Food Insecurity and Academic Outcomes: Analyzing Supermarket Density and School Performance in NYC

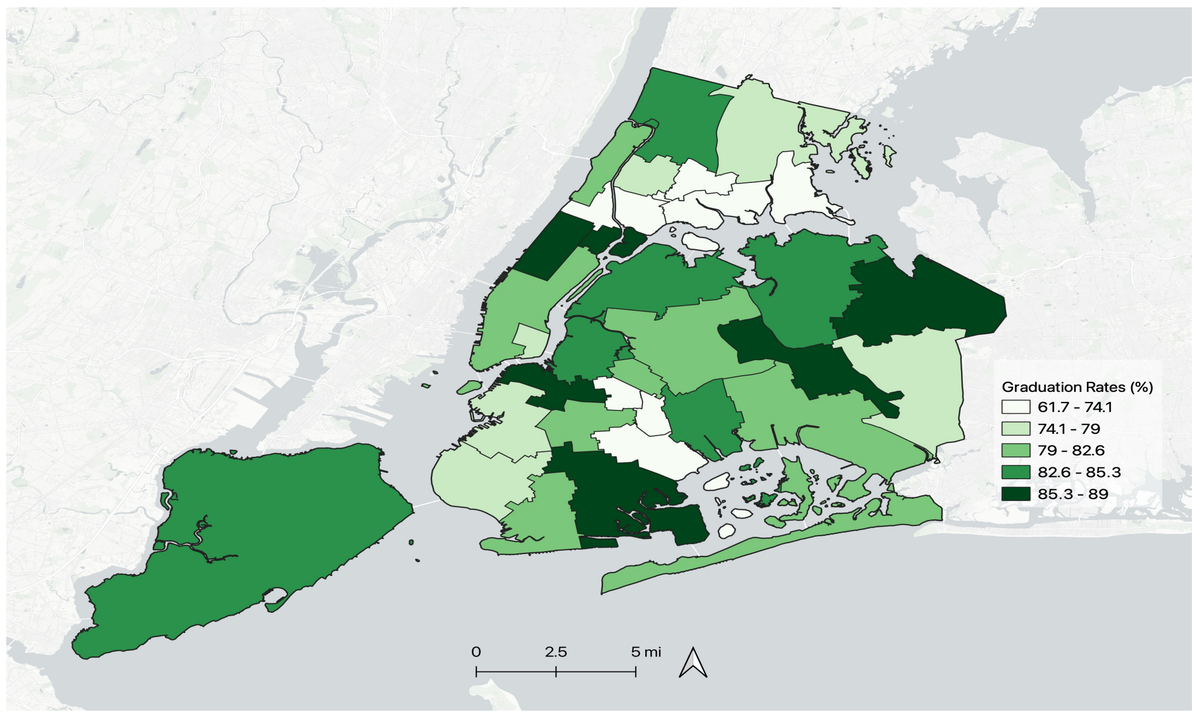
Brianna Carnagie, MPH Candidate[1]

Columbia University Mailman School of Public Health, Department of Epidemiology

Background

- Food insecurity, or the lack of reliable access to nutritious food, is a known impediment to cognitive and academic development in children. In urban areas like New York City, this issue is particularly pressing due to socioeconomic disparities.
- Previous research has demonstrated a clear association between poor nutrition and cognitive deficits, which can significantly hinder academic performance and future opportunities.
- This study employs a novel approach by using the density of supermarkets in school districts to measure food access and analyzing its relationship with graduation rates across the five boroughs of New York City.
- The research contributes to the discourse on the intersection of public health and education, emphasizing the need for integrated policy interventions.

Figure 1. Graduation Rates of NYC Public School Districts, 2018.



Methods

- Graduation rate data was sourced from the NYC Open Data portal, encompassing the academic year 2017-2018 for public schools within the five boroughs. Supermarket locations were extracted from OpenStreetMap (OSM) using the Overpass API, with the term 'supermarket' employed to filter relevant points of interest.
- The obtained datasets were cleaned to ensure accuracy by removing any duplicates and verifying the consistency of entries.
- Using QGIS software, supermarket locations were overlaid onto an NYC school district boundary map. Each supermarket was spatially joined to its corresponding school district to facilitate the analysis of food accessibility in relation to educational outcomes.
- GeoDa was utilized to perform bivariate Moran's I spatial autocorrelation analysis, which allowed us to examine the spatial correlation between the number of supermarkets in each New York City school district and the corresponding graduation rates.

