

# Using Big Data to Evaluate Equitable Access to Community Resources

Transportation Research Board Annual Meeting

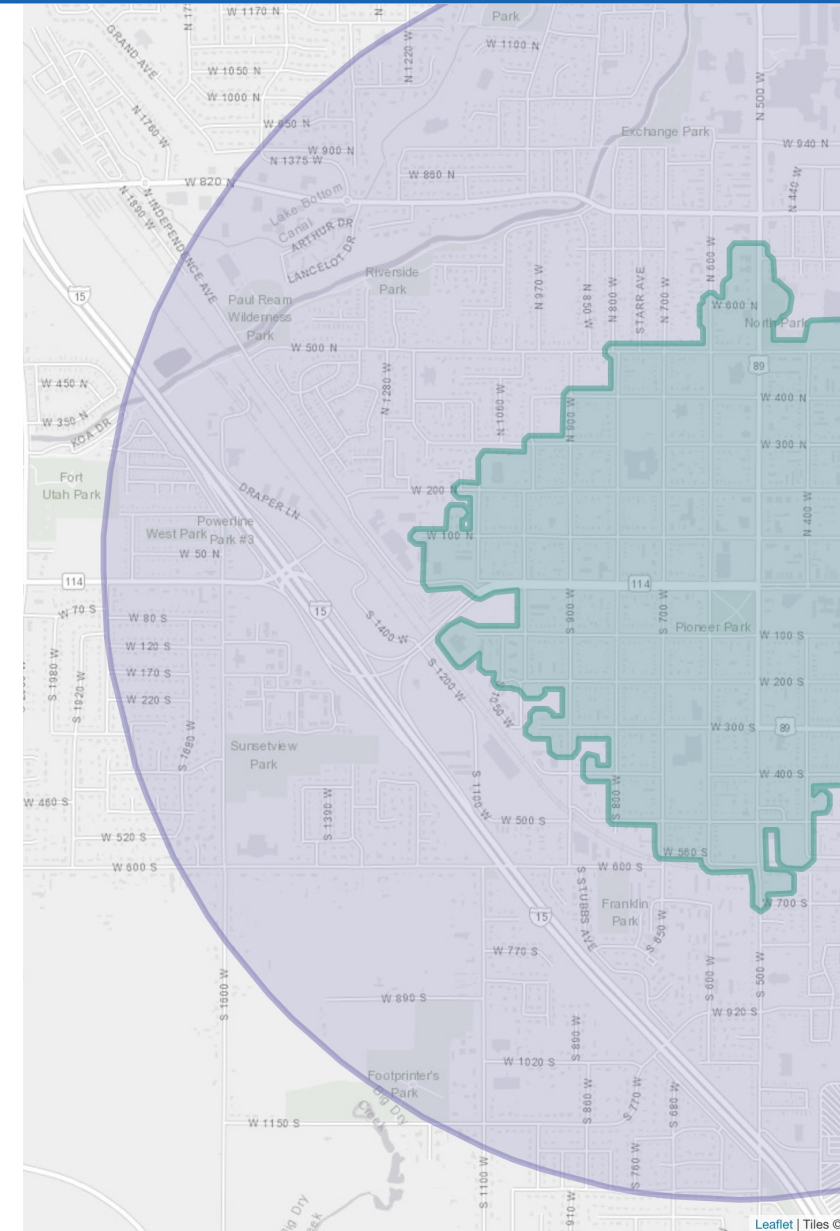
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- Access and Equity
- Methodology
  - utility-based access from location-based services data
- Some findings:
  - Correlation of access and health
  - Heterogeneity in attitudes
  - Benefits of shifting streets

# Access to Community Resources

- Lack of consistency in spatial impact findings
  - Parks access and physical / mental health
  - Nutrition access and physical health
  - Libraries and community membership / educational attainment
- Frustrating inconsistency in spatial definitions
  - Percent of green space within 5 miles / any park within 10 minute walk, etc.
  - A “high-quality” grocery store within 1 mile



