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Is Food Insecurity a Contributing Factor to Childhood Obesity?
The Association of Household Food Insecurity and Obesity
Prevalence Among Children and Adolescents in the United
States

by

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May 2010

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Acknowledgments

I would like to extend my gratitude to the following people because their efforts and support would not have made this research possible. Dr. Derek Chapman is the faculty advisor whose patience, confidence in me, and support has guided the research smoothly. His feedback on my work was helpful in notifying me on how I can improve my methods and the paper. Caroline Stampfel has been readily available for any burning questions, relating to SAS code and statistical analyses.

Abstract

The obesity epidemic is a major public health concern, where the prevalence rates amongst the American children population have more than doubled since the 1980s. Among overweight children, the risk of becoming an overweight or obese adult is 70% higher than children of normal weight, and obese children are more likely to remain obese into adulthood and face a number of morbidities associated with it, including lower quality of life and increased financial burden. In this research, we examined the relationship between household food security and obesity among children and adolescents between the ages of 2-18 years old. We used data from the NHANES 2005-2006 (n= 3,432). Amongst the children aged 2-18 years, 31.21% were determined to be obese or at-risk for obesity. Children aged 2-18 years were 1.27 times more likely to be obese or at-risk when living in a food insecure household after adjusting for race/ethnicity. Adolescents aged 12-18 years were 1.47 times more likely to be obese or at-risk when living in a food insecure household. No significant association was found for young children aged 2-11 years. After adjusting for race/ethnicity and poverty level status, however, the association between food insecurity and obesity was not significant for either age group. Further investigation of other potential confounders could explain the association for both young children and adolescents. There are other factors, like social and societal, that influence the trends of obesity. Future programming could work to ameliorate the conditions of food insecurity and other infrastructure factors.

Introduction

Obesity is not only a major concern for the public health of Americans, but it has become a global epidemic. The prevalence rates continue to climb around the world affecting both the young and the old, and it is a health condition that leads to the development of additional chronic diseases like type II diabetes, cardiovascular disease, some cancers, and several other morbidities. In addition to chronic diseases, obesity can also lead to social discrimination and depression, decreasing one's quality of life (Pinhas-Hamiel et al., 2006). Within the United States, the prevalence of being at-risk for obesity has quadrupled since the 1960's with 127 million adults currently at-risk (Haskins, 2009; LaFee, 2009). In addition to these complications, obesity negatively affects the United States health care system "because of the rising health care costs and lost productivity that result" (Department of Health and Human Services [DHHS], 2001). In 1995, obesity resulted in \$99.5 billion in health-related costs in the United States (Wang, Yang, Lowery, & Wechsler, 2003). In 2000, the Surgeon General estimated that the economic costs in healthcare for treating obesity would rise to \$117 billion, where \$61 billion comes from direct care costs and \$56 billion from indirect costs like lost wages and productivity (Haskins, 2009; Hu, 2008).

Unfortunately, obesity is not limited to the adult population; childhood obesity rates are also increasing. The Healthy People 2010 objective for childhood obesity is to "reduce the proportion of children and adolescents who are overweight or obese" with a target prevalence of 5% by 2010 (DHHS, 2010). For children aged 6 to 11 years the prevalence of obesity has more than doubled from 6.5% in 1980 to 17.0% in 2006, and more than tripled from 5.0% to 17.6% among children aged 12 to 19 years (Center for Disease Control and Prevention [CDC], 2009). In a study of 2007-2008 National Health and Nutrition Examination Survey (NHANES) data,

approximately 10% of children younger than two years, more than 10% of 2-5 year olds, 19.6% of 6-11 year olds, and 18.1% of 12-19 year olds were obese, while 31.7% of 2-19 year olds were at-risk or overweight (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). According to the Youth Risk Behavior Surveillance System (YRBSS), 13% of United States high school students are obese and 15.8% more are at-risk (DHHS, 2007). The risk of becoming an overweight or obese adult is 70% higher for overweight children compared to those who were not, and the risk is even greater (80%) when at least one of the parents was also overweight or obese (DHHS, 2001). Starting from childhood, obesity “is likely to have a significant impact on adult morbidity and mortality” (Wang et al., 2003). Obese children are more likely to remain obese into adulthood (Keller, 2008).