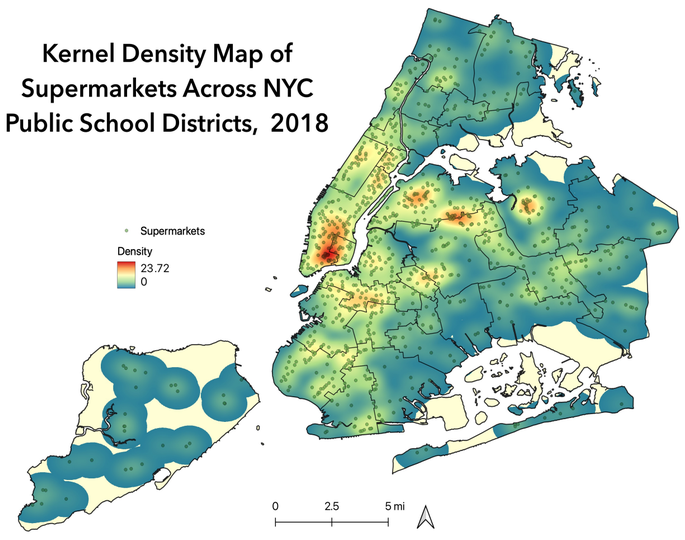


Figure 2. KDE Map of Supermarkets, 2018.

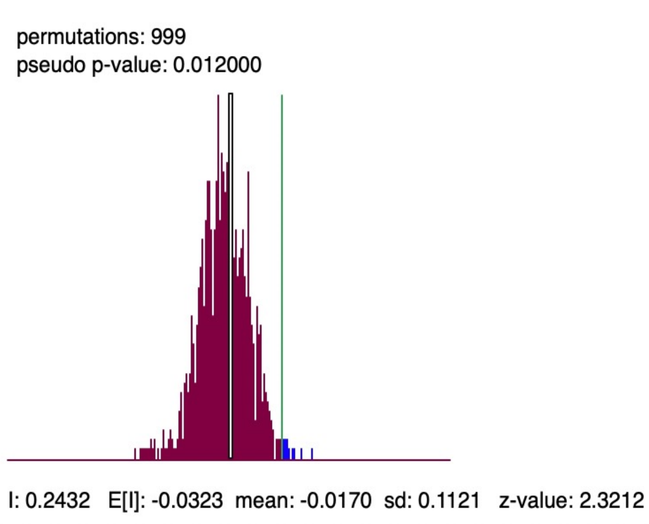


Figure 3. Bivariate Local Moran's I Histogram with 999 Permutations.

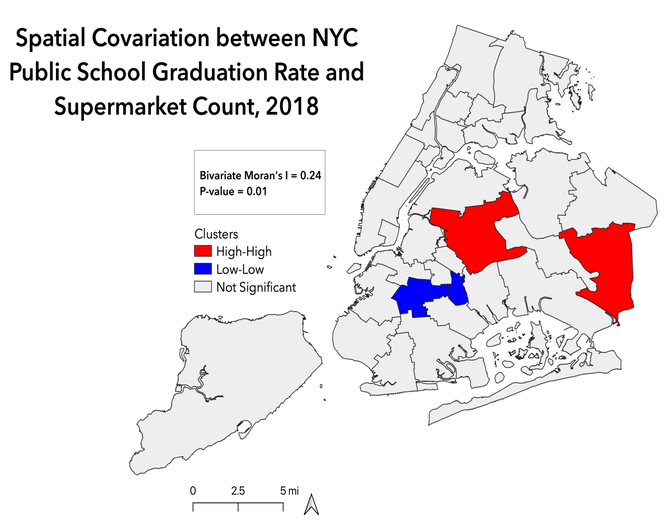
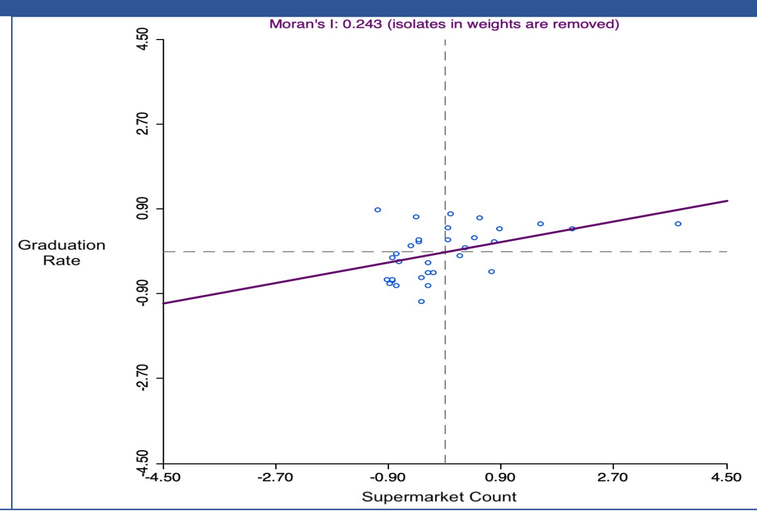


Figure 4. LISA Clusters Map Between Supermarket Density and Graduation Rates, 2018.