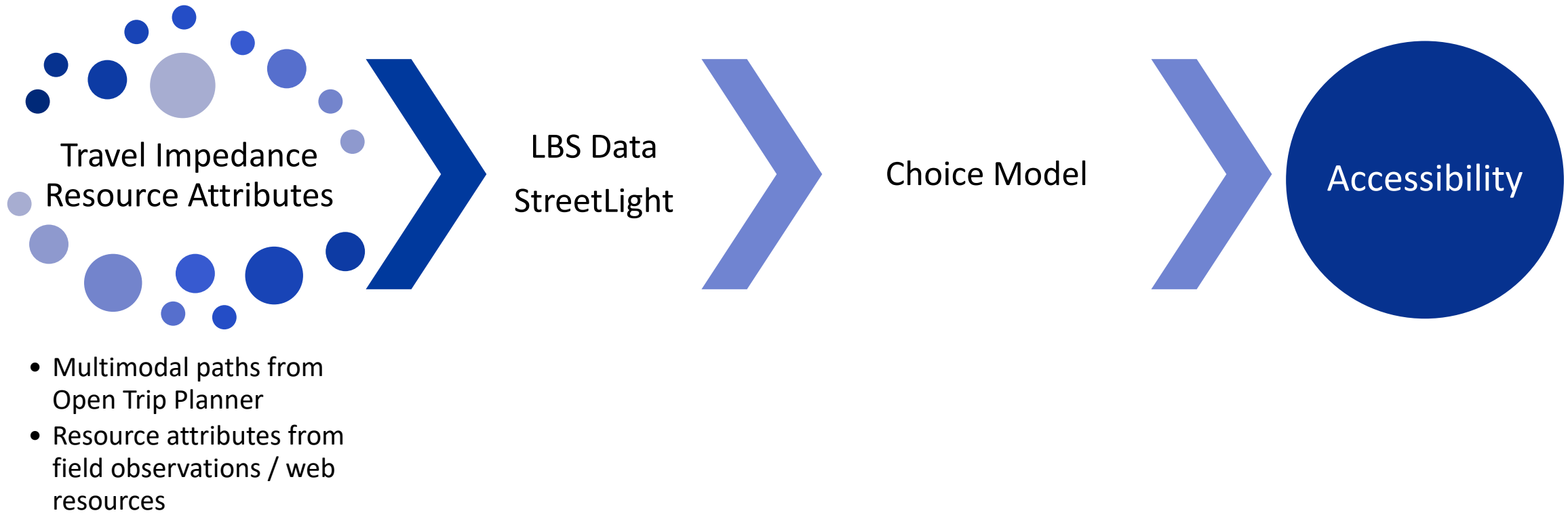
A destination choice model logsum gives a measure of access at zone  $i$

