# Food Deserts and Obesity and Malnutrition Hospitalizations in Virginia

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## Background

The prevalence of obesity among adults in the U.S. from 2011-2014 stood at 36.5% (Ogden, 2015). The consequences of growing obesity rates include higher morbidity, higher mortality, higher U.S. debt, and lower worker productivity (Philipson, 2008; Schafft, et al., 2009; Wang, et al., 2008). Prior research has focused on food access as a potential contributing factor to adverse health problems, such as malnutrition, obesity, and comorbid factors of obesity, such as, obstructive sleep apnea (OSA) (Ghosh-Dastidar, et al., 2017; Schafft, et al., 2009). Higher rates of obesity are found in areas with low median household incomes and areas with high percentages of minority racial and ethnic groups. The association of low incomes and food insecurity can be directly related to lower intakes of fresh fruit and vegetables and greater intakes of high-caloric and processed foods associated with lower prices (Ghosh-Dastidar, et al., 2014; Schafft, et al., 2009). Areas characterized by low access to healthy and affordable food which contribute to social and spatial disparities of diet-related health outcomes are described as “food deserts.” Food desert research began in the United Kingdom with researchers examining the spatial inequalities of food access and its related incidence to poor diet and malnutrition (Schafft, et al., 2009). Food desert research has become increasingly common due to a potential deprivation amplification contributing to social disparities for people living in low access areas and because of geospatial analyses expanding research capabilities of spatially dependent research studies.

## Purpose

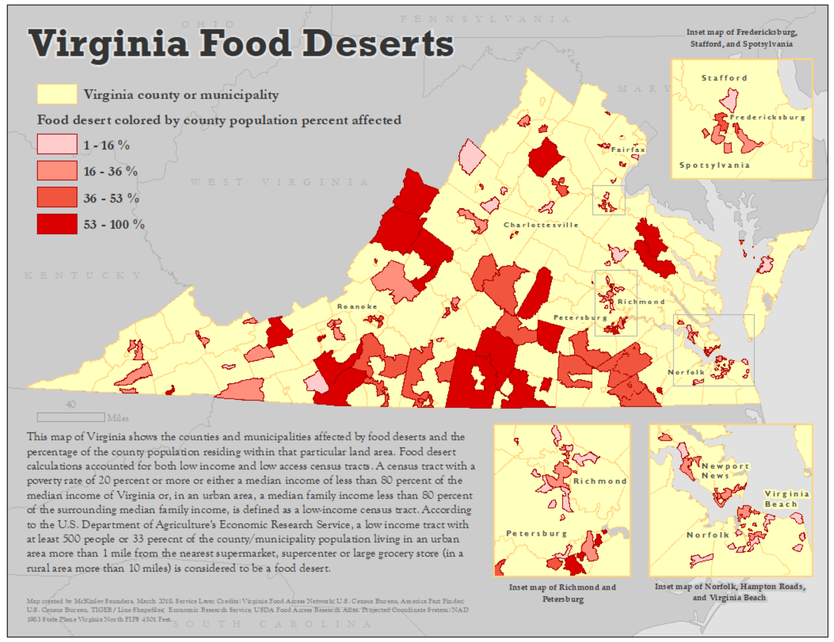
The present study seeks to add to the literature by focusing on the relationship between hospitalizations for three types of food-related health conditions and food access. Hospitalizations for food-related conditions include hospitalizations with a diagnosis of malnutrition, obesity, or obesity-related obstructive sleep apnea (OSA). In our analysis, we use county-level data from Virginia inpatient hospital discharges and geospatial data on food deserts. Food deserts calculations were according to the USDA Food Access Research Atlas (see map for a more detailed explanation of food desert and access measures).

