Spatial Accessibility to Healthcare: Disparities between Low-income Blacks and Whites Using Public Transit in Buffalo, NY

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Introduction

Minority groups in the U.S. are more likely to have health problems than whites. The poorer health outcomes are greatly affected by limited access to health care services. Access to health care services is mainly concerned with the means of approaching, entering and making use of health care services. Both whites and African-Americans with higher incomes, education levels and health coverage tend to have more access to health care than those with lower incomes, education attainment and health coverage. However, among the groups with the same social economic status, African-Americans still have lower utilization of health services than Whites. Disparity in health outcomes and use of health services are affected by spatial accessibility.

Research Questions

This study seeks to explore whether there is disparity in spatial accessibility to health care services between Whites and African-Americans.

Research Objectives

- Low income people will be the focus of this study.
- Spatial accessibility to public clinics will be measured by those who travel by public transportation.
- The relative distribution of African Americans and whites will be assessed at the scale of block groups.
- Disparity in spatial accessibility to public clinics will be explored from three aspects: accessibility, efficiency and inflexibility.
- Positive relationships between a high ratio of African Americans versus whites and accessibility, efficiency and inflexibility of public transportation are expected if disparity exists.

Literature Review

- Chronic care patients have higher use of public transit. To evaluate the spatial accessibility of chronic care patients, it is important to consider those that travel via public transit. (Arcury et. al., 2005).
- For those who do not own private transit, the possibility of taking a bus makes a greater difference in their access to health services. (Lovet et. al., 2002).
- Age-adjusted death rates from all causes were 30% higher among African Americans than Whites in 2002.(2005 National Center for Health Statistics)
- Uneven distribution of poverty not only results in disparity in the physical and social environment, but also in the uneven distribution of public infrastructure (Schulz et. al., 2002).
- In poor neighborhoods with high percentages of poverty, the ones with higher percentage of African Americans are 1.10 to 1.15 miles away from the supermarket. Being both African American and poor result in lower accessibility to supermarkets and healthy food. (Zenk et. al., 2005).

Null Hypotheses

Null hypotheses for bus accessibility in LIBGs

H_{O1} There is no difference in the mean ratio of African-Americans in Low Income Block Groups (LIBGs) to whites in LIBGs that have public transit available versus those that do not.(**Availability**)

H_{O2} There is no difference in mean ratio of African-Americans to whites in LIBGs that have frequent public transit versus those that do not.(**Frequency**)

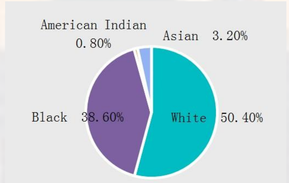
H_{O3} There is no relationship between the mean ratio of African-Americans to whites in LIBGs and travel time to public clinics.(**Efficiency**)

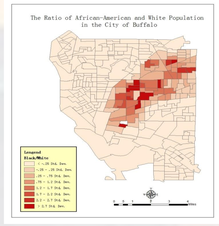
Study Area

The study area is city of Buffalo, Erie County, NY.

Race Distribution

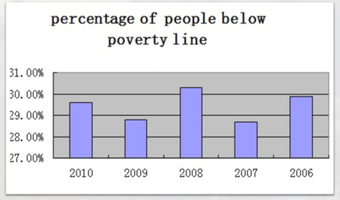
- Buffalo city has the total population of 261,310, with 42% African-Americans and 54% Whites.
- It is the 8th most segregated area in the American.Most African-Americans are concerntrated in the middle and northeast part, while Whites are evenly distributed in the northwest and south part of city.

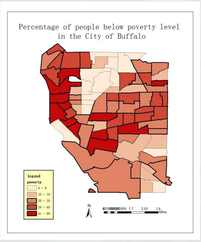




Economic Distribution

- *The median of household income is* $29,285 and the average % of people living below the poverty line in the past five years is around 29.
- LIBG is defined as an area with 20% or more of the people living below the poverty line.





Health Outcome

- African American infant mortality rate is three times higher than whites.
- African Americans are more than three times more likely to be hospitalized for asthma than whites.

Public clinics and public transit:

- There are three public clinics, located in the north and southwest part of city.
- The public transit system carries about 94,000 people a day, more than 50% are citizen.
- 7 out of 25 bus routes have bus stops within 500 meters buffer of at least one of the public clinic.