Weight gain can be explained by a combination of “genetic, endocrine/regulatory, behavioral, psychosocial, and environmental factors” (Hu, 2008). Biologically, changes in weight are due to the imbalance between energy (in the form of calories from food) intake and spending (CDC, 2009). Dietary fats are considered foods with the highest energy density because they provide 9 calories per gram, compared to the 4 calories per gram provided by carbohydrates and protein (Woodward-Lopez, Ritchie, Gerstein, & Crawford, 2006). Within the body, fat absorption is higher than carbohydrate absorption because fats are more metabolically efficient serving as an excellent energy storage source in adipose tissue and can be observed in feces that energy expenditure is lower with high fat diets (Woodward-Lopez et al., 2006). In a multivariate analysis, there was a significant association found between an increase in trans fat and the increase in waist circumference, in which a 9 year follow up determined that the findings could be confounded by factors like fast food habits (Koh-Banerjee et al., 2003). Also, diets that

include a large amount of starchy foods like potatoes and white bread elicit more bodily glucose responses of energy absorption and storage than simple sugar foods (Hu, 2008).

Children are living more sedentary lifestyles: staying inside more and playing outside less. According to the 2007 YRBSS, a quarter of high school students surveyed played video or computer games for more than three hours a day and 35.4% watched television for more than three hours a day (DHHS, 2007). One study examined the change in physical activity participation between the ages of 9 and 15; at the age of 9, children spend about three hours per day engaging in moderate to vigorous physical activity, but at the age of 15, the time spent is cut down to 50 minutes per weekday and 36 minutes per weekend day (Nader, Bradley, Houts, McRitchie, & O'Brien, 2008). Because less energy is required for children who lack of moderate or vigorous physical activity, a paradox is created: "food becomes ever more available, while the individual's caloric requirement lessens" (Tillotson, 2008).

The major contributing factors to obesity are influenced by the environment and individual and societal behaviors, which allow for prevention and treatment actions (DHHS, 2001). It has been determined that low social economic status groups in developed nations are more likely to be obese than those of higher social economic status (Hu, 2008). From a focus group study of parents in Boston, Massachusetts, the most frequently expressed barriers to preventing obesity were the time and financial costs with activities like transportation and the convenience of fast food (Sonnevile, La Pelle, Taveras, Gillman, & Prosser, 2009).

Obesity seems to disproportionately affect some racial/ethnic groups more than others. Compared to non-Hispanic whites, all other racial/ethnic groups experience a higher prevalence of obesity for adult men, women, and children (Brownell, 2004). The highest rates of obesity prevalence are found in the Midwest and the South, where both Behavioral Risk Factor

Surveillance System (BRFSS) 2001 and NHANES 2003-2004 identified black, non-Hispanic females as the population group with the highest prevalence (Hu, 2008). Black non-Hispanic adults also had the highest obesity prevalence in the 2006-08 BRFSS (CDC, 2009). Culture may also play a role in obesity associated with specific racial/ethnic groups, where “being fat or large is ‘pretty’ and that thinness is related to sickness” (Sonneville et al., 2009).

With the introduction of assembly lines to create speed and efficiency in the 1940’s, mass production has made food widely available, which one would expect leads to higher caloric intake and increases in weight. Additionally, the structure of households changed, enabling the frequent eating outside of the home for convenience. During the 1970’s to 1990’s, the number of per capita fast-food restaurants doubled, indicating the growing dependence on the fast-food industry as a food source (Woodward-Lopez et al., 2006). One literature source claims that “today the commercial food supply is America’s food,” referring to the increase in food prepared outside of the home (Tillotson, 2008). On average, a household spends about \$2,116 per year, or \$846 per person, on food eaten outside the home (Brownell, 2004). The consumption of fast-food meals is more prevalent among younger age groups, those with low income, and minority groups, where the restaurants tend to cluster in predominantly black neighborhoods and low social economic status neighborhoods (Keller, 2008). The portion sizes served in restaurants have also been growing (Woodward-Lopez et al., 2006). In addition to increased caloric and fat consumption associated with eating out, the more frequently children eat outside the home, the less likely they are to develop healthy eating habits (Gillman et al., 2000).