Results

The bivariate Moran's I analysis yielded a value of **0.243 (p=0.01).** This result indicates a **positive spatial correlation** between the number of supermarkets per school district and the graduation rates in New York City school districts.



This analysis, while not implying causation, points to key areas for urban policy interventions to enhance food access and education, supported by the significant p-value indicating a robust spatial relationship. Further research should focus on supermarket quality, socioeconomic factors, and community resources to understand their influence on educational success.

Limitations & Conclusions

Limitations

- The number or supermarkets may not be an exhaustive indicator of food insecurity across school districts.
- The analysis was based on data limited to public schools, excluding private and charter schools. Supermarket data, sourced from OSM, may not encompass smaller, informal vendors.

Conclusions

- I observed a tendency for school districts with higher supermarket densities to correlate with higher graduation rates. Conversely, districts with fewer supermarkets often aligned with lower graduation rates.
- Further studies could explore the impact of other variables, such as income levels or access to public transportation, on these findings. Longitudinal data could also shed light on how these relationships evolve over time.
- This study suggests a link between supermarket access and educational outcomes, offering valuable insights for data-driven urban planning and policymaking.

Contact

Brianna Carnagie
Columbia University Mailman School of Public Health
Email: bac2214@columbia.edu
Website: bcarnagie.github.io
Phone: 347-319-4749

References

1. Alaimo, K., Olson, C. M., & Frongillo, E. A., Jr (2001). Food insufficiency and American school-aged children's cognitive, academic, and psychosocial development. Pediatrics, 108(1), 44–53.
2. Ames, A. J., Ames, G. C. W., Houston, J. E., & Angioloni, S. (2016). FOOD INSECURITY AND EDUCATIONAL ACHIEVEMENT: A MULTI-LEVEL GENERALIZATION OF POISSON REGRESSION. International Journal of Food and Agricultural Economics (IJFAEC), 4(1), 21-34. https://ageconsearch.umn.edu/record/231359
3. Elbel B, Tamura K, McDermott ZT, Duncan DT, Athens JK, Wu E, Mijanovich T, Schwartz AE. Disparities in food access around homes and schools for New York City children. PLoS One. 2019 Jun 12;14(6):e0217341. doi: 10.1371/journal.pone.0217341. PMID: 31188866; PMCID: PMC6561543.
4. Faught, E. L., Williams, P. L., Willows, N. D., Asbridge, M., & Veugelers, P. J. (2017). The association between food insecurity and academic achievement in Canadian school-aged children. In Public Health Nutrition (Vol. 20, Issue 15, pp. 2778–2785). Cambridge University Press (CUP). https://doi.org/10.1017/s1368980017001562
5. Howard, L. L. (2011). Does food insecurity at home affect non-cognitive performance at school? A longitudinal analysis of elementary student classroom behavior. Economics of Education Review, 30(1), 157-176. https://doi.org/10.1016/j.econedurev.2010.08.003
6. Jyoti, D. F., Frongillo, E. A., & Jones, S. J. (2005). Food insecurity affects school children's academic performance, weight gain, and social skills. The Journal of nutrition, 135(12), 2831–2839. https://doi.org/10.1093/jn/135.12.2831
7. Orihuela, C. A., Cox, C., Evans, R., & Mrug, S. (2023). Associations of Household Food Insecurity With Academic Outcomes in Early Adolescents. In Journal of School Health (Vol. 93, Issue 10, pp. 883–890). Wiley. https://doi.org/10.1111/josh.13358
8. Shankar, P., Chung, R., & Frank, D. A. (2017). Association of Food Insecurity with Children's Behavioral, Emotional, and Academic Outcomes: A Systematic Review. Journal of developmental and behavioral pediatrics : JDBP, 38(2), 135–150. https://doi.org/10.1097/DBP.0000000000000383
9. von Maltzahn, A. (2019). Investigating the relationship between household food insecurity and academic performance among Nova Scotia elementary school students (Unpublished master's thesis). Dalhousie University, Halifax, Nova Scotia.
10. Winicki, J., & Jemison, K. (2003). Food insecurity and hunger in the kindergarten classroom: Its effect on learning and growth. Contemporary Economic Policy, 21(2), 145-157. https://doi.org/10.1093/cep/byg001