

## Regional Variation in Obesity: A Life Course Approach

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### Abstract:

Previous research indicates that the South has higher rates of obesity than other regions, which often is attributed to factors such as higher levels of poverty and poor diet. However, little research has examined the effect of region on later life obesity. Additionally, the heterogeneity within broader Census regions is rarely considered. The differences in obesity due to being socialized in an urban or rural area are also rarely examined. We use HRS data from 2010 to model regional effects on obesity in later life using three different measures: (1) current region, (2) early life region, and (3) early life urban/rural residence. We find that current region of residence does not predict obesity in late life. However, individuals socialized in the West South Central sub-region, especially in rural areas, are more likely to be obese than individuals raised in other parts of the country.

### Early Life Region and Later Life Obesity

Although the relationship between obesity and region has been examined, few have investigated regional effects within a life course framework. The principle of life span development suggests that factors such as health behavior and cultural values in early life can influence later life outcomes. Hayward and Gorman (2004) use the term the “long arm of childhood” to describe how early life experiences differentially affect health in later life.

The obesity literature documents that the trajectory of weight gain is launched in childhood (Ferraro et al., 2003; Cunningham et al., 2014). It is speculated that health habits such as physical activity and eating behaviors obtained in childhood are carried on into later life (Ferraro et al., 2003).

Early life location could potentially influence later life obesity. Nicholson and Browning (2012) examined the effect of neighborhood disadvantage in early adolescence on racial disparities in obesity in adulthood. They found that females living in a disadvantaged neighborhood during childhood were more likely to become obese during the transition to adulthood than children socialized in safer neighborhoods. However, no literature has appeared to have investigated the effect of Census region in early life on later life obesity despite a consistent association of southern residence being linked to other health and health-related outcomes. It is possible that access to resources in one’s current regional location and/or being socialized in an area with culturally reinforced physical activity and exercise habits may contribute to obesity in later life. In this research, we examine whether one’s current region of residence, one’s early life region, and the urban/rural nature of one’s early life experiences predict late life obesity.

### *Heterogeneity within Broader Census Regions*

A growing body of literature examines the impact of place on obesity. However, the majority of this work examines geographic context either from the neighborhood level or from the context of the four category Census regions. Little literature investigates the cultural heterogeneity within the broader Census categories. At the neighborhood level, urban sprawl, neighborhood safety, the availability of parks, the connectivity of sidewalks, and the proximity to grocery stores are factors believed to influence obesity. For example, Rundel and colleagues (2010) examined the association between the food environment and obesity among New York City residents. The researchers discovered that residents who resided in neighborhoods with a higher density of grocery stores and fruit and vegetable markets had lower BMIs than residents who lived in areas with a greater number of fast food outlets and convenience stores. The literature that does examine broader region compares the South to other areas of the country (Sakamoto, 2008). Anecdotally, the southern diet is believed to be nutritionally inferior to the diets of other regions. Dishes high in sugar, starch, and animal fat are staples of Southern cooking. In addition, the south is believed to be more rural than other areas of the country, with less access to healthcare.

However, it is possible that cultural factors can influence obesity within the Census' four region categories. The South is a diverse region with differing rates of obesity. Some of the highest obesity rates in the nation are observed in the West South Central and the East South Central (Trust for America's Health, 2013). With the exception of West Virginia, obesity rates are comparatively lower in the South Atlantic than other areas of the South. Many factors could explain this possible discrepancy. For example, Florida is a South Atlantic state that attracts

retirees from the Midwest and North Central. These retirees could bring different physical activity and eating behaviors with them from their early life residence. The current study is unique because it considers the differences within broader Census region categories on obesity.

### *Rurality and Obesity*

The literature suggests that individuals who reside in rural areas are more likely to be obese than residents who live in metropolitan areas (Patterson et al., 2004). This discrepancy is believed to be due to a lack of physical activity and subpar dietary practices observed among rural residents (Champagne et al., 2007; Ewing et al., 2003). Residents in metropolitan areas are more likely to walk for utilitarian purposes because buildings are closer together and mass transit is more available (Ewing et al., 2003). Rural residents may be more likely to experience food insecurity due to poverty and a lack of access to grocery stores (Ewing et al., 2003). In the United States, food insecurity is associated with obesity due to the relatively low cost of processed foods compared to fresh fruits and vegetables (Drewnowski & Specter, 2004).

