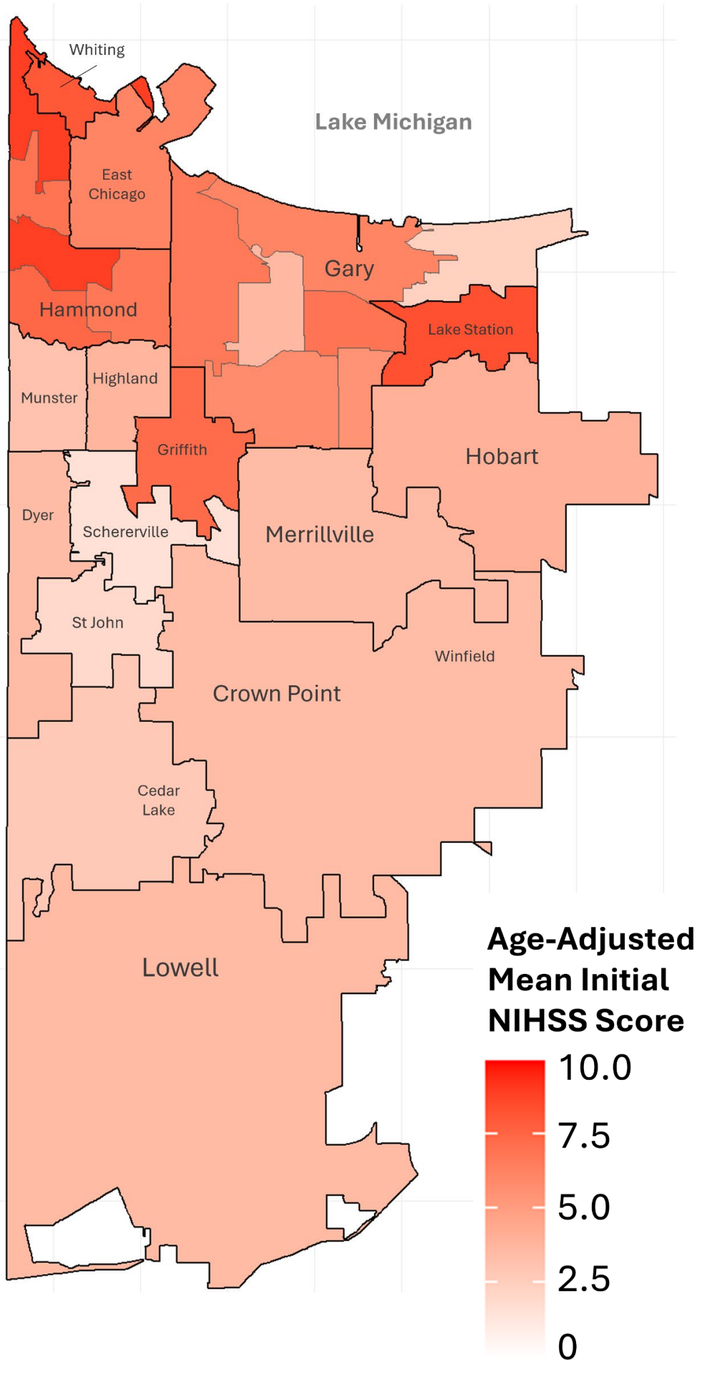


Figure 1. Heatmaps of the CDC Census Bureau Statistics for ZIP codes for Lake County, IN.[4] Maps are annotated with major municipalities.

Figure 2. Hospital Presentation Severity ZIP Code Heatmap



Methodology

Study Design: Retrospective study

Data Collection: GWTG Stoke Case Records from 3 Stroke Centers under Powers Health from Jan. 2022 to May 2024.

Descriptive Statistics: Mean, median, and interquartile range (IQR) for continuous variables. Counts and percentages for categorical variables.