Despite the ability to mass produce food, access to it may still be limited to some of the population. According to the World Health Organization (WHO), food security is evaluated on

food availability, food use, and food access (WHO, 2010). The United States Department of Agriculture (USDA) defines household food security as:

“access by all people at all time to enough food for an active, healthy life. Food security includes at a minimum: (1) the ready availability of nutritionally adequate and safe foods, and (2) an assured ability to acquire acceptable foods in socially acceptable ways (e.g., without resorting to emergency food supplies, scavenging, stealing or other coping strategies)” (Bickel, Nord, Price, Hamilton, & Cook, 2000).

In 2001, a household with children was two times more likely to be food insecure than a household without children (Woodward-Lopez et al., 2006). Logically, one would expect a restraint on the food access resulting in a decrease of caloric intake, resulting in weight loss. However, food insecurity does not always guarantee a decrease in caloric intake because it is usually due to financial constraints that result in less choices of food and eating behavior changes (Sarlio-Lhteenkorva & Lahelma, 2001). The literature associating food security status and obesity prevalence in children have mixed conclusions. Some studies demonstrate no significant difference in obesity prevalence between food security and food insecurity (Alaimo, Olson, & Frongillo, 2001; Casey, Szeto, Lensing, Bogle, & Weber, 2001). Other studies concluded a positive association between food insecurity and childhood obesity (Dubois, Farmer, Girard, & Porcherie, 2006; Jyoti, Frongillo, & Jones, 2005). Some studies reported that low-income, food secure households were more likely to have obese children (Gundersen, Lohman, Eisenmann, Garasky, & Stewart, 2008; Rose & Bodor, 2006).

In this research, we examined the relationship between food security and obesity among children and adolescents between the ages of 2-18 years old. Looking at factors associated with the childhood and adolescent obesity is essential to understanding the trends that lead to a

lifestyle conducive for obesity and developing intervention programs and campaign to end obesity overall. Further analyses were conducted on the childhood population as categorized by age groups: children 2-11 years and adolescents 12-18 years because access to foods may differ between the age groups. We hypothesize that those children in food secure households are less likely to be obese or at-risk. Our objective was to identify socio-demographic and environmental factors that play a role in childhood obesity, which could lead to the development of health policies and obesity campaigns to address this important public health issue.

Methods

This is a cross-sectional study with subject data taken and analyzed from 2005-2006 NHANES data. All physical examinations, laboratory sampling, audio computer-assisted personal self interviews (ACASI), and computer-assisted personal interviews (CAPI) were conducted in trailers, or mobile examination centers (MEC), while all other questionnaires were given at the sample person's household or the MEC. The children surveyed were part of a national probability sample in order to be representative of the population of United States children. These data are publicly available on the NHANES website; therefore, no prior IRB approval was necessary.

United States children, aged 2-18 years, were the target sample population. The original sample consisted of 4,216 children, aged 2-18 years, and was surveyed between 2005 and 2006. Pregnant females, children not measured for anthropometrics at the MECs, and children without household food security data were excluded from the sample. After the exclusions, 3,432 children were eligible for the study, where 1,559 were young children aged 2-11 years and 1,873 were adolescents aged 12-18 years. In the sample, the gender distribution was approximately

equal with 1,715 males and 1,717 females, nearly one third of the sample was below 100% poverty level, and about 15% were not covered by insurance.

Based on the definitions by the WHO and the USDA, food security is experienced by those persons where food is readily available, access to it is not limited, and personal behavior is not changed due to avoiding hunger. The USDA measures food security with an 18-question Core Food Security Module, which is included in the NHANES questionnaire (see Appendix A). The number of affirmative responses to the module determines the level of food security. Having zero affirmative answers is categorized as High Food Security, where the household experiences no issues or worries with acquiring food. Having one to two affirmative answers is categorized as Marginal Food Security, where the household experiences some issues at times but eating behavior is not drastically changed. High and Marginal Food Security are considered food secure households. Having three or seven affirmative responses is categorized as Low Food Security, where the household experiences food issues, but there is no hunger and eating behavior is not drastically changed. Having more than seven affirmative responses is categorized as Very Low Food Security, where the household experiences hunger at times and eating behavior has been changed. Low Food Security and Very Low Food Security are considered food insecure households.