$$A_i = \ln \sum_{j \in J} \exp(u_{ij})$$

Where  $u_{ij}$  is the *utility* of destination  $j$ ,

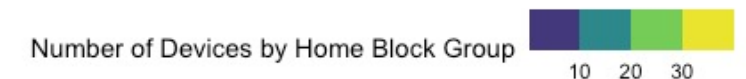
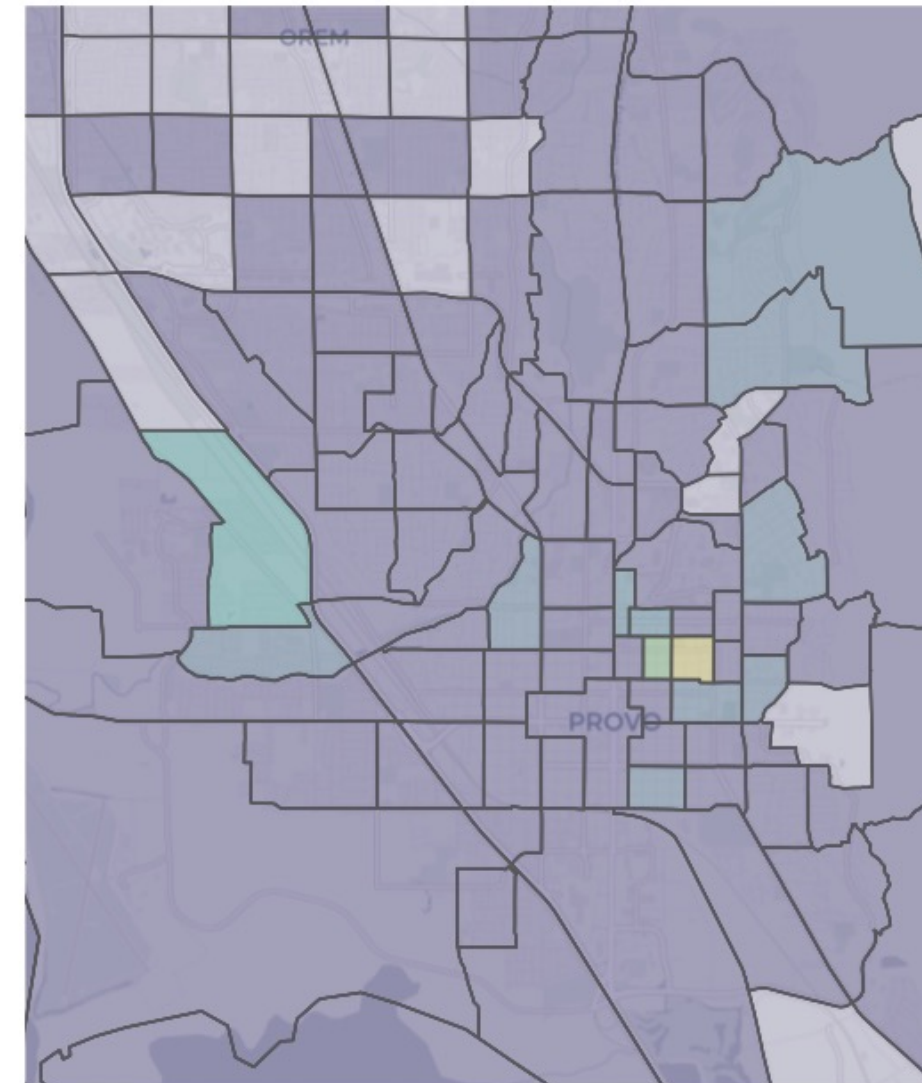
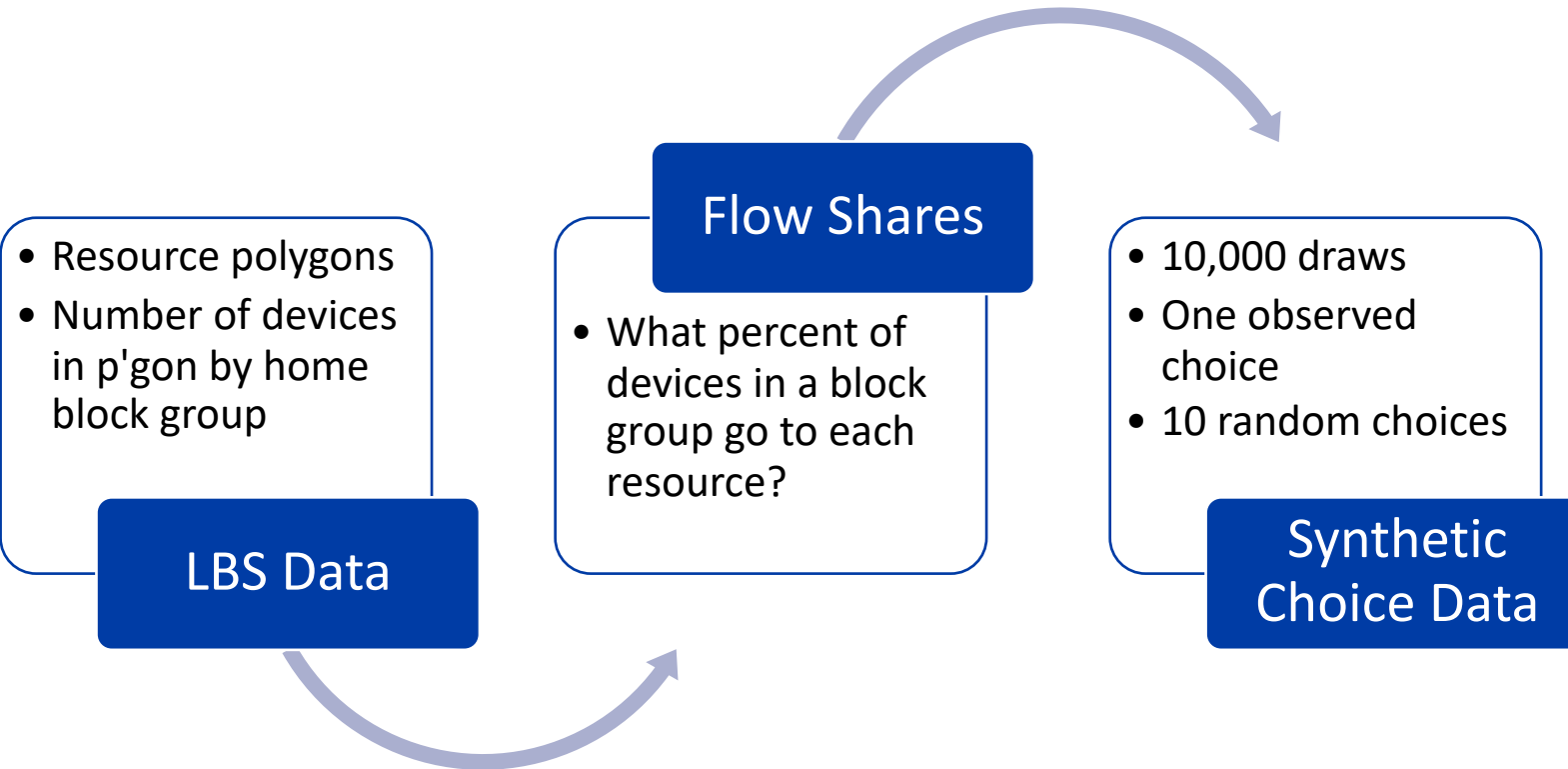
$$u_{ij} = \beta_t t t_{ijk} + X_j \beta$$

Problem: how to get plausible estimates of  $\beta$ ?





