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## Executive Summary

Nearly 20% of the U.S. population resides in non-metropolitan areas, yet our knowledge about the prevalence of obesity in rural America is very limited. Previous research by the South Carolina Rural Health Research Center found that rural children, paradoxically, were both more likely to be overweight or obese and more likely to be physically active than urban children. That initial work was based on parent-reported information from the 2003 National Survey of Children's Health, which did not include information about children's diets. The current report expands on prior work by using information from the 1999-2006 National Health and Nutrition Examination Surveys (NHANES), which included both height and weight measurements by trained NHANES examiners and detailed diet information obtained from parents and children.

Using the 2000 Body Mass Index (BMI) charts from the Centers for Disease Control and Prevention as a reference, children whose gender- and age-specific BMI values were at or above the 95<sup>th</sup> percentile of the reference population were categorized as *obese*. Those children with BMI values at or above the 85<sup>th</sup> percentile of the CDC reference population were classified as being either *overweight or obese*. For simplicity, we used the term *overweight* to represent this group. Residence was measured at the census tract level using the Rural-Urban Commuting Area (RUCA) definition, with "urban" defined as RUCA codes between 1 and 3 and "rural" defined as RUCA codes between 4 and 10. To provide guidance for potential interventions, we also examined obesity-related behaviors (i.e., diet, physical activity and sedentary behavior) as risk factors for childhood obesity. Key findings of the report are as follows:

### **The prevalence of overweight and obesity is higher among rural children than urban children**

- In 1999-2006, 30.9% of US children aged 2-19 years old were overweight and 15.9% of them were obese. A greater proportion of rural children were overweight (35.5%) than those living in urban areas (29.5%). Similarly, the overall prevalence of obesity was higher among rural than urban children (18.5% vs. 15.2%).

- The prevalence of overweight and obesity was higher among black and Hispanic children than white children. Among whites, rural children had significantly higher rates of overweight and obesity than their urban counterparts. Among blacks and Hispanics, rural children had significantly higher rates of overweight, but not obesity, than their urban peers. Rural black children had the highest prevalence of overweight (41.6%) and obesity (26.2%) among all children.

### **Differences in obesity-related behaviors**

Because diet and activity recommendations and measurement of these behaviors vary with the age of the child, our findings are organized by age group:

#### **Pre-school aged children (2 to 5 years old)**

We did not observe differences in the prevalence of obesity among rural versus urban pre-school aged children. However, we found differences in obesity-related behaviors that could lead to the development of obesity later in life:

- Two to five year old children in rural areas consumed significantly more fat than children in urban areas (62.7 g versus 56.9 g per day).
- Rural children in the two to five year age group consumed more sweetened beverages than urban children, with 13.5% of rural children, versus 7.9% urban children, consuming more than 24 ounces of sweetened beverages per day on average.
- About one of four US children, aged 2 to 5 years old (24.4%) did not report levels of physical activity sufficient to meet physical activity guidelines ( $\geq 5$  bouts of exercise per week). There were no significant differences by urban or rural residence among these children.
- At least three out of five US children aged two to five years old spent two hours or more per day on sedentary activities such as watching TV or videos, using a computer, or playing computer games (63.6%). Rural girls aged 2 to 5 were less likely to exceed

screen time guidelines than their urban counterparts (52.0% rural vs. 63.7% urban).

Other than this, no significant differences between urban and rural two to five year old children were found.

### **Elementary school-aged children (6 to 11 years old)**

We did not find that rural children in the 6 – 11 age group were more likely to be overweight than their urban peers. As with younger children, however, we did note differences in diet and activity that may have implications for weight as the children grow older:

- Six to eleven year old rural children consumed more fat on average than urban children (80.3 g versus 73.2 g per day). We did not observe any other substantive differences in dietary intake in school-aged children.
- Approximately 24.7% of US children aged 6 to 11 years old did not report enough physical activity to meet physical activity recommendations. Rural children were less likely to fail to meet physical activity guidelines than urban children (19.6% versus 26.2%), with most of the difference coming among rural girls. Rural girls were less likely to fail to meet physical activity guidelines than urban girls (16.5% versus 31.5%), but failure to engage in physical activity was similar among rural and urban boys in this age group (19.2% and 20.9%, respectively).
- Seventy-two percent of US children aged 6 to 11 years old spent two hours or more per day on sedentary activities. There were no significant differences between urban and rural children, in either boys or girls.

