Linking Potentially Misclassified Healthy Food Access to Diabetes Prevalence

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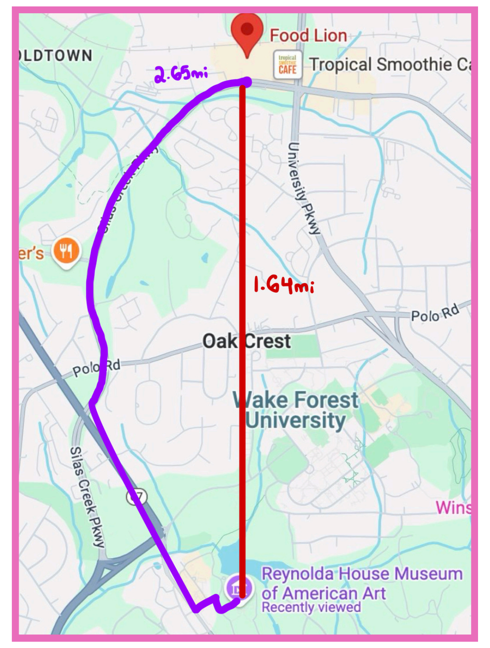
for more!

1. Motivation

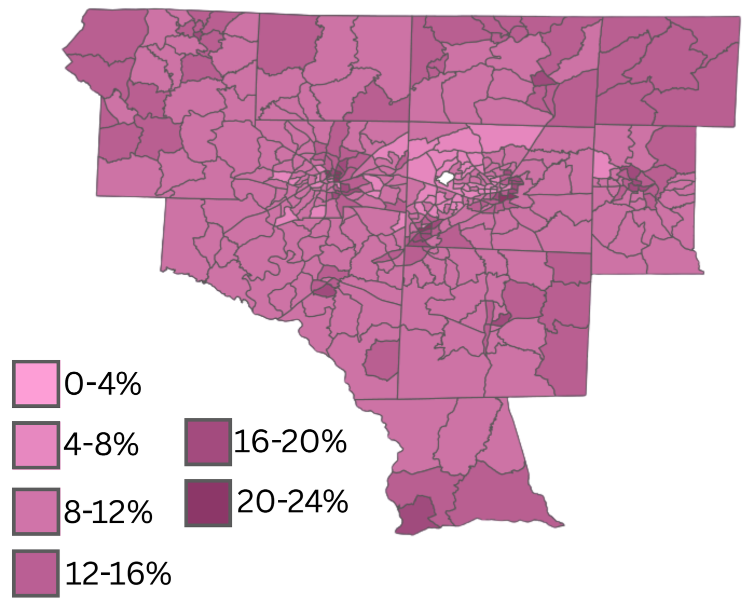
- A healthy diet increases the likelihood of good overall health and decreases risk of preventable illness (1).
- Maintaining a healthy diet requires consistent access to healthy food, which may be hindered by geography, income, or social factors such as structural racism.
- Review studies found high prevalence of diabetes in food-insecure households (2).

