MODELING BODY MASS INDEX BASED ON THE BUILT ENVIRONMENT

WILLIAM SERCOMBE | ALEX THOMAS | SPRING, 2014

INTRODUCTION

Given that over one-third of U.S. adults qualify as obese and are thereby exposed to a greater risk of chronic disease and general morbidity, obesity is one of the most pressing issues in public health today. In order to monitor and analyze the spatial distribution of obesity, the Oregon Health Authority's Environmental Public Health Tracking (EPHT) division released a dataset of body mass index (BMI) estimates derived from DMV records.[1] The dataset provides age-adjusted mean BMI scores down to the census block group level.

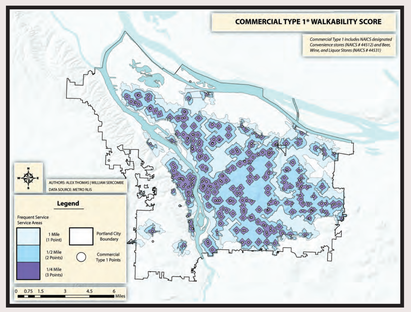
RESEARCH QUESTION

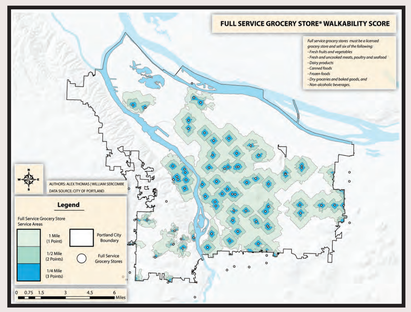
Our primary research question asks: is the built environment a statistically significant influence on the spatial distribution of mean BMI scores?
In order to quantify the built environment's influence on BMI we are focusing on walkability as an environmental measure.
We modeled our definition of walkability on The City of Portland's recent 20-Minute Neighborhoods Analysis.[2]

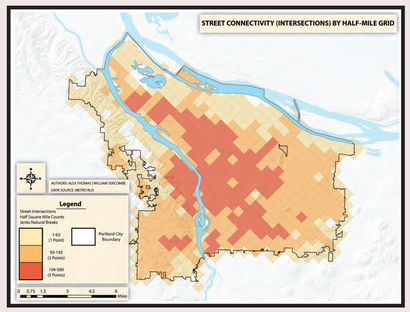
WHY WALKABILITY?

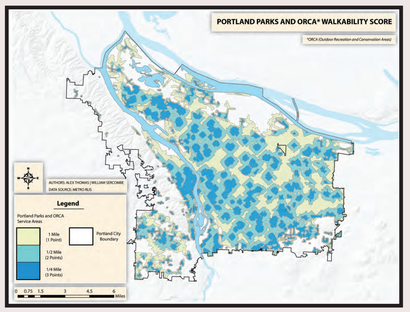
Studies have shown that individuals in less walkable areas are more likely to be obese or have diabetes.[3]
Walkable areas foster active lifestyles and reduce vehicle miles traveled. Availability of walkable amenities can be considered a measure of good policy making and a healthy built environment.[3]

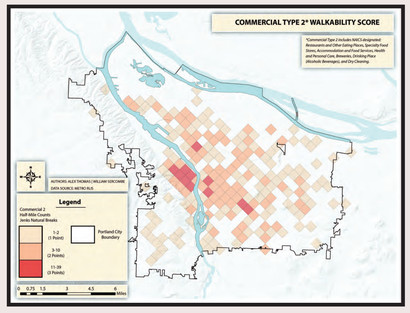
WALKABILITY AS DETERMINED BY BUILT ENVIRONMENT