### **Adolescents (12 to 19 years old)**

Rural adolescent girls were more likely to be overweight than adolescents in urban areas (38.0% versus 30.1%, respectively), while rural and urban boys were similar (31.1% versus 31.9%, respectively). Minor differences in diet and exercise were found across this age group:

- Adolescents in both rural and urban areas had poorer dietary quality than younger children. In general, diet quality did not vary by residence. Rural and urban adolescents had similar fat consumption. Minor differences were present:
  - Rural adolescents were more likely than their urban peers to report eating two or more cup equivalents of fruit.
  - Rural adolescent girls consumed slightly less fiber than urban girls (11.2 g versus 12.3 g).
- Approximately 21.2% of US adolescents reported no vigorous physical activity (VPA) in the past 30 days, while 11.6% reported no participation in vigorous or moderate-to-vigorous physical activity (MVPA) in the past 30 days. Among all adolescents and adolescent boys, the likelihood of participation in VPA and MVPA did not differ by residence. Within girls, rural adolescents were more likely to be in the highest terciles of VPA and MVPA category than their urban counterparts.
- A higher proportion of adolescents (74.2%) reported 2 or more hours of sedentary activities than among younger children (68.9%, 2 to 11 year old). Sedentary behaviors did not vary by residence in this age group.

**Obesity-related behaviors: Not yet a full explanation for differences**

We used multivariable analyses to ascertain the degree to which specific behaviors captured in the NHANES survey might contribute to overweight among children.

- While unadjusted analysis did not find differences in the prevalence of overweight among children age 2 – 11 years, after adjusting for socio-demographic characteristics, health, and obesity-related behavioral factors, rural children were more likely to be overweight than urban children (AOR: 1.4, 95% CI: 1.1-1.7). Differences based on residence were found for both boys (AOR: 1.4, 95% CI: 1.0, 1.9) and girls (AOR: 1.3, 95% CI: 1.0, 1.7) after controlling for all covariates. Diet, physical activity and sedentary behaviors were not significantly associated with overweight in 2 to 11 year old children.

- Rural adolescents (12 – 19) were more likely to be overweight in unadjusted analysis, a relationship that remained when indicators of socio-demographic status were held equal (AOR: 1.3, 95% CI: 1.0-1.6). After further controlling for diet, physical activity and sedentary behaviors, the difference in overweight among rural and urban children was still significant among all adolescents and among girls. There was no significant difference in overweight among rural and urban adolescent boys. The principal significant findings are noted below:
  - Among children aged 12-19 years old, every 5 g increase in total fiber was associated with 10% reduction in the odds of being overweight (95% CI: 0.8, 0.9).
  - Spending more than 2 hours in screen activities was associated with 50% increase in the odds of being overweight compared to children who spent less than 2 hours in screen activities (AOR: 1.5, 95% CI: 1.3-1.8).

### **Recommendations for reducing obesity among rural children**

For children aged 2-11 years old, programs and policies that seek to reduce the amount of sedentary behavior, particularly television viewing, and grams of fat and sweetened beverages that children consume on a regular basis, might lead to long term benefits for children living in rural areas in terms of obesity prevention.

For children aged 12-19 years old, programs and policies with a focus on encouraging participating in vigorous physical activity, less sedentary behaviors, and higher fiber intake would be beneficial in reducing rural differences in overweight.

Because obesity tracks from childhood to adulthood and obese adults suffer adverse social and health consequences due to obesity, it is very important to develop policies and programs aimed at reducing the gap in childhood obesity between rural and urban children. At the end of the report, we suggest some relatively simple policy and program targets that can help rural communities address the relatively high prevalence of childhood obesity and prevent the consequences of obesity.