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Research Study Design for Individual and Neighborhood-Level Obesity

in Seattle / King County, Washington

**Goals:**

In an attempt to link specific individual and neighborhood-level factors to the prevalence of overweight and obese individuals in Seattle / King County, Washington, an observational study will be performed. The far-reaching goal of this project is that by identifying what is associated with obesity on a small geographic scale, we can both reduce risk factors and increase positive factors throughout the entire county, and target specific interventions to the neighborhoods of Seattle / King County that have the most risk factors and highest levels of overweight and obesity. The short-term goal of this project is to identify which individual and neighborhood factors are associated with higher body mass index. Then using this study data, project our estimates onto census blocks to determine which areas are at highest risk for poor health outcomes. Part of this approach has already been performed by Drewnowski et al., however we seek to make improvements to their model by assessing both individual-level and neighborhood-level factors(Drewnowski, Buszkiewicz, Aggarwal, Cook, & Moudon, 2017).

**Study Population:**

The sample for this new study will be based on the Seattle Obesity Study. In this previous study, participants were selected via stratified sampling in order to oversample low-income zip codes, and zip codes with high proportions of African-Americans and Hispanics (Aggarwal, Monsivais, Cook, & Drewnowski, 2011). In order to get more solid estimates for many of the groups with small sample sizes, we will repeat this stratified sampling process in order to achieve a larger sample of roughly 3,000 participants. The original paper does not state whether cell phone numbers were included in the sampling scheme, but this new study would include them in order to get a larger proportion of respondents between the ages of 18 and 44. Respondents 18 to 44 only made up 26.1% of the Drewnowski et al. analysis, while Seattle / King County has approximately 40.8% of its population in the 18 to 44 year old age range (Dow, 2014). All data will be collected by phone. We also would like to include an option for respondents to participate in common languages other than English such as Spanish, Chinese, Japanese, and Vietnamese in order to assess the large immigrant communities of Seattle / King County.

**Study Design:**

This study will be a cross-sectional observational study. Because our primary goal is to assess associations – not necessarily causality, a cross-sectional study will be the most efficient approach.

At minimum the following data will be collected via self-report for each participant: height, weight, home address, income, sex, race, education level, home ownership, exercise frequency, parent obesity, and primary mode of transportation. Body mass index will be assessed on a continuous scale. Property value will be obtained from the county tax assessor’s office and will likely be assessed on a log scale to account for right skew. Income will also likely be assessed on a log scale. Education level will be assessed on an ordinal scale of years of education completed. Home ownership is whether the participant owns or rents their place of residence. Exercise frequency will be measured with a simple self-report questionnaire, many options of which are described by Sylvia et al. (Sylvia, Bernstein, Hubbard, Keating, & Anderson, 2015). Participants will be asked if they believe that one or both of their biological parents are/were overweight for a majority of their adult life. Primary form of transportation will be assessed as walking, biking, driving, or public transit. We may also want to separately assess the primary form of transportation for getting to work and primary form of transportation for other errands, social gatherings, and commitments.

Based on home address, several neighborhood measures will be assessed for each participant. Walkability will be assessed using the walk score (walkscore.com) of the participant’s address. Census tract level information regarding the Modified Retail Food Environment Index (mRFEI) will be used to assess the availability of healthy food in all the census tracts within a 1-mile radius of the participant’s home address in order to account for the availability of healthy food options in the areas nearest to the participant (Centers for Disease Control and Prevention, 2011). Median property value and percentage of families below the poverty line will be assessed at the census block level for each participant’s home address. All values will be assigned at the lowest level possible which is likely census tract. Any variables that are only available at higher levels will be assumed to be homogenous for all census tracts located within higher levels.

**Statistical Techniques:**

First we hope to assess individual characteristics and neighborhood characteristics separately. Every model shown below is only an idea for what a full model could look like, many predictors will likely be altered or not included in final models.

*Individual Model*

*Neighborhood Model*

Finally, in order to assess whether some individual-level variables may be related to neighborhood level variables, I will run a hierarchical model.

*Individual and Neighborhood Model*

It is likely that we will see many of these predictors overlap and will need to select only one for the final set of models. For example, income and property value will likely overlap so we will need to assess which one fits the model better. We will likely also test whether a model with average property value as a neighborhood-level predictor or a model with individual property value fits better. This will give us some idea of whether the socioeconomic status of the individual or the neighborhood matters more when it comes to body mass index.

Similarly to the Drewnowski et al. paper, we then will fit our model to the census block level of Seattle and King County. What we include in this prediction will depend on the results of our models above. For example, I will assume that our model yields significant results on the individual-level race, property value, home ownership, exercise frequency, and parent obesity predictors and that our model yields significant results on the neighborhood-level walkability and percentage of families below the poverty line predictors. To project our model to the census tract level we will find the average values of property value, prevalence of each racial/ethnic group, estimated prevalence of home ownership, walkability, and percentage of families below the poverty line for each census tract in Seattle / King County. We will then use those values along with average values for exercise frequency and parent obesity in our sample to predict the average body mass index for each census tract. This will then be mapped using a choropleth map.

**Limitations:**

There are several limitations to the approach taken in this study. Primarily, all of the individual predictors are self-reported which may entail error and bias. Also, this study is cross-sectional which means we cannot make causal conclusions, only associations. Hopefully our data and model is an improvement over the approach taken by Drewnowski et al. in that we include several neighborhood predictors and will be able to use these to make a more accurate weight predictions to the census blocks of Seattle and King County.

References

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