Dissertation Title: Exploring Spatial Patterning and the Impact of Obesogenic Built Environments for Youth Obesity

Author: S. Morgan Hughey, MPH, Department of Health Promotion, Education, and Behavior, Arnold School of Public Health

Youth obesity is a major public health concern due to an array of physical, social, and psychological health consequences. While rates of youth obesity levels have been documented, less research has explored localized spatial clustering patterns and associated correlates. Place has continued to emerge as a key health determinant with studies showing that where a child lives impacts their health, including obesity. Environments where it is easy for individuals to have low levels of physical activity – either by discouraging active behavior or promoting sedentary behavior – and easy for individuals to consume unhealthful foods – either by the limited availability of healthful foods or increased availability of unhealthy foods – have been coined 'obesogenic'. Obesogenic built environments describe community structures that influence physical activity and nutrition behaviors, representing both elements of the energy balance equation that contribute to weight status. Additional research is needed to improve measurement of obesogenic built environments and test associations with childhood obesity.

This study occurred in a southeastern US county (pop:474,266) in 2013 and combined four unique datasets: 1) demographic, weight status, and address from all 3rd through 5th grade youth enrolled in a large southeastern school district (n=13,469), 2) detailed audit data on all public park facilities, 3) location of all food stores and restaurants, and 4) sociodemographic Census data. Global Moran's Index and Anselin's Local Moran's I (LISA) were used detect global and local spatial clustering while residuals from a series of linear regression models were subsequently spatially analyzed, mapped, and compared to examine correlates of spatial clustering. Significant, positive global clustering (Index=0.04,$p<0.001$) was detected. In

addition, LISA results showed that about 4.7% (n=635) and 7.9% (n=1,058) of the sample were identified as high and low obesity localized spatial clusters ($p<0.01$). Individual and neighborhood sociodemographic characteristics accounted for the majority of spatial clustering and differential patterns were observed by level of urbanicity (e.g., urban, suburban, rural).

The second part of this project developed and tested an obesogenic built environment measure. Public parks (n=103) were identified and then scored using detailed audit data, while two commercial databases of food stores (n=395) and restaurants (n=717) were collected, categorized, and geocoded. Grocery stores that offered access to fresh produce classified as 'healthy' while convenience stores, discount/drug stores, fast food restaurants, and fast casual restaurants with less access to fresh produce were classified as 'less healthy'. In ArcGIS, kernel density estimation procedures were used to create, normalize, and summarize separate raster (pixel) surfaces representing the nutrition and park environments. Using multilevel linear analyses, results showed that health promoting built environments were related to lower weight status in youth (b=-0.25, $p<0.05$) among youth in this southeastern county. Associations were stronger for youth living in non-urban areas.

Identifying geographic areas that contain significant spatial clusters can be a powerful tool for understanding the location of and contributing factors to geographic patterns of childhood obesity. Environments that were classified as health promoting by providing greater access to public spaces to be active and places to consume healthier food options were related to lower youth obesity. This dissertation project integrated innovative methodology to analyze spatial patterns of youth obesity and develop and test a unique characterization of obesogenic built environments.