2. Distances and Data

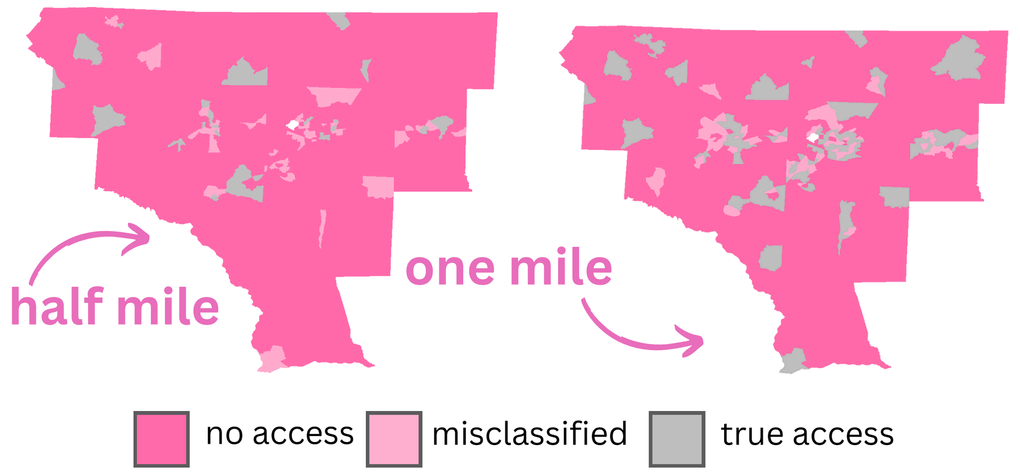
Distances



Diabetes Prevalence



Food Access



- We **measure food access** by constructing an **indicator variable** that evaluates to 1 if at least one healthy food retailer exists within a **given distance**.
- We **measure distance** in two ways, the **Haversine** distance and **route-based** driving distance.

(accurate but expensive)

(error-prone and always an underestimate)

