A latent profile analysis of the food environment in the Brooklyn borough, NYC: Geospatial patterns and associations with fruit, vegetable, and sugary beverages intake among early to late middle-aged adults

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INTRODUCTION

• Neighborhood food environments differ in their degrees of accessibility, affordability, and availability, all of which contribute to differences in individual diet behavior and diet-related chronic disease outcomes.
• In the present study, we combine density and buffer geospatial approaches with latent profile analysis to assess the impact of the food environment on diet.

OBJECTIVES

1) To develop and test clustering properties of the neighborhood food environment measures across five (5) neighborhoods in Brooklyn, NY;
2) To assess associations between neighborhood food environment profiles and diet outcomes (i.e., fruit, vegetable, and sugary beverage consumption).

METHOD

• Data source: Cross-sectional survey focused on adults’ risk perception for cancer and CVD. Geospatial information drawn from NYC Department of Agriculture, Food Help NYC, and NYC Department of Health and Mental Hygiene.
• Setting: Neighborhoods with increased annual cancer cases registered in the Cornell Weill healthcare system (>20% and predominant representation of individuals with low SES (HH income less than $34,999 per year).
• Sample: Survey respondents across five Brooklyn neighborhoods (Bedford-Stuyvesant, Coney Island, Crown Heights, East Flatbush, and Flatbush/Midwood).
• Measures:
  • Food environment: Availability of fast-food restaurants, food retailers, farmer’s markets, community kitchens, SNAP application centers, food pantries, bodegas, and supermarkets within 800 meters (about a half mile, or a 10–15-minute walk) were drawn around each participant’s address.
  • Diet outcomes: Daily serving of fruit, vegetable, and/or sugary beverages using one (1) survey item.
• Covariates: Age, foreign born status, and race (i.e., identifying as Black).
• Analysis:
  • Food environment indicators and participant addresses were geocoded into QGIS 3.14.
  • Latent profile analysis (LPA) was used to identify participants’ neighborhood food environment profiles, based on food environment indicators.
  • Mixed linear regression was used to assess the association between profile memberships and diet outcomes.

RESULTS

Figure 1: Latent neighborhood profiles:
• Limited/low access (blue): (n = 254): likelihood of reliance on a few large supermarkets or restaurants, with much less likelihood to access nearby food pantries, community kitchens, farmer’s markets, or bodegas; overall, very low food access compared to other groups.
• Bodega-dense (grey): (n = 140): likelihood of reliance on either large supermarkets or bodegas for food access, and with some access to farmer’s markets; least access to restaurants in their own communities, and some access to SNAP sign-up locations and food pantries.
• Food swamp (pink): (n = 254): likelihood of reliance on an abundance of nearby fast-food restaurants, with some access to bodegas, farmer’s markets, and food pantries, and the lowest access to community kitchens and SNAP sign-up locations.
• High access (margin): (n = 512): moderate to high access of the majority of food outlets nearby, lower availability of restaurants near by.
• LPA identified four neighborhood food environment profiles of the food environment (with significant high clusters ranging from 17-57 across profiles), as visualized in Figure 2.
• Most participants in the study were females (71%), with a mean age of 61 years.
• Approximately 54% of the sample identified as Black or African-American, most of which were predominantly represented in high food access (79%), food swamp (73%), and bodega-dense (46%) neighborhoods.

Table 2: Multivariate model predicting diet outcomes from neighborhood food profiles and sociodemographic factors using reduced maximum likelihood (REML).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Fruits (servings/day)</th>
<th>Vegetables (servings/day)</th>
<th>Sugary drinks intake (servings/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>2.96 (2.27)</td>
<td>2.37 (2.63)</td>
<td>1.24 (2.24)</td>
</tr>
<tr>
<td>Age</td>
<td>0.13 (0.05)</td>
<td>0.37 (0.11)</td>
<td>0.12 (0.05)</td>
</tr>
<tr>
<td>Food swamp</td>
<td>0.11 (0.05)</td>
<td>0.38 (0.11)</td>
<td>0.12 (0.05)</td>
</tr>
<tr>
<td>Limited/low access</td>
<td>0.01 (0.05)</td>
<td>0.37 (0.11)</td>
<td>0.12 (0.05)</td>
</tr>
<tr>
<td>Bodega</td>
<td>0.11 (0.05)</td>
<td>0.38 (0.11)</td>
<td>0.12 (0.05)</td>
</tr>
<tr>
<td>Food swamp</td>
<td>0.11 (0.05)</td>
<td>0.38 (0.11)</td>
<td>0.12 (0.05)</td>
</tr>
<tr>
<td>U.S. Born</td>
<td>-1.03** (-1.35)</td>
<td>0.63* (1.97)</td>
<td>0.12 (0.05)</td>
</tr>
</tbody>
</table>

Note: B Unstandardized Coefficient, SE Standard Error, Z Standard Score Statistic, *p < 0.05 **p < 0.01.

• Only participants in the limited/low food access profile were more likely to consume sugary drinks compared to those in the bodega profile (b = .44, p < 0.05) in adjusted models. (see Table 2). On average, participants who identified as Black or African American reported less vegetable consumption (b = -.13, p < 0.01) and greater sugary beverage intake (b = .50, p < 0.01) than other racial and ethnic groups in this sample. Also, participants who were born in the U.S. were less likely to consume fruit (b = -.13, p < 0.01), but more likely to consume vegetables (b = .12, p < 0.05) and sugary beverages (b = .17, p < 0.01).

CONCLUSION

• In sum, this study identified four neighborhood profiles of the food environment in Brooklyn, NYC.
• Individuals in limited and low food access neighborhoods, as well as minoritized Brooklyn residents, are in a vulnerable position to consume significant amounts of SBs compared to those in bodega-dense neighborhoods.
• Further research is warranted to elucidate strategies to alleviate food security that leverage local food environments (i.e., bodegas) for health and nutrition promotion in urban settings.

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SELECT REFERENCES

• New York City Department of Health and Mental Hygiene. Community Health Survey; public use dataset accessed on October 10, 2020.