However, little literature has investigated how the metropolitization of America has influenced obesity. Lichter & Brown describe how spatial and social boundaries are becoming blurred with the metropolitization of America. Residential areas are increasingly growing outside of central cities, but within metropolitan boundaries (Sellers, 2003). In 1900, more than 60% of Americans lived in rural areas. Today, less than 20% of Americans live in rural areas. Rural areas are becoming even less isolated from mainstream culture than before. Technological innovations such as railroads and highways have facilitated the transportation of information such as the internet and television (Lichter & Brown, 2011). It has even been argued that there is no cultural “rural” left in America (Friedland, 2002). Increasing numbers of Americans are not

growing up in rural areas, their exposure limited to vacation excursions and stereotypes in the media. In the early 20<sup>th</sup> century, the most drastic changes in metropolization were observed in the Northeast, Middle Atlantic, and Pacific Coast (Lichter & Brown, 2011). However, the most recent changes have been in the Southern and Mountain regions. By 2000, over half of the population in the South Central and Mountain regions lived in metropolitan areas (Sellers, 2003).

For this reason, measuring differences in obesity between rural and urban areas within regions may become obsolete. However, older cohorts of adults may still be influenced from being socialized in rural areas. In previous decades, living in a rural area was often associated with farming and manual labor. However, the agricultural transition in the United States changed the landscape of traditional family farms. After the Second World War, the number of family farms declined by half and the market share of large producers with hired labor increased from 38% in 1939 to 55% in 1987. The majority of remaining family farms shifted from the South to the Mid-West (Lobao & Meyer, 2001). However, older adults who were socialized in rural areas before this time period may still carry health habits learned from their farming experience in early life. They may be more likely to be physically active due to performing manual labor during childhood. Thus, the current study also examines the effect of being socialized in a rural area in early life.

### *The Current Study*

This study uses a life course approach to examine the association between early life region and later life obesity. We seek to determine whether current region, early life region, and early life urban/rural residence is associated with later life obesity. We expect that both currently residing and being socialized in the West South Central and the East South Central sub-regions

are associated with higher rates of obesity among older adults. We also hypothesize that residing in a rural area during childhood is associated with lower rates of obesity among older adults.

### Data & Methods

Data come from the 2010 wave of the Health and Retirement Survey. The HRS is a longitudinal panel study that collects information about economic, health, and family status of Americans over the age of 50. Data were collected biennially from the year 1992 until the year 2012. The annual household income variable is taken from the RAND versions of the HRS data. We measure obesity using BMI. Respondents are classified as obese if their BMI is  $\geq 30.0$  kg/m<sup>2</sup>, which is consistent with World Health Organization (WHO) standards. The respondents are categorized as either obese (1) or not obese (0).

In the HRS, current region is measured in the Census' nine category assessment. However, sample size issues prevent the use of the full nine Census categories. We collapse region into the following categories: Northeast: (CT, ME, MA, NH, RI, NJ, NY, PA and VT), Midwest (IL, IN, IO, KS, MI, MN, MO, NE, ND, OH, SD, WI, CO) West: (AK, AZ, CA, HW, ID, MT, NV, NM, OR, UT, WA, WY) South Atlantic: (DE, MD, DC, WV, VA, WV, VA, NC, SC, GA, FL); East South Central: (KY, TN, AL, MS); West South Central: (LA, AR, TX, OK). We also include the region the respondent lived most of the time during grade school with the same categorization as above. For both region measures, the Midwest category serves as the reference category. Additionally, whether the respondent lived most of the time in a rural area during grade school is also measured. Respondents are categorized as either living in a rural area (rural=1) or a non-rural area (non-rural=0) in early life.

Control measures include age measured in years, sex (male=0; female=1), race (Black=1; Nonblack=0), Latino (Latino=1; not Latino=0), marital status (married=1, not married=0), smoking status (smoker=1, non-smoker=0), total household income (logged), and a respondent's highest level of education (less than high school, high school, some college, college grad, post college).

