Heterogeneous Effects in the Built Environment

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Introduction

- The availability of built environment amenities may affect members of the population differently.
- We adapt our previous method, Spatial Temporal Aggregated Predictors [1], to identify these **heterogeneous effects**.
- We examine the relationship between availability of fast food restaurants (FFRs) near schools (a point pattern predictor) and child obesity.

Motivating Data

- Obesity status of 5th grade students attending California public schools during 2010-2011 academic year (source: FitnessGram© test[2]).
- Locations of FFRs were obtained though a commercial data source [3].

Table 1:CA Schools' 2010 Descriptive Information

Urbanicity	Rural	Suburban	Urban
Total Number of Schools	712	1857	2200
Mean # of Obese Students	19.33	27.24	33.63
Mean # of Students	61.54	88.40	88.22

Figure 1:Example FFR Data in Los Angeles, CA

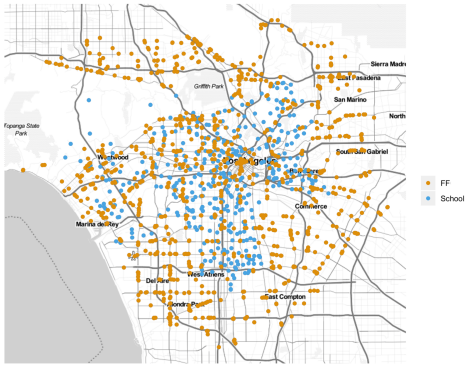
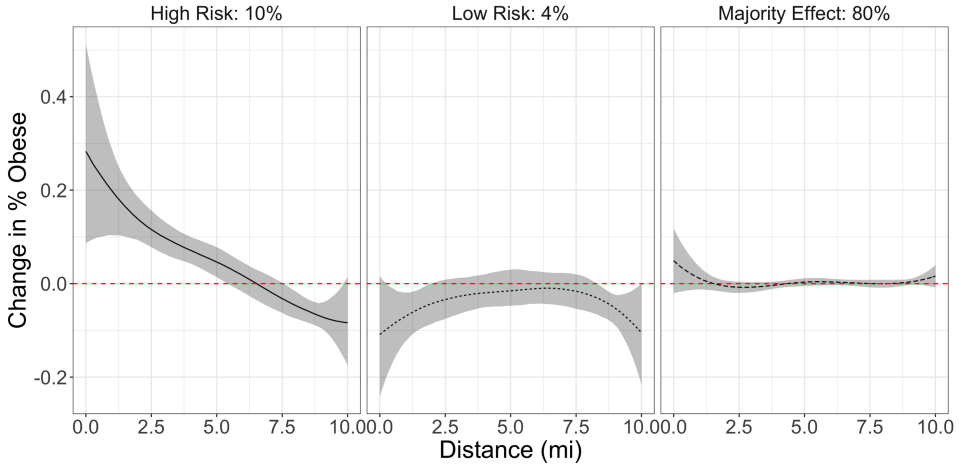


Figure 2:FFR Heterogeneous Exposure Effects on Childhood Obesity with Median and 95% Credible Intervals



Main takeaways

- FFR exposure effects decompose into three major groups.
- This decomposition reinforces prevailing ideas that different populations interact with and are affected by the built environment in different ways.

Modeling Framework

The STAP-DP model is parameterized in the following manner:

$$E[\%\text{Proportion Obese}_i] = \boldsymbol{Z}_i^T\delta + f_i(\text{FFR Exposure}), \quad i = 1, ..., 4769 \tag{1}$$

where

$$f_i(\text{FFR Exposure}) = \sum_{d\in\mathcal{D}_i}\sum_{j=1}^{J}\beta_{ij}\phi_j(d)$$
$$(\boldsymbol{\beta_i}, \boldsymbol{\tau}_i) \sim DP(\alpha, G_0)$$
$$\alpha \sim \text{Gamma}(a_\alpha, b_\alpha)$$
$$G_0 \equiv N(0, \sigma^2\tau) \times \text{Inv-Gamma}(1, 1)$$

- $\boldsymbol{Z}_i$ represents school level covariates and $\boldsymbol{\delta}$, their corresponding effects.
- $\phi_j(d)$ is a b-spline basis function expansion of the euclidean distance, d, between the FFR and school.
- $\mathcal{D}_i$ is the set of distances between school i and FFRs within 10 miles.
- $DP(\alpha, G_0)$ is a Dirichlet Process with concentration parameter α and base measure G_0.

Group Analysis

Median Income (1000 USD)	Majority %	High Risk %	Low Risk %
(11,68]	84	10	5
(68,124]	84	12	4
(124,181]	86	10	4
(181,238]	81	9	10
Urbanicity			
Rural	82	11	4
Sub-Urban	84	11	4
Urban	84	11	5

Table 2:Cluster Assignment Probability by School Characteristics

References

[1] Adam Peterson and Brisa Sanchez. rstap: An R package for spatial temporal aggregated predictor models. *arXiv preprint arXiv:1812.10208*, 2018.

[2] https://www.cde.ca.gov/ta/tg/pf/, Nov 2017.

[3] D Walls. National establishment time-series (nets) database: 2012 database description. *Oakland: Walls & Associates*, 2013.

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