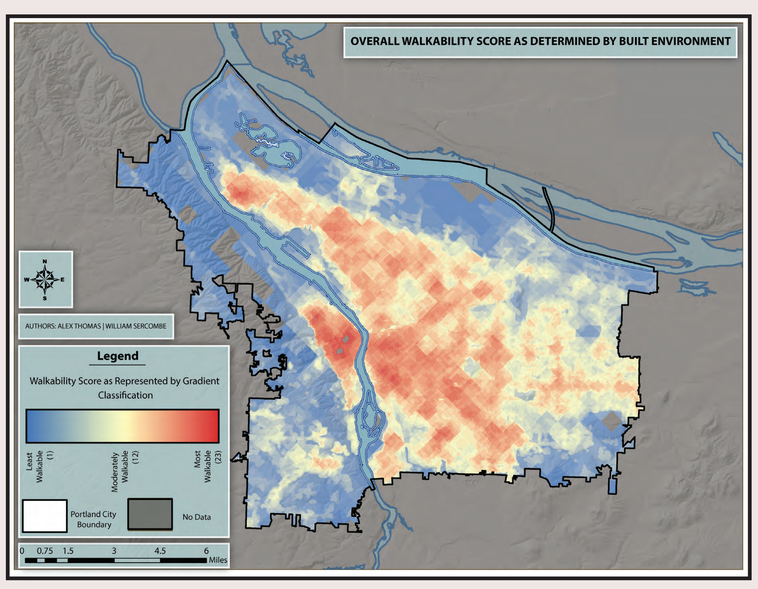


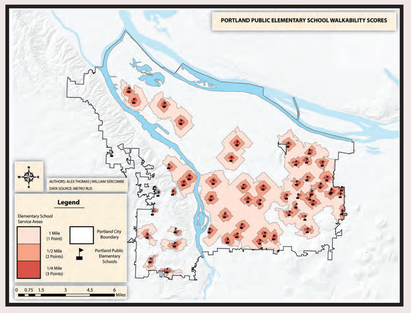


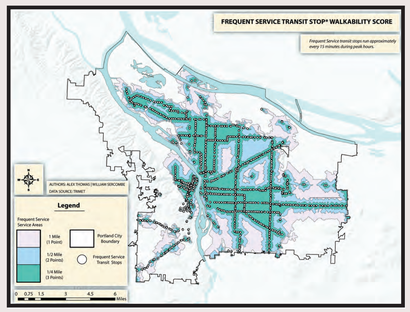


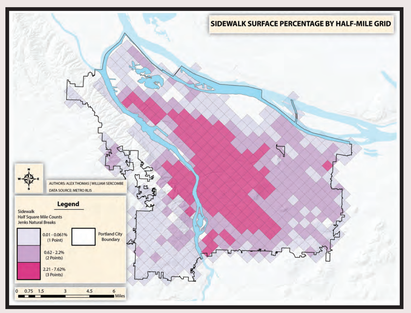












METHODOLOGY

The final walkability score is a composite of eight different GIS analyses. In order to define walkabillity we constructed Network Analyst service area buffers and square half-mile grids to produce feature scores between 0 and 3, 3 being the most walkable.

We used Network Analyst 's service area function to determine accessibility to specific amenities including:
- Full service grocery stores
- Public elementary schools
- Frequent service transit stops
- Commercial type 1 locations
- Parks and natural areas

We included a slope impediment where roads with a slope greater than 20% were excluded.

Amenities within a square quarter-mile received a score of a 3, square half-mile a 2, and square mile a 1.

We created a square half-mile grid over the city, which was used to perform spatial joins in order to ascertain:
- Street intersection count (connectivity)
- Commercial type 2 location count
- Sidewalk surface percentage

Jenks natural breaks were used to classify the captured amounts into three classes, which were then assigned a score of 0 to 3.

All eight components were converted into raster surfaces with cell values based on the 0 to 3 rank attribute. Using ArcMap's Raster Calculator, the eight rasters were then combined into a final walkability surface with potential scores ranging from 0 to 24.

