Gauging the Health Risks Associated With Fast Foods
A Method for Evaluating Fast Food Retailers in Milwaukee County, WI

Ryan Simpson, NUTR-0231 GIS Fundamentals
Wisconsin South State Plane Projection (NAD 1927)

Purpose
This project explores the possibility of using census data on income and age to evaluate fast food retailers in terms of their proximity to schools and low income residents. This information may be useful for prioritizing certain retailers for closer surveillance based on the populations that they serve. With this information, public health agencies can then more efficiently and affordably target specific geographic areas and subpopulations for nutrition-related intervention.

Conceptual Model
Models 1-3 (right) provide the specific entities (food retailers and schools) and conditions (neighborhood density and low income density) explored in this analysis. The first condition, neighborhood density, estimates the density of individuals per block group as well as among surrounding block groups. In contrast, the second condition, low income density, uses estimates of income density as a percentage of low income residents as it wrongly assumes that low income persons are more or less likely to consume fast foods.

Model 1. Neighborhood Density
These scores were developed from block group statistics with gaps caused by large waterfront parks and outdoor recreational areas for which no population statistics are recorded. First, density was calculated from the persons per block group divided by the land area within that block group. Then, focal statistics calculations determined the population density within a 500m radius of every raster cell on the map. Below, darker hues reflect a higher density of peoples (>7000 persons per 500m radius) while lighter hues reflect lower densities (<1000 persons per 500m radius). This score wrongly assumes evenly distributed population density across block groups. This does not address whether densely populated areas are more or less likely to consume fast foods.

Model 2. Low Income Density
Unlike for overall population density, this score first calculated the proportion of households falling in the lowest income bracket (<$15,000) to total households per block group. Then, this proportion was multiplied by the total persons and divided by the land area for that block group. Using focal statistics, a density score similar to neighborhood density was calculated for 500m radii for each raster cell. Below, darker hues reflect higher densities of low-income peoples (>5000 persons per 500m radius) while lighter hues reflect lower densities (<500 persons per 500m radius). This score wrongly assumes evenly distributed population density across block groups and household residents across households.

Model 3. School Cost Distance
All schools and universities are geocoded (not constrained to block group levels) with potential omission of more recent school/university developments and closures since the source data’s publication. (2013) Cost distance scores were developed for estimating travel time on either foot (using footpaths across urban environments) or by car (using primary roadways). This score was calculated by developing a travel time cost estimate (assuming 10 min per km walking rate on footpaths and maximum speed limit on streets) that could apply expected cost of time traveled (minutes) across spatial distances between schools/universities and food retailer consumer profiles, obesity rates within block groups, and average weekly meals consumed by residents at fast food retailers could help illuminate needed interventions.

Analysis & Results
Model 4 (right) illustrates a subpopulation of schools/universities and fast food retailers that can be evaluated using this location evaluation technique. As can be seen, this neighborhood has been evaluated by the estimated density of low income peoples as well as among low income peoples among surrounding block groups. This estimate low density was calculated from block group statistics with gaps caused by large waterfront parks and outdoor recreational areas for which no population statistics are recorded. First, density was calculated from the persons per block group divided by the land area within that block group. Then, focal statistics calculations determined the population density within a 500m radius of every raster cell on the map. Below, darker hues reflect a higher density of peoples (>7000 persons per 500m radius) while lighter hues reflect lower densities (<1000 persons per 500m radius). This score wrongly assumes evenly distributed population density across block groups. This does not address whether densely populated areas are more or less likely to consume fast foods.

Model 4. Example of Fast Food Retailer Evaluation by School Proximity and Low-Income Resident Density

Table 1. Example of Food Retail Summary Statistics

<table>
<thead>
<tr>
<th>Map ID</th>
<th>Retailer</th>
<th>Address</th>
<th>Low Income Residents</th>
<th>School Cost Distance (min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>La Casada</td>
<td>3316 W Lincoln Ave.</td>
<td>&gt; 3,000</td>
<td>2 – 4</td>
</tr>
<tr>
<td>2</td>
<td>Pancho's Bar &amp; Grill</td>
<td>1701 W Lincoln Ave.</td>
<td>&gt; 3,000</td>
<td>0 – 2</td>
</tr>
<tr>
<td>3</td>
<td>Mr. D's Pizza</td>
<td>2038 W Greenfield Ave.</td>
<td>&gt; 3,000</td>
<td>4 – 6</td>
</tr>
<tr>
<td>4</td>
<td>Motaya Mexican American Carryout</td>
<td>2066 S 33rd St</td>
<td>2,800 - 3,200</td>
<td>2 - 4</td>
</tr>
<tr>
<td>5</td>
<td>Krystal's Mexican Restaurant</td>
<td>1520 W Lincoln Ave.</td>
<td>2,800 - 3,200</td>
<td>2 - 4</td>
</tr>
<tr>
<td>6</td>
<td>La Pica</td>
<td>3434 W Lincoln Ave.</td>
<td>2,800 - 3,200</td>
<td>4 - 6</td>
</tr>
<tr>
<td>7</td>
<td>La Guacamaya Mexican Food LLC</td>
<td>565 W Lincoln Ave.</td>
<td>2,400 - 2,800</td>
<td>4 - 6</td>
</tr>
<tr>
<td>8</td>
<td>Mitchell Street Grill</td>
<td>837 W Historic Mitchell St.</td>
<td>2,400 - 2,800</td>
<td>0 - 2</td>
</tr>
<tr>
<td>9</td>
<td>Mitchell Grill and Wraps</td>
<td>604 W Historic Mitchell St.</td>
<td>2,400 - 2,800</td>
<td>2 - 4</td>
</tr>
<tr>
<td>10</td>
<td>Jerry's Pizza</td>
<td>1009 W Lincoln Ave.</td>
<td>2,400 - 2,800</td>
<td>12 - 14</td>
</tr>
</tbody>
</table>

Limitations & Discussion
Though a helpful tool, this model is based on a handful of warping assumptions. First, both neighborhood density and low-income density scores are based on evenly distributed peoples across block groups and households, respectively. Similarly, the low-income density score assumes that low-income residents are evenly dispersed across all households within a block group. As neither of these assumptions are believed to hold, this model likely overestimates the true estimate of low-income persons within 500m of surrounding food retailers.

With regards to the spatial relationship between residents, schools, and food retailers, this calculation follows two key assumptions: expected driving time and expected walking time. For the farmer, estimates were developed using countywide speed limits, likely to over- or underestimate true travel time depending on streetway traffic. Additionally, the model does not consider other mechanisms of transportation such as public transportation, inaccessibility to vehicles, or in the case of younger children, inability to drive. In terms of walking distance, this model likely underestimates walking travel time as all residential lands and urban parks were assumed to be easily traversable, irrespective of buildings, other architecture, or elevation.

Despite its flaws, public health agencies can use this model as a tool for community outreach, nutrition education, and food consumption surveillance. Though not shown in Table 1, sources provide educational and informational insight on differences within and between neighborhoods and their corresponding fast food retailers. Additionally, survey statistics on food retailer consumer profiles, obesity rates within block groups, and average weekly meals consumed by residents at fast food retailers could help illuminate needed interventions.

Recommendations
Future studies should consider incorporating other demographic factors such as age, gender, and racial group differences among subpopulations. This will provide greater insight on differences within and between neighborhoods and their corresponding fast food retailers. Additionally, survey statistics on food retailer consumer profiles, obesity rates among block groups, and average weekly meals consumed by residents at fast food retailers could help illuminate needed interventions.

Data Sources