Data Analysis Tests: All data is nonparametric. Ordinal comparisons: Wilcoxon and Kruskal Wallis. Categorical comparisons: Chi-squared (χ2)

Results

Table 1. Descriptive Statistics and Bivariate Analysis

Variables	Count (% of Total)	Pre-Stroke mRS		Discharge mRS		Initial NIHSS		Discharge NIHSS	
		Mean	*p*-value	Mean	*p*-value	Mean	*p*-value	Mean	*p*-value
Sex			4.1E-5*		0.59		0.98		0.36
Male	722 (46.19%)	0.727		2.415		5.979		3.505	
Female	841 (53.81%)	0.364		2.338		5.532		3.825	
Race (Age Adjusted)			0.53		0.073		4.7E-5*		0.0031*
American Indian/ Alaska Native	3 (0.23%)	N/A		0.621		1.594		0.000	
Asian	13 (0.83%)	0.202		1.003		2.594		0.137	
Non-Hispanic Black or African American	340 (21.75%)	0.284		2.561		7.105		4.676	
Hispanic Ethnicity	239 (15.29%)	0.352		2.187		5.803		3.856	
Non-Hispanic White or Caucasian	953 (60.97%)	0.330		1.809		4.601		2.759	
Payment/ Insurance Type			8.7E-7*		5.5E-9*		7.8E-5*		0.00018*
Medicaid - Private/HMO/PPO/Other	458 (28.15%)	0.293		2.108		6.078		3.833	
Medicaid Title 19	120 (7.38%)	0.111		2.552		5.060		3.697	
Medicare - Private/HMO/PPO/Other	211 (12.97%)	0.630		2.664		6.815		4.906	
Medicare Title 18	598 (36.75%)	0.809		2.556		5.753		3.191	
Other/Not Documented/UTD	11 (0.68%)	0.000		2.750		8.000		0.500	
Private/HMO/PPO/Other	221 (12.97%)	0.110		1.503		3.960		2.132	
Self-Pay/No Insurance	16 (0.98%)	0.111		0.667		4.250		8.100	
VA/CHAMPVA/Tricare	2 (0.12%)	N/A		N/A		N/A		N/A	
Mode of Arrival			0.0083*		2.2E-16*		2.2E-16*		1.0E-13*
EMS from home/scene	802 (51.58%)	0.688		3.088		8.854		5.547	
Private transport/taxi/other from home/scene	720 (46.30%)	0.406		1.611		2.401		2.056	
Mobile Stroke Unit	1 (0.06%)	N/A		N/A		N/A		N/A	
UTD	32 (2.06%)	N/A		N/A		N/A		N/A	

Based on n = 1563 patient data, subset to exclude patients outside of Lake County ZIP codes and from transfer arrivals. *Denotes statistical significance.

Figures 3-5. Significant Results

Figure 3. Boxplots of Age-Adjusted Initial and Discharge NIHSS Strokes by Race and Ethnicity

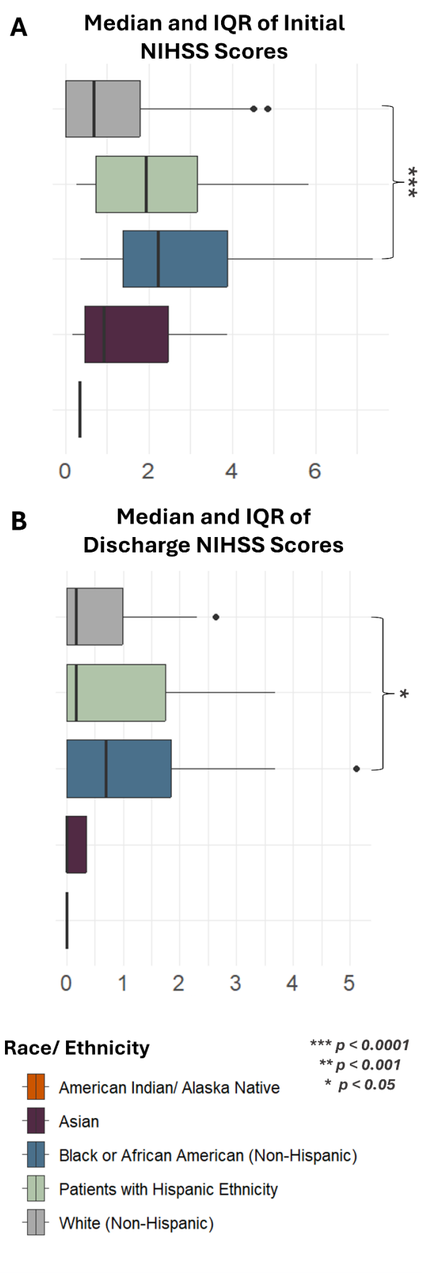


Figure 4. Age-Adjusted Percentages of Initial and Discharge NIHSS Stroke Severity Incidence by Race and Ethnicity