Data and Method

Data Acquisition Sources

- Public transit data, Niagara Frontier Transportation Authority
- Block group, Census tract, Census 2010
- City of Buffalo websites

Variables of Study

- Ratio of African-American population to White population
- Availability (Presence/Absence of a Bus transit)
- Frequency of bus whithin one week
- Travel time to public clinics

Method of Data Extraction

- *Block group is scale for this study. The key assumption is that people living in the block group are concentrated in the centroid.*
- *500 meters is the maximum walking distance.*
- Two variables, frequency and travel time, were extracted from the public transit timetable.

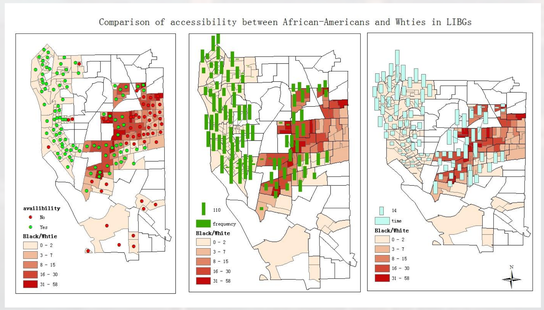
MONDAY THRU FRIDAY

INBOUND TO DOWNTOWN				OUTBOUND TO UNIVERSITY			
UNIVERSITY STATION	UTICA RAIL STATION	THEATER RAIL STATION	ERIE CANAL HARBOR STATION	ERIE CANAL HARBOR STATION	THEATER RAIL STATION	UTICA RAIL STATION	UNIVERSITY STATION
A.M.	A.M.	A.M.	A.M.	A.M.	A.M.	A.M.	A.M.
536	544	549	557	510	517	521	531
600	608	613	621	530	537	541	550
612	620	625	633	545	552	556	606
626	634	639	647	557	605	609	619
638	646	651	659	610	617	621	631

Method of Data Analysis

- *t*-tests, and ANOVA were used to assess the differences.
- Correlations were used to test the relationships.
- Arc Map 10.1 was used to create the maps

Results and Analysis



H_{O1} **Difference in availability**

	availability	N	Mean	Std. Deviation	Std Error Mean
Black/White	No	50	8.59	1.13	1.61
	Yes	98	6.91	1.17	1.18

On average, By dividing the black population by the white, LIBGs that do not have public transit available is 8.59%, While LIBGS that have public transit available is 6.91%.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Black/White	Equal variances assumed	.091	.764	1.330	146	.186	2.68305554E0	2.01745023E0	-1.3041234E0	6.67023454E0
	Equal variances not assumed			1.341	101.033	.183	2.68305554E0	2.00069576E0	-1.2857707E0	6.65188184E0

Equal variance not assumed
Fail to Reject the H_{O1}: Sig. *p=0.183*>.01

H_{O2} **Difference in frequency**

Times of bus available in a week	Frequency	N	Mean	95% Confidence Interval for Mean	
				Lower Bound	Upper Bound
<70	Low	42	8.6	4.3	1.28E1
70-140	Moderate	45	6.8	3.6	1.00E1
>140	High	11	6.2E-1	2.93E-1	9.56E-1

- On average LIBGs that have low and moderate frequency bus accessibility respectively are 8.6%, 6.8%. This is derived by dividing the blacks population by whites.
- By contrast, the Ratio of LIBGs that have high frequency bus accessibility is 0.65%

ANOVA: F=2.081(df1=2,df2=95)
Fail to Reject the H_{O2}:Sig=0.13>0.1

H_{O3} **Relationship between travel time and ratio**

		Black/White	time
Black /White	Pearson Correlation	1	0.75
	Sig. (2-tailed)		0.46
	N	98	98
time	Pearson Correlation	0.75	1
	Sig. (2-tailed)	0.461	
	N	98	98

Fail to Reject the H_{O3}: Sig. p=0.46>.01
Strength=0.75

Discussion

- LIBGs that do not have public transit available have 2% higher black population compared to the whites, but the results of t-test shows that there is no significant difference. The results are due to the means of ratio are too close.
- There is no significant difference among LIBGS with low, moderate and high frequency of the public transit in ratios, but LIBGS with more frequently accessible to bus has distinctly low ratio of blacks versus whites.
- The strength of relationship between travel time and ratio of African-Americans to whites is statistically strong, but the correlation is not significant. This is probably because the low quantities of data.
- In sum, the disparity in spatial accessibility between blacks and whites in this study is not distinctly.

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