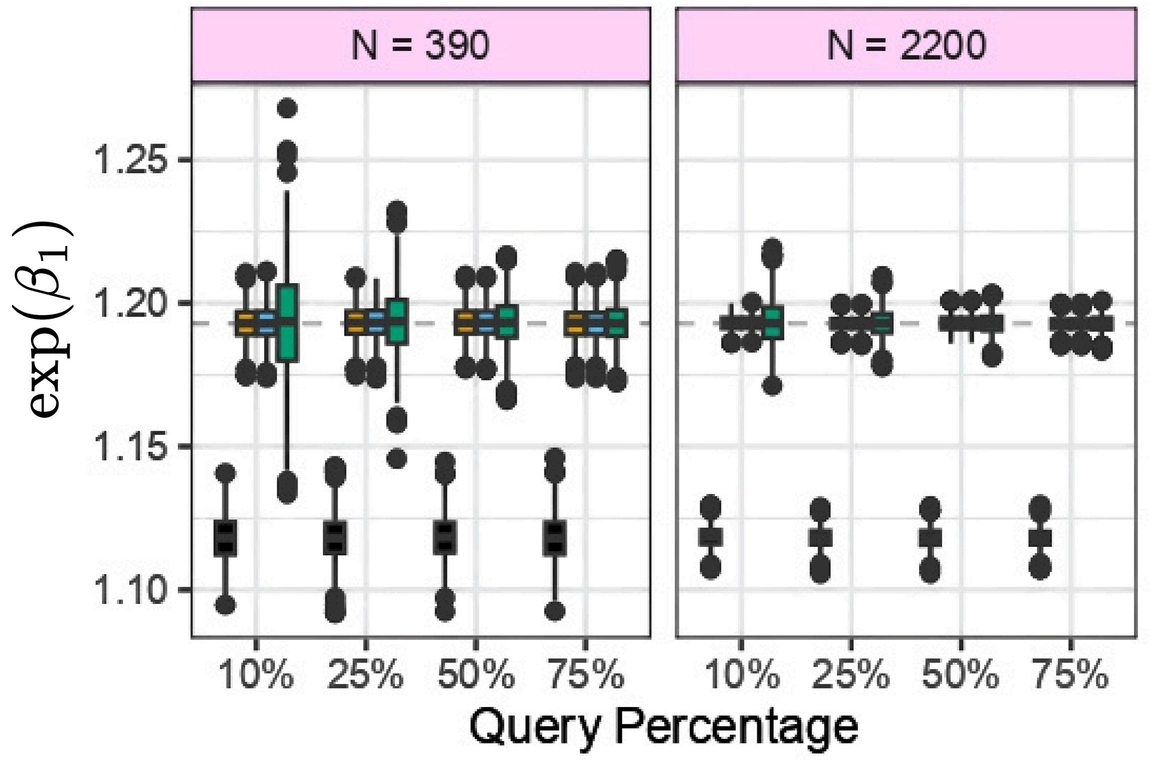
3. Design and Analysis

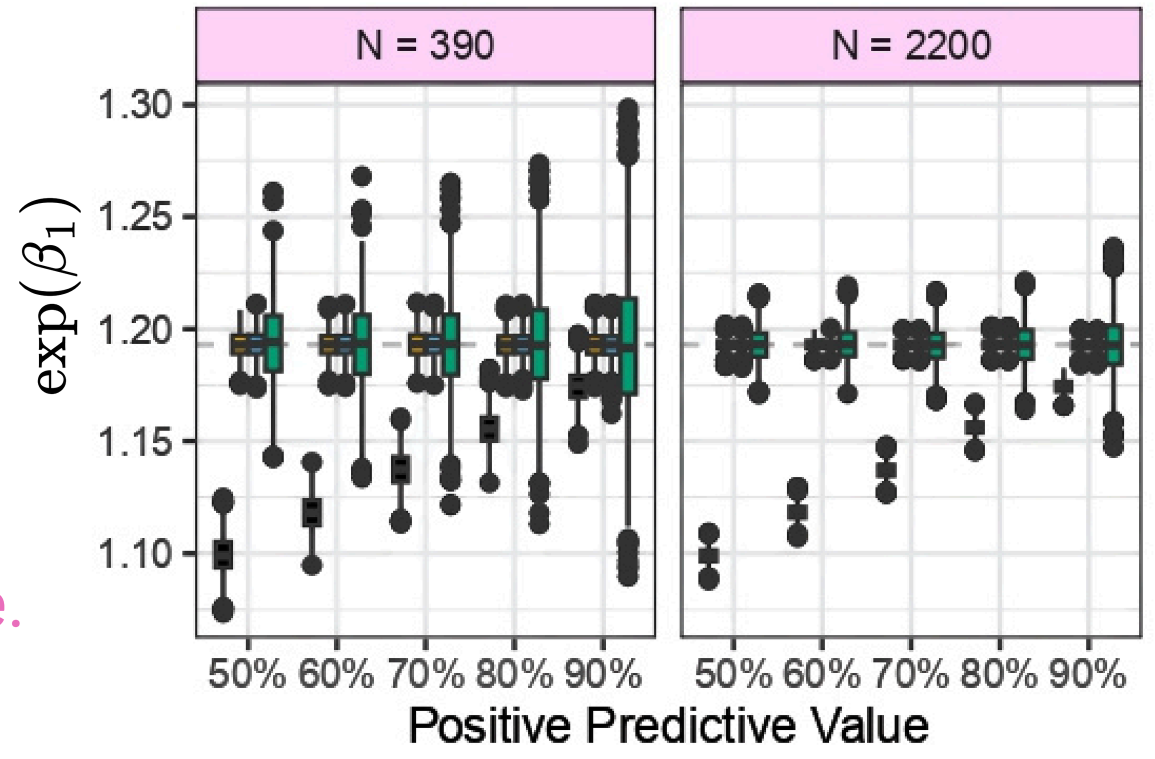
- We use **two-phase design** to maximize the available food access information, measuring error-prone access X* for **all (N) neighborhoods** and picking a **subset of n** neighborhoods to measure route-based access X.
- Factoring a **joint likelihood** sets us up to use the **EM** algorithm to find the **maximum likelihood estimator** for Poisson regression of **diabetes cases (Y)** on **food access** and **covariates (Z)**.

$$\ell(\boldsymbol{\beta},\boldsymbol{\eta}) = \sum_{i=1}^{N}\left\{Q_i \log P_{\boldsymbol{\beta}}(Y \mid X, \boldsymbol{Z})P_{\boldsymbol{\eta}}(X \mid X^*, \boldsymbol{Z}) + (1-Q_i)\log\sum_{x=0}^{1} P_{\boldsymbol{\beta}}(Y \mid X = x, \boldsymbol{Z})P_{\boldsymbol{\eta}}(X = x \mid X^*, \boldsymbol{Z})\right\}$$

