An environmental justice framework for analyzing obesigenic environments: A GIS analysis of walkability, park access, and neighborhood demographics in Phoenix, Arizona

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Research Question

In Phoenix, AZ, similar social, economic and demographic characteristics are associated with both higher exposure to environmental hazards and obesity risk. Are these same characteristics – relative linguistic isolation, presence of children, higher poverty, and lower educational attainment – also associated with less walkable neighborhoods and lower access to public parks?

Introduction

One of the biggest public health concerns in the U.S. today is obesity, a condition affecting over 30% of Americans[1]. In Arizona, **obesity tends to disproportionately affect Latino and low-income individuals**[2].

Physical activity is an important component of obesity prevention and treatment. Although sociocultural factors also determine physical activity, the structure of the built environment plays a significant role. Two characteristics of the built environment influence residents' physical activity level: park availability and neighborhood walkability. **More walkable neighborhoods correlate with higher levels of physical activity and lower body mass index (BMI)**[3,4]. At the same time, **residents with access to parks are reported to be almost three times more likely to get the recommended amount of daily physical activity**[5].

Since **built environments that do not promote physical activity can be seen as obesity-promoting (obesigenic)**, and **obesity is a dangerous condition that disproportionately affects minority and lower income groups in the U.S.**[6,7], the study of neighborhood amenities related to physical activity provides a potentially important but relatively under-explored context for environmental justice inquiry and activism.

	Walkability Analysis	Park Analysis
Spatial unit of analysis	Census block groups	Census block groups with dasymetric mapping to reapportion demographic data to only those areas zoned as residential
Defining obesigenic environments	Low walkability index (modified[8]): low dwelling density, low street connectivity, low land use diversity	Low park access: > 1/4-mile (Euclidean) from a public park
Dependent variables	Walkability index score	Park access (binary)
Independent variables	U.S. Census[9] variables often associated with environmental justice concerns: % Latino, % poverty, % children under 18, educational attainment, income, % linguistic isolation (Note: Many of these variables are collinear.)	
Statistics analysis	We conducted a stepwise multiple regression with transformations to correct for correlation among independent variables.	We achieved the best model fit by treating the independent variables as binary, with the median as the cut-off point. We then conducted a stepwise regression.
Results	After using stepwise multiple regression with transformations, we determined % poverty and children under 18 to be the most appropriate variables, with % poverty positively associated with walkability and % children negatively associated with walkability.	After using stepwise regression to select the most appropriate model, we determined educational attainment and % children to be the most appropriate variables, with both positively correlated to park depravity.

Demographics Associated with High Obesity or Environmental Vulnerability as they associate with Neighborhood Walkability: Multiple Regression (n=1038)

Variable	Parameter Estimate	Standard Error	Type II SS	t-Value	Pr>t
Intercept	18.97784	0.83131	11825	521.16	<.0001
Population living below poverty level (square root transformation)	12.06171	0.83044	4786.67921	210.96	<.0001
Youth: Population under 18yrs (square root transformation)	-12.86942	1.67205	1344.15917	59.24	<.0001

R-Square: 0.1760 Adj R-Sq: 0.1744

Demographics Associated with High Obesity or Environmental Vulnerability as they associate with No access to parks versus Access to Parks: Logistic Regression Odds Ratios (n=2443)

	Odds Ratio*	95% Confidence Interval
High Educational Attainment (more than high school and some college)	1.714	1.431-2.056
High Percentage Children (above median)	1.563	1.305-1.875

*$p<0.0001$

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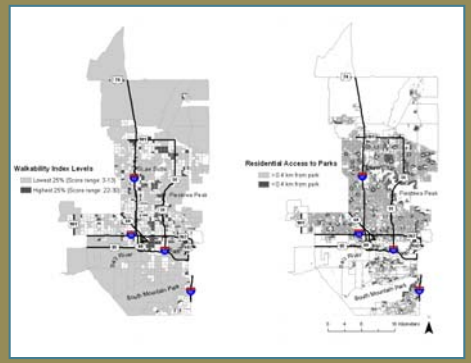

Key Findings

- Areas with limited park access: high educational attainment (at least high school and some college) and high percentage of children
- Areas with low walkability: higher than average percentage of children and lower than average percentage in poverty

Conclusions

In this case study of Phoenix, **we find that subpopulations generally considered vulnerable to obesity are more likely to live in walkable neighborhoods and have better walking access to neighborhood parks than other groups**. These results counter our characterization of obesigenic environments as an environmental justice issue. Given high obesity rates for these groups in Phoenix, the results suggest that the physical activity benefits of built environments may be offset by other social or built-environment characteristics.

One exception to this pattern are children, who are underrepresented in walkable neighborhoods and neighborhoods near parks.

Additional research is necessary to tease out significant social and cultural factors and determine their importance relative to built environment conditions in contributing to obesity in Phoenix, AZ.