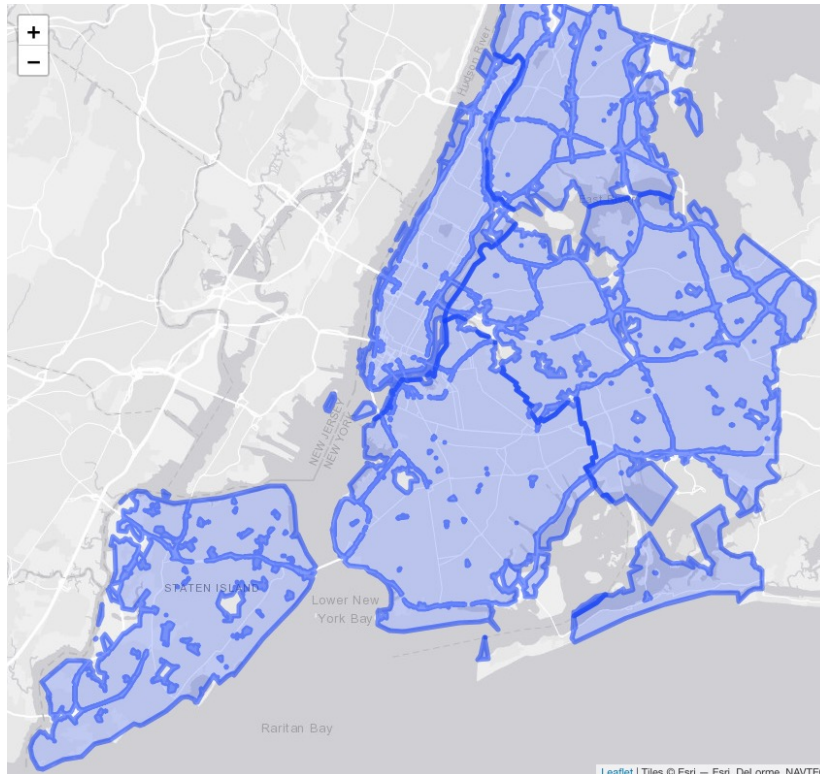
# Location-based Services Data



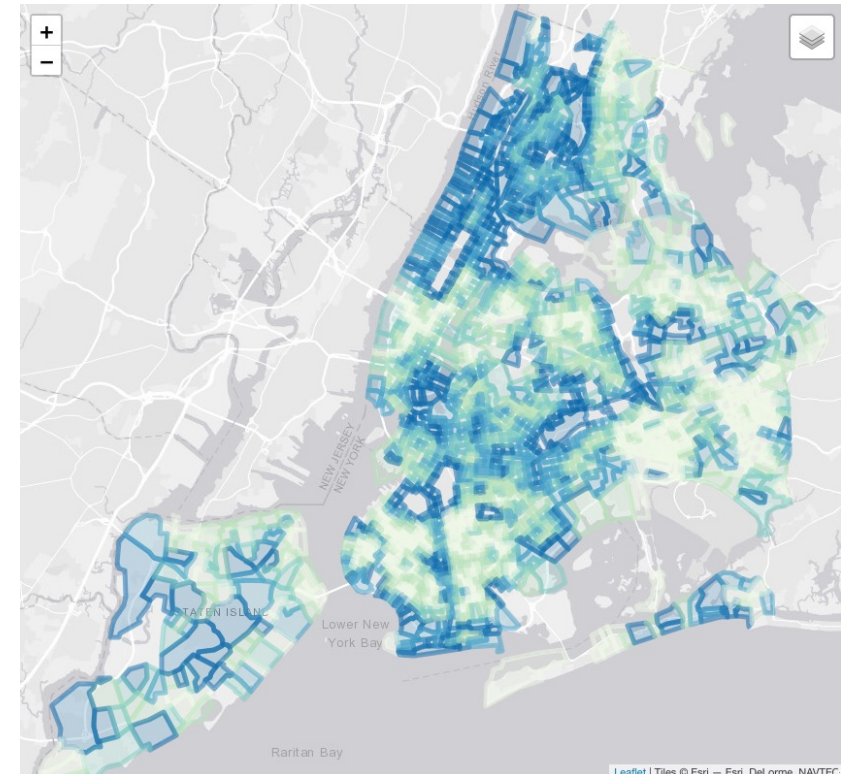
# Buffers vs Utility-based Access

## ParkScore

10-minute network walk



## Utility Logsums



Correlation w/  
utility-based  
access, not with  
walk buffer

Macfarlane, G.S., Boyd, N., Taylor, J.E., & Watkins, K. (2021). Modeling the impacts of park access on health outcomes: A utility-based accessibility approach. *Environment and Planning B: Urban Analytics and City Science*, 48(8), 2289–2306.