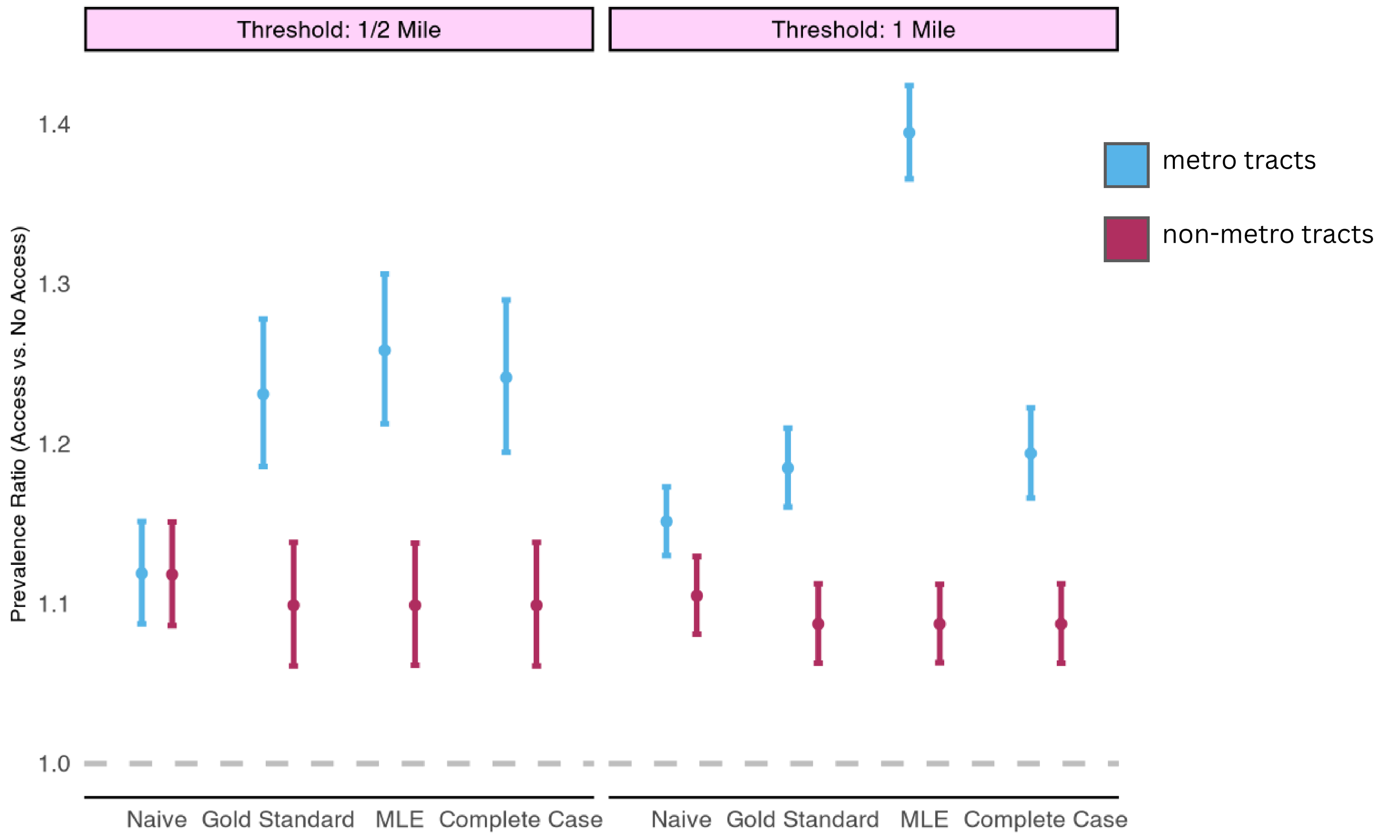
4. Simulations and Case Study

Method: naive, gold standard, MLE, complete case





- The simulations explore various **query percentages** and **misclassification settings**.
- The **case study** models **diabetes prevalence** as a function of **food access** and metropolitan status.



5. Takeaways

- The **MLE** retains the **unbiasedness** of the gold standard estimator and **recovers more efficiency** than the complete case in **simulations**.
- At both radii, we observe that tracts with **access to healthy food** tend to have **higher prevalences of diabetes** than tracts without it.

References

1. World Health Organization. Healthy diet, 2019. URL https://iris.who.int/handle/10665/325828
2. E. Gucciardi, M. Vahabi, N. Norris, J. P. Del Monte, and C. Farnum. The intersection between food insecurity and diabetes: a review. Current nutrition reports, 3:324–332, 2014

Acknowledgements

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