

# 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).

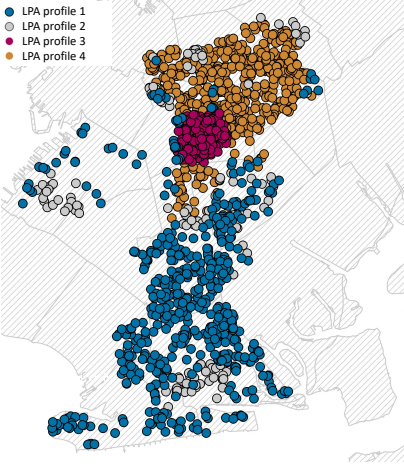
## METHOD

- **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):** ( $n = 587$ ): 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 (marigold):** ( $n = 512$ ): moderate to high access of the majority of food outlets nearby, lower availability of restaurants nearby.



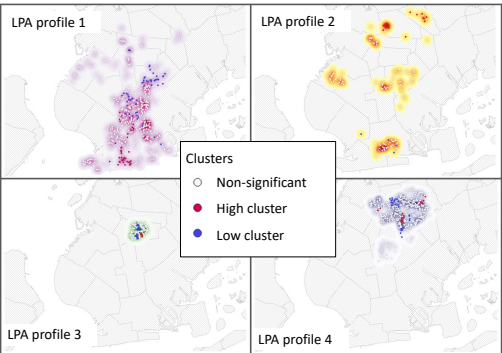
- LPA identified four neighborhood food environment profiles of the food environment (with significant high clusters ranging from 17-57 across profiles), as visualized in **Figure 2**.
- Most participants in the study were females (71%), with a mean age of 61 years.
- Approximately 54% of the sample 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.** Multilevel model results predicting diet outcomes from neighborhood food profiles and sociodemographic factors using Reduced Maximum Likelihood (REML)

Variables	Fruit intake (servings/day)			Vegetable intake (servings/day)			Sugary drink intake (servings/day)		
	B	SE	Z	B	SE	Z	B	SE	Z
Limited food access (ref)	--	--	--	--	--	--	--	--	--
Bodega-dense	-.06	.09	-.63	-.11	.09	-1.24	-.24*	.10*	-2.27*
Food swamp	.06	.08	-.37	.05	.08	.63	.07	.09	.24
High food access	.07	.07	-.86	-.03	.06	-.54	.14	.07	1.87
Age	-.00	.00	-.63	-.00*	.00*	-2.53*	.00	.00	1.52
Sex	-.02	.05	-.37	-.10	.05	-1.84	.47**	.06**	7.53**
NH Black	-.05	.06	-.86	-.15*	.06*	-2.48*	.50**	.06**	7.44**
U.S. Born	-.13**	.05**	-2.63**	.12*	.05*	2.40*	.17**	.05**	3.07**
Intercept	2.04**	.13**	15.00**	2.17**	.13**	16.17**	.44**	.14**	2.96**

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 ( $b = -.15$ ,  $p < 0.05$ ) 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 ( $b = .17$ ,  $p < 0.01$ ).



**Figure 2:** Cluster analysis revealed that the (a) limited/low access profile had 57 significantly high clusters, (b) the bodega-dense profile had 21 significantly high clusters, (c) the food swamp profile had 17 significantly high clusters, and (d) the high food access profile had 25 significantly high clusters. Note: Heatmaps indicates density; darker shades indicate higher density

## 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 SSBs 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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