Table 3. Estimated Effect of Accessibility on Physical Activity Rates

	Size and Distance	Amenities	10-Minute Walk
Accessibility	0.2306* [0.0907; 0.3705]	0.1923* [0.0498; 0.3347]	0.5865 [−0.1778; 1.3508]
Num. obs.	2099	2099	2099
Parameters	28	28	28
Log Likelihood	−4433.0965	−4434.7087	−4436.9264

\* Null hypothesis value outside the confidence interval. 95% confidence interval in brackets.  $y$  = tract-level physical activity rate.

Table 4. Estimated Effect of Accessibility on Obesity Rates

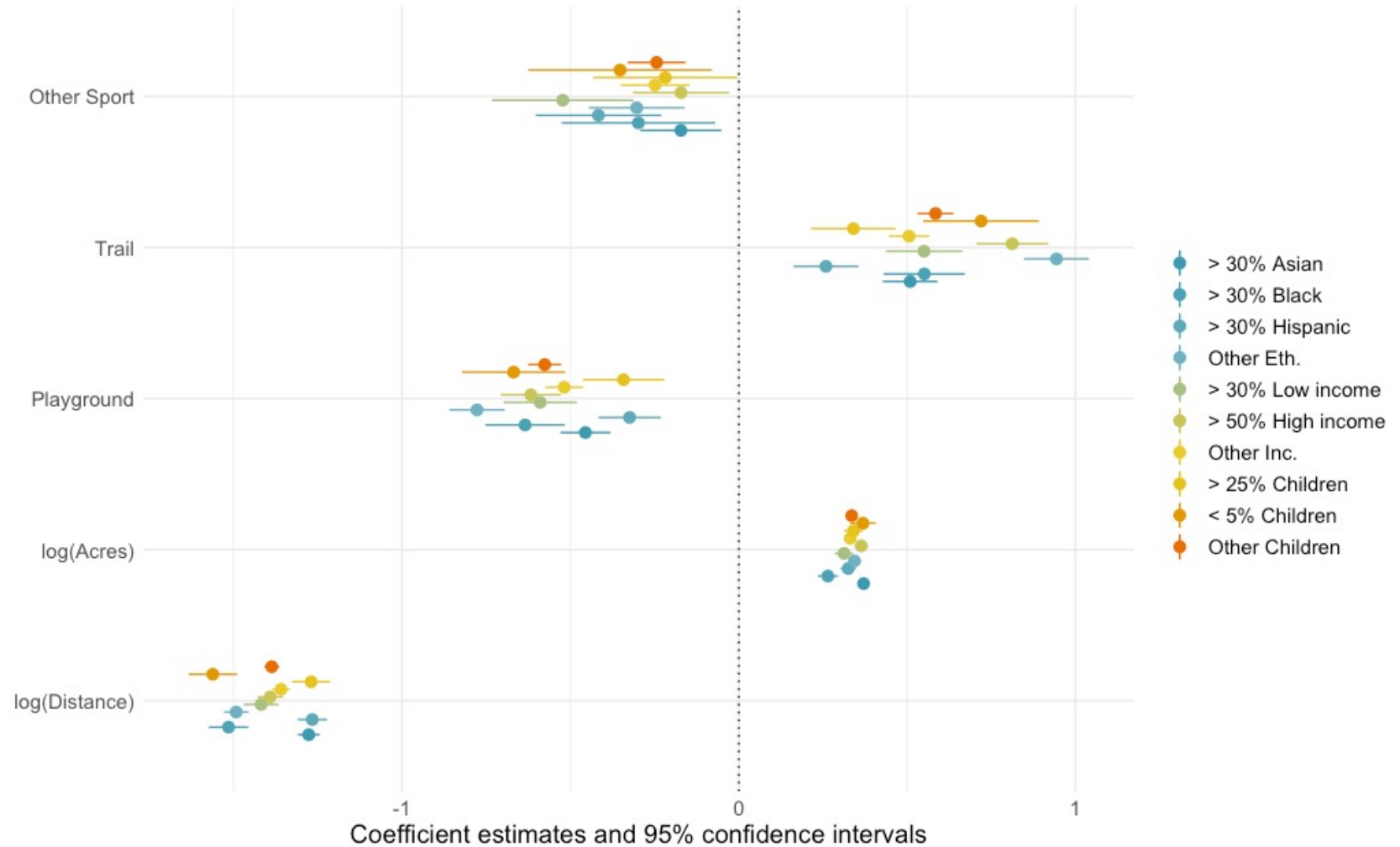
	Size and Distance	Amenities	10-Minute Walk
Physical Activity	−0.4798* [−0.5039; −0.4556]	−0.4800* [−0.5041; −0.4558]	−0.4803* [−0.5044; −0.4562]
$\gamma$ : Physical Activity	0.0207 [−0.0371; 0.0785]	0.0204 [−0.0375; 0.0782]	0.0173 [−0.0404; 0.0750]
Accessibility	−0.0495 [−0.1260; 0.0270]	−0.0471 [−0.1259; 0.0316]	−0.2630 [−0.6491; 0.1232]
Num. obs.	2099	2099	2099
Parameters	30	30	30
Log Likelihood	−3113.5891	−3113.7048	−3113.5028

\* Null hypothesis value outside the confidence interval. 95% confidence interval in brackets.  $y$  = tract-level obesity rate.