### Analytic Strategy

To analyze this data we employ a series of logistic regression models, taking into account sample weights and household clustering. For each model obese is the outcome measure; also, age, sex, race, ethnicity, marital status, smoking status, and income, education, and rural residence are included in each model. First, the effect of current region on late life obesity is modeled (Model 1). Next, early life region is added to the model (Model 2). And finally, early life region is included alongside interaction terms for early life region and rural/urban status (Model 3).

### Results

Descriptive characteristics of the sample are shown in Table 1. Respondents are a majority female (53.7%) with a mean age of almost 69 years old. Most of the sample is married (almost 62%), and a substantial minority (27.5%) are current smokers. The mean income of the sample is \$76,801. However, over half of the sample reported an income of less than \$47,800. Regional distribution of the sample is diverse for both current region ranging from just under 55 in some regions to as much as a third of the sample currently residing in the Midwest.

Regression results are shown in Table 2. The effects of the control measures across all three models are relatively consistent and not surprising given what is known from previous literature. Females are more likely to be obese than males. Blacks are more likely to be obese than their White counterparts. Respondents who smoke and who have higher incomes are both less likely to be obese. These results do not change whether region is assessed during old age or early in life.

Regarding region, however, our findings are somewhat surprising, but still offer a strong argument for the life course approach to analyzing regional variation. Current region has no significant effect on obesity when taking into account all of the covariates (see Model 1). Where one currently resides in later life seems to have no bearing on whether one is obese or not. For early life region, this finding differs. Outside of the South, early life region does not significantly differ in its prediction of late life obesity (see Model 2). There is no statistical difference between those raised in the Midwest, West, or Northeast regions. Likewise, being socialized in the South Atlantic or East South Central sub-regions does not differ in the odds of having a high BMI from the Midwest. However, early life region does seem to matter if one was raised in the West South Central sub-region. Individuals from this sub-region are 1.76 times more likely to have a BMI above 30 than individuals raised in the Midwest region.



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**Table 1. Descriptive statistics**

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<b>Variable</b>	<b>Means and Percentages</b>
Age	68.7
Female	53.7
Black	4.6
Hispanic	4.1
Married	61.7
Smoke	27.5
Rural Early Life	42.1
Education	
High School	26.4
Less than High School	15.1
Some College	27.5
College Grad	17.5
Graduate School	13.5
Income (in thousands)	76.8
Current Region	
Northeast	21.8
West	4.9
Midwest	24.5
South Atlantic	35.5
East South Central	4.9
West South Central	8.3
Early Life Region	
Northeast	26.4
West	3.6
Midwest	27.6
South Atlantic	27.4
East South Central	4.9
West South Central	7.8

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Table 2. Odds Ratios from Logistic Regression Models of Late Life Obesity

	Model 1	Model 2	Model 3
Age	0.97*	0.97	0.97*
Female	1.52***	1.63***	1.65***
Black	1.51**	1.39*	1.42*
Hispanic	1.38	1.48	1.48
Married	0.86	0.86	0.87
Smoker	0.56***	0.53***	0.52***
Income (logged)	0.85**	0.83**	0.83**
Rural	1.17	1.12	0.79
Less than High School	0.90	1.00	0.96
Some College	0.94	0.97	0.95
College Graduate	0.85	0.79	0.78
Graduate	0.63*	0.63	0.63
<i>Current Region</i>			
West	1.33		
Northeast	0.95		
South Atlantic	0.85		
East South Central	1.53		
West South Central	1.35		
<i>Early Life Region</i>			
West		1.48	0.95
Northeast		1.04	0.86
South Atlantic		0.92	0.92
East South Central		1.32	0.84
West South Central		1.76*	1.01
Rural*West			2.76
Rural*Northeast			1.66
Rural*SA			1.01
Rural*ESC			2.41
Rural*WSC			3.83***

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

In order to explore this unusual finding further, we examined the potential of rural residence to interact with early life region given the substantial shift in rural populations in 20<sup>th</sup> century America noted above (see Model 3). Here again, the effects of covariates typically associated with obesity remain little changed from Model 2. The early life region effect for the

West South Central sub-region, however, is mitigated by early life rural/urban status. Contrary to our original hypothesis, those who were socialized in rural areas of the West South Central sub-region are far more likely to be obese than those socialized elsewhere in the U.S.

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