## Data and Methods

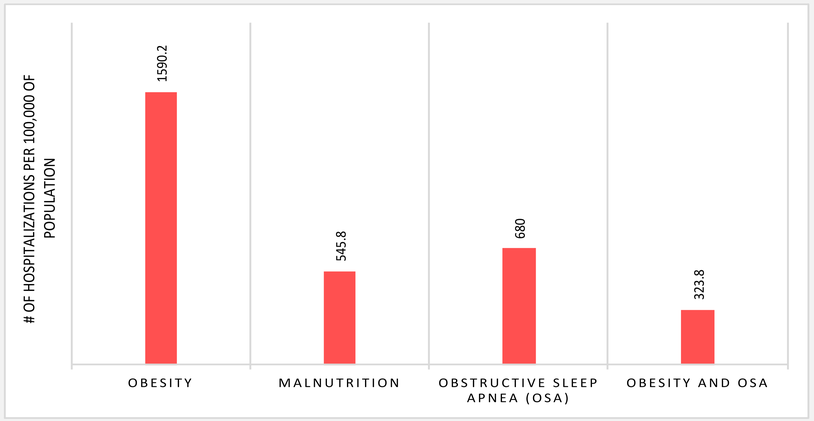
Data: This research used 2016 hospitalization inpatient discharge data from Virginia Health Information (VHI). Individual discharges were identified using ICD-10 codes related to obesity, malnutrition, and obesity with obstructive sleep apnea (OSA). The ICD-10 codes used to flag obesity, malnutrition, and obesity with OSA were selected based on codes used in similar studies (Phillips, 2015; Jennum, et al., 2015; Mclynn, et al., 2017; Visscher, et al., 2017; Healthcare Cost and Utilization Project, 2017). The discharges were aggregated to hospitalization rates at the county/municipality level for Virginia. Hospitalization rates for each condition were defined as the number of hospitalizations for a given condition and for patients of all ages, divided by the total number of population, and are expressed as rates per 100,000 persons. This study also used data at the county/municipality level from the U.S. Census Bureau, Virginia Food Access Network, and the U.S. Department of Agriculture’s Economic Research Service. Geospatial analyses were used to construct measures of the share of the population residing in a food desert, as described below.

Methods: Using the definition of a food desert from the U.S. Department of Agriculture’s Economic Research Service and data from the U.S. Census Bureau, we calculated the percentage of each county/ municipality residing in a food desert. We then estimated a population-weighted regression model, focusing on the percentage of the county population residing in food deserts as the main explanatory variable to assess the variation in obesity, malnutrition, and obstructive sleep apnea and obesity-related hospitalization rates at the county level. We also included other explanatory variables such as population mean age, and percent population African American, and economic factors like median household income. All explanatory variables were measured at the county level and were obtained from the U.S. Census Bureau’s American Fact Finder.

*Comments and questions are welcome and encouraged. Please send to vereese@email.wm.edu or mesaunders@email.wm.edu.*




## Hospitalizations of Obesity, Malnutrition, and OSA




## Regression Results

| Explanatory Variable | Obesity Rate | Malnutrition Rate | Obesity & OSA Rate |
|---|---|---|---|
| **All Counties in VA** | **Coefficient (Std. Error)** | **Coefficient (Std. Error)** | **Coefficient (Std. Error)** |
| % County Population in Food Desert | 1.679 (2.614) | 1.626 (1.519) | 1.380 (0.622) * |
| Median Household Income | -0.010 (0.002) ** | -0.003 (0.001) ** | -0.002 (0.0004) ** |
| Median Age | 17.952 (8.337) * | 7.780 (4.843) | 1.573 (1.984) |
| % African American | 14.931 (3.173) ** | 1.854 (1.785) | 2.604 (0.731) ** |
| **Large Counties in VA** | **Coefficient (Std. Error)** | **Coefficient (Std. Error)** | **Coefficient (Std. Error)** |
| % County Population in Food Desert | 5.426 (3.872) | 3.393 (2.383) | 2.664 (0.959) ** |
| Median Household Income | -0.009 (0.002) ** | -0.002 (0.001) | -0.001 (0.0005) * |
| Median Age | 16.588 (10.621) | 8.056 (6.536) | 1.217 (2.630) |
| % African American | 13.402 (3.817) ** | 1.626 (2.349) | 1.937 (0.945) * |

The dependent variable is the rate of obesity, malnutrition, or obesity and obstructive sleep apnea (OSA). The regression model is weighted by census tract population. Statistical significance is indicated by * ($\geq 0.05$), ** ($\geq 0.01$). Large counties are defined as having a population greater than 20,000.

## Preliminary Findings

### The Association between the Percent of County Population in a Food Desert and Diagnoses of Obesity and OSA

The map to the left details the variation of the percentage of the population residing in a food desert in each county and municipality in Virginia.

The variation in percentage of the county population residing in a food desert is not independently linked to the rate of hospitalization for obesity without OSA or the rate of hospitalization for malnutrition.

The association between the percent of the county population residing in a food desert and hospitalization for obesity with OSA is positive and significant. In the model based on all Virginia counties, the regression coefficient is 1.380 and significant at the $\alpha = 0.05$ level. In the model based on only large Virginia counties, the regression coefficient is 2.644 and significant at the $\alpha = 0.01$ level. On average across all counties, this indicates that as the share of the population living in a food desert increases by 10 percentage points in a given county, the mean hospitalization rate for obesity with OSA will increase by 13.8 hospitalizations, or 4.26%.

## Future Directions

In the future, we would like to consider:

- Additional factors that may be present in the relationship between the percentage of county populations residing in a food desert and hospitalizations for obesity with OSA.
- The relationship between food swamps and hospitalizations for obesity, malnutrition, and obesity with OSA.

## Select References

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