# Heterogeneity in Park Preferences

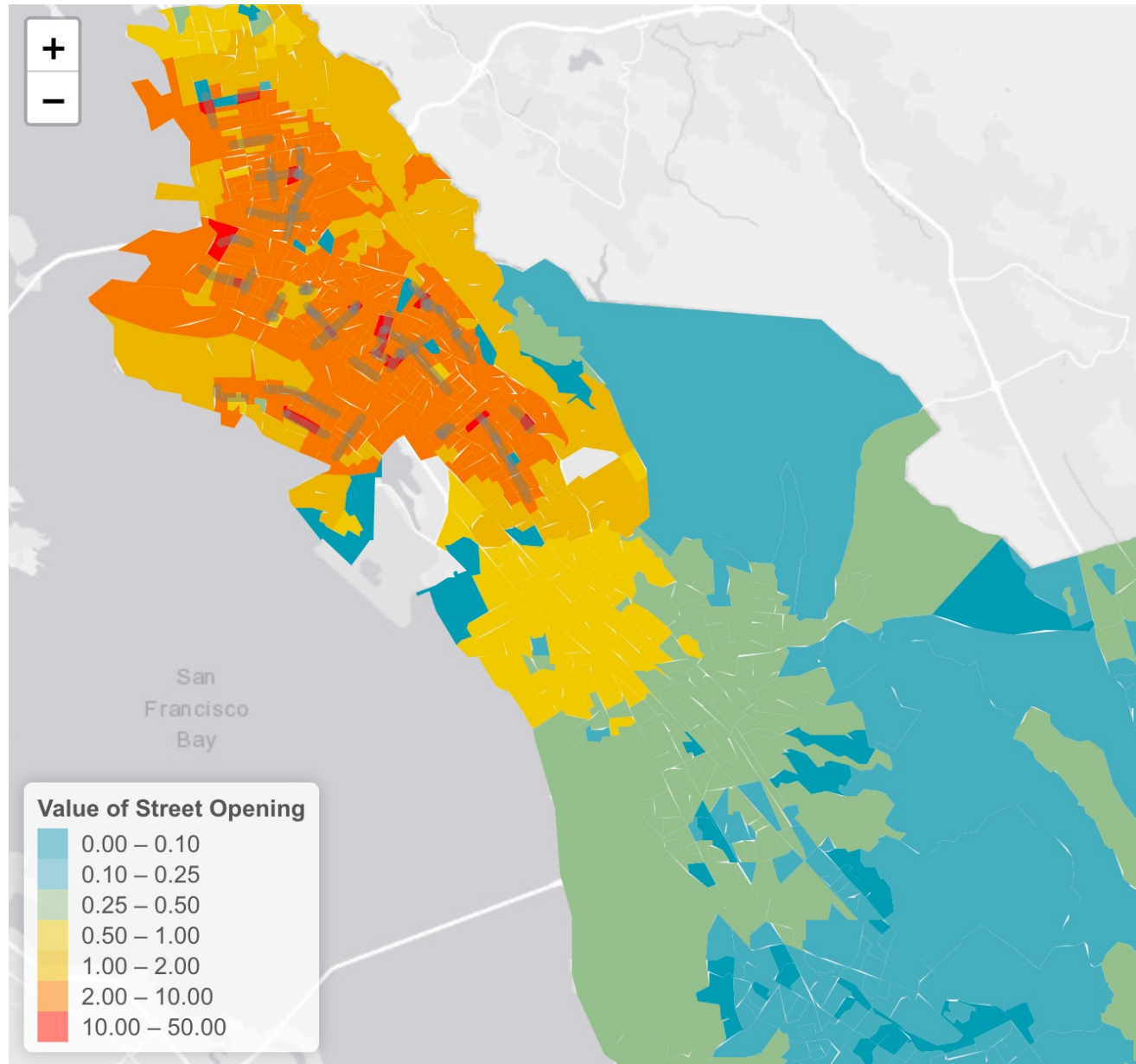
Macfarlane, G.S., Turley Voulgaris, C., & Tapia, T. (2021). If you build it who will come? Equity analysis of park system changes during COVID-19 using passive origin-destination data. Under second-round review.