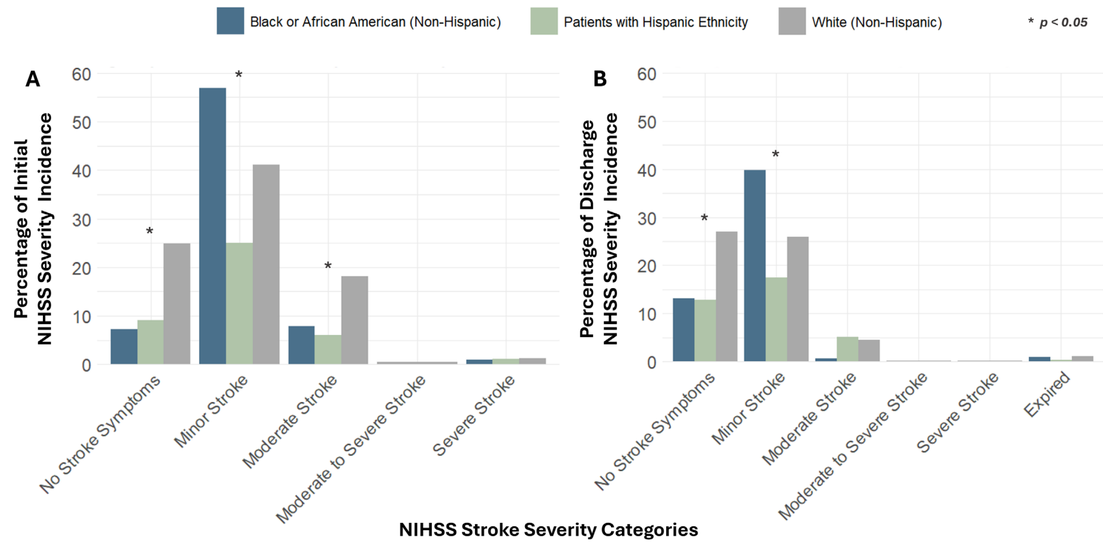
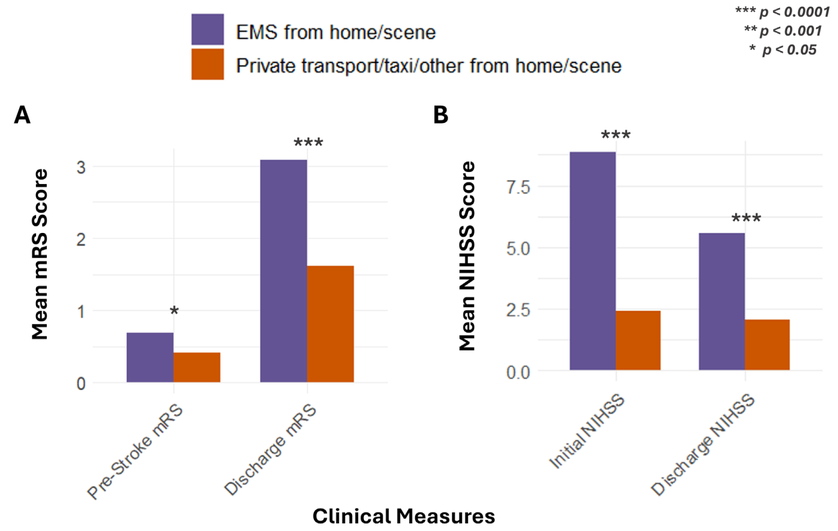


Figure 5. Mean mRS and NIHSS Scores by Arrival Method



Discussion

ZIP Code

Patients from ZIP codes with a lower median household income and education attainment correlate with higher average initial NIHSS scores than those from wealthier and more educated ZIP codes, suggesting slower stroke response and/or less resource availability for these patients. This may imply a need to increase stroke awareness in these highlighted areas. This pattern continues with discharge mRS and NIHSS scores, which may suggest further differences in quality of care for these two demographics.

Race

Black or African American patients had higher initial and discharge NIHSS scores than White patients. Such racial disparities warrants further investigation to the structural systems at play in Lake County, IN and to the ways we can inform preventative care.

Conclusions

Encouragement of Data Collection

Collection of clinical measures such as mRS and NIHSS scores are useful in providing insight to where healthcare disparities propagate and can guide quality improvement.

Limitations & Future Considerations

There was limited available data on post-discharge clinical outcomes for analysis (i.e. 90-day mRS, a useful markers for stroke outcome comparison). We recommend that healthcare providers implement more rigorous data collection practices, such as the surveys used in this study.

References

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