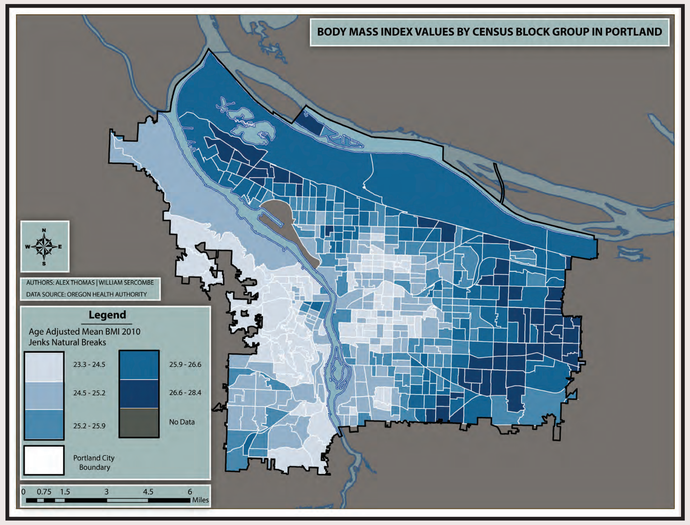
BMI scores, originally provided as a CSV file by the OHA, were joined by attribute to a block group shapefile of Multnomah County, which was clipped to the City of Portland boundary. In order to analyze the relationship between walkability and BMI, the Zonal Statistics as Table tool was used to capture average walkability scores per block group. Joining the resulting table to the BMI block group shapefile allowed for analysis via spatial regression.

RESULTS

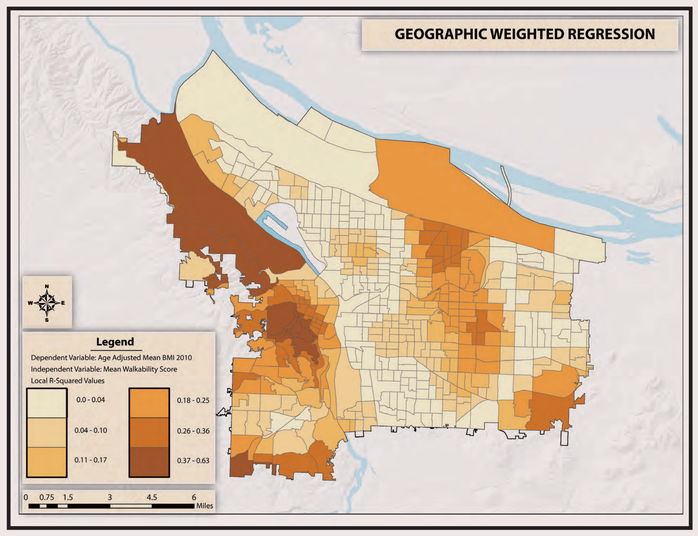
Due to evidence of non-stationarity, geographic weighted regression was selected as a method of analysis over OLS or linear regression models. Performing GWR analysis of mean BMI scores with walkability as the sole explanatory variable results in a strong R-Squared value. Including additional environmental variables, such as population density, only resulted in a reduced R-Squared and increased AICc.

Variable	Value
R^2	0.7935
Adjusted R^2	0.7642
AICc	621.7634

2010 BODY MASS INDEX SCORES



REGRESSION ANALYSIS



REFERENCES

1. Oregon Health Authority. Environmental Public Health Tracking. DMV Records Are Valuable for Monitoring Obesity in Oregon. By Daniel S. Morris. Vol. 1. Portland: 2010

2. City of Portland. Bureau of Planning and Sustainability. 20 Minute Neighborhoods. Vol. 1. Portland: 2012

3. Glazier RH, Creatore MI, Weyman JT, Fazli G, Matheson FI, et al. Density, Destinations or Both? A Comparison of Measures of Walkability in Relation to Transportation Behaviors, Obesity and Diabetes in Toronto, Canada. Toronto: 2014