# Benefit of Converting Streets to "Parks"

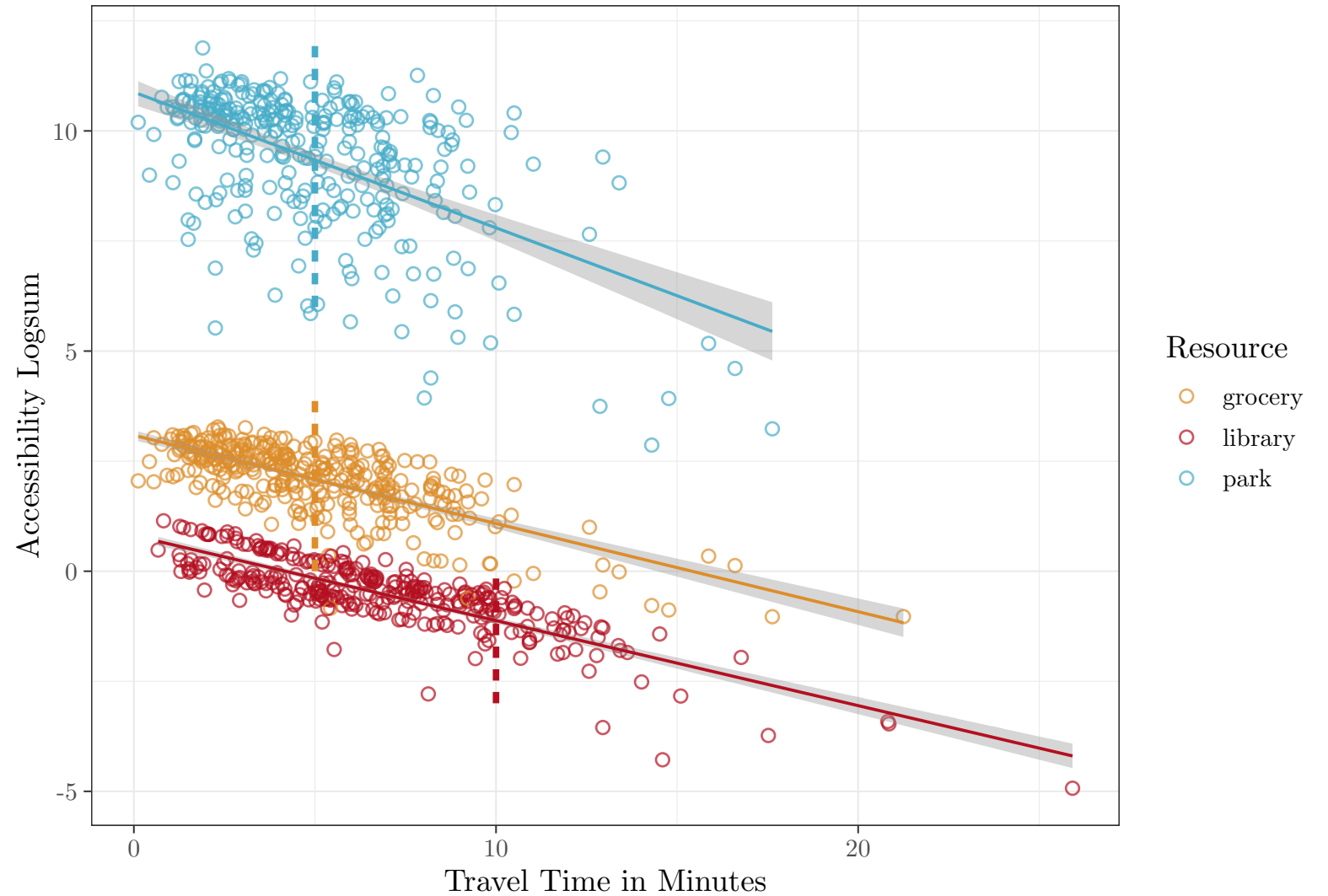
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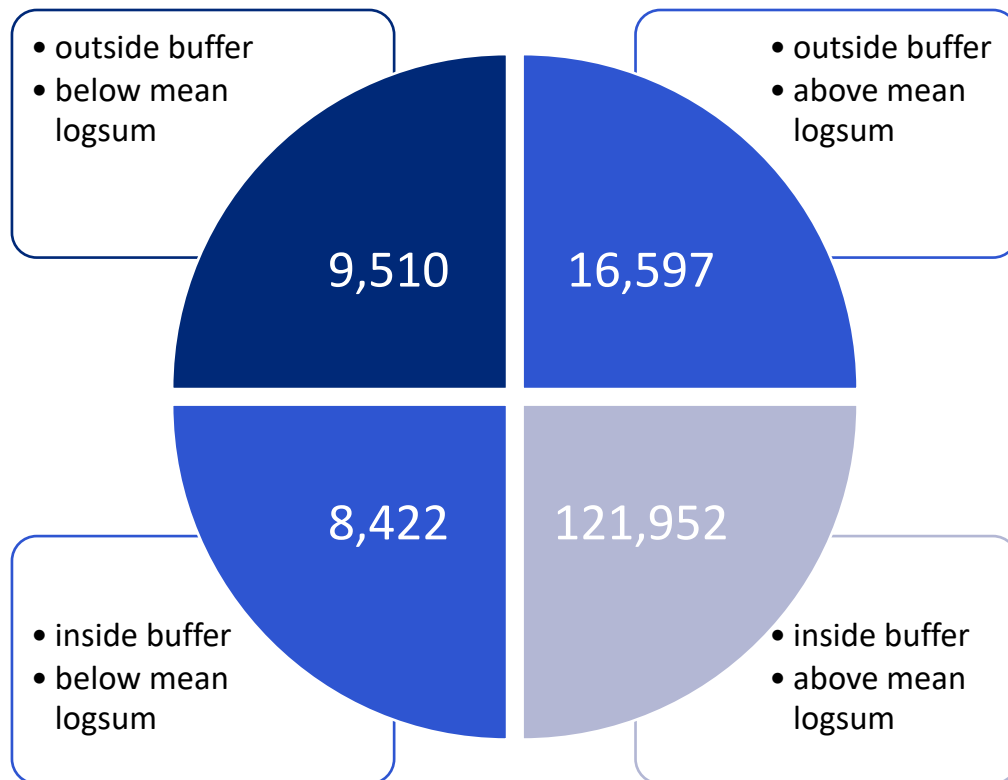


# Utah County

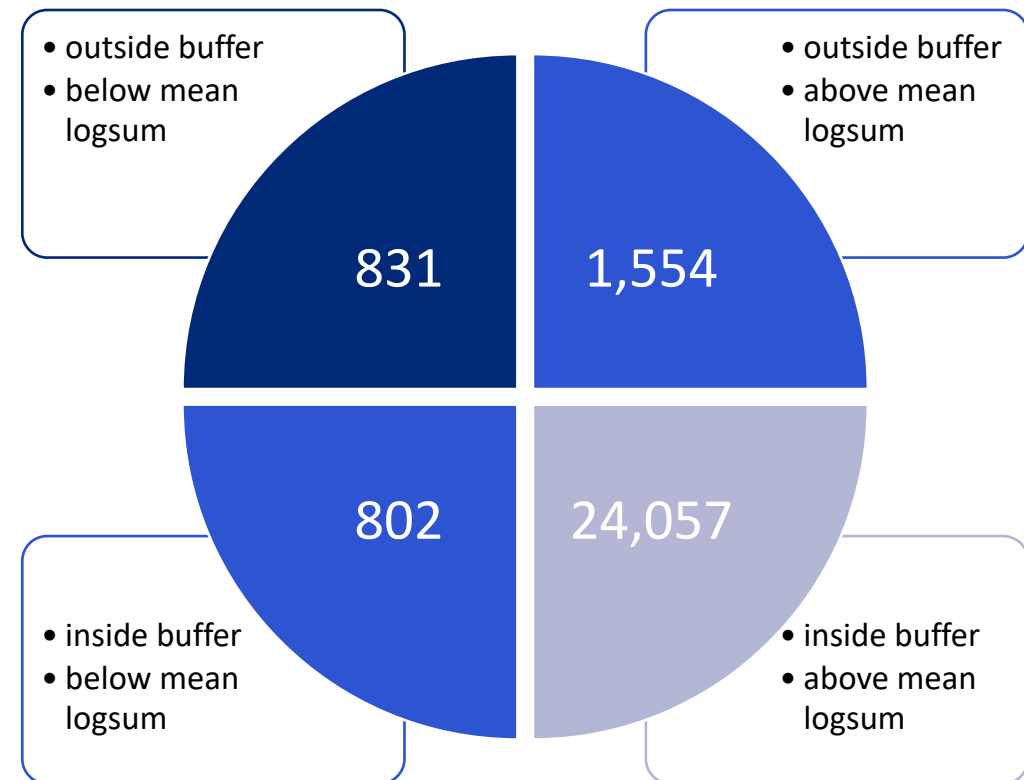
Travel time is correlated with utility-based logsum, but there is large variance



## All Households



## Low-income (<\$35k) Households





## Strengths

- Availability / Convenience

## Limitations

- Block-group correlation, not individual
  - Can segment
- Cannot guarantee activity was accomplished
- May uncover spatial availability more than real preferences



# Thank You

[gregmacfarlane.github.io](https://gregmacfarlane.github.io)

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