Obesity is determined by an individual's calculated body mass index. Body mass index (BMI) among adults is calculated by their weight in kilograms and their height in meters. However, BMI for children cannot be calculated the same as that for adults; BMI varies with age in childhood (Siervogel, Roche, Guo, Mukherke, & Chumlea, 1991). It takes into account the child's age, gender, and circumferential measurements because children are still undergoing that

critical period of growth and development. The CDC had developed a growth chart to determine children's BMI by BMI-for-age percentile (2009).

Because children are still undergoing critical periods of growth and development, the CDC developed Sex- and Age-Specific Growth Charts for children in determining their BMI class. Children's BMI cannot be calculated the same as that of adults. The calculation factors in height or recumbent length, weight, and head circumference if available, in addition to gender and age. Based on the CDC growth charts, children at or above the 95th percentile among those of the same gender and age are considered obese, and children at or above the 85th percentile are considered overweight, or at-risk for obesity (see Appendix B).

The 2005-2006 NHANES survey is a complex probability sample, in which analyses require a weight and cluster variable. Data were analyzed using SAS 9.2 (SAS Institute Inc, Cary, North Carolina) for Windows XP. SAS complex survey procedures were used for all analyses to take into account sample weighting and unequal probabilities of selection. For the complete statistical SAS code, see Appendix C. To determine significant differences among the variables, the data were analyzed using Chi-square analysis. A p-value found to be less than $\alpha=0.05$ was determined to be statistically significant. To determine a significant association between household food security status and obesity status, the data were analyzed using logistic regression. A crude odds ratio of food insecurity and the prevalence of obesity and those at-risk was calculated for the whole sample and then separately for children and adolescents. An adjusted odds ratio was then calculated for each age group, controlling for age, race, insurance status, poverty level, the frequency of eating outside the home, television and computer use, and physical activity. An odds ratio whose interval did not contain 1.00 was determined to be significant.

Among the potential confounders, the variables were ascertained as confounder using the model of 10% change in odds ratios (Mickey & Greenland, 1989). First, the initial odds ratio of only the exposure and outcome was calculated. Then the odds ratios were calculated for each of the variables, arranged as $\text{variable}_n + \text{exposure} = \text{outcome}$. A percent difference was computed, comparing the variable odds ratios to the initial odds ratio. If the percent difference was less than 10%, then none of the variables were retained, and the initial odds ratio was reported. If the percent difference was 10% or greater, then that variable (variable1) was retained in the model and its respective odds ratio was now used. The analysis was repeated for each of the remaining variables: $\text{variable}_n + \text{variable1} + \text{exposure} = \text{outcome}$.

Results

The sample population consisted of 3,432 children aged 2-18 years surveyed in the 2005-2006 NHANES: 1,559 children aged 2-11 years and 1,873 adolescents aged 12-18 years. About 60.69% were reported being non-Hispanic white, 14.86% being non-Hispanic black, and 16.79% being Hispanic. Nearly half the sample was male. Approximately 11.30% of the children sampled were not covered by insurance, while 20.44% lived below the poverty level. Only about 5% used the computer more than three hours or ate outside the home daily and 14.39% watched television or played video games for more than three hours daily. About a third were obese or at-risk, while 15.51% lived in a food insecure household.

Table 1 summarizes the prevalence of obesity within the sample population by potential confounding variables. Overall, nearly one third (31.21%) were either obese or at-risk for becoming obese. The proportion of children living in food insecure household and obese (37.75%) was greater than those living in food secure households and obese (30.07%; $p=0.0019$). There were no differences between males and females, yet more adolescences (34.06%)

were obese than young children (28.66%; $p=0.0106$). The race/ethnicity with the highest prevalence of obesity was the Hispanic group with 41.15%, while children classified as “Other,” including multiracial children, have the lowest prevalence at 19.55% ($p<0.0001$). More uninsured children (39.19%) were obese or at-risk than insured children (30.17%; $p=0.0029$). For poverty level status, there were 37.07% of children living below poverty level and 29.75% of children living above poverty level who were obese or at-risk ($p=0.004$). Among the behavior variables, 41.19% of children watching more than three hours of television a day were obese, while 29.60% of children who watched less than that were ($p<0.0001$). No differences were observed for frequent dining outside the home and prolonged daily computer use.

However, there was a difference in the behavior and choices that young children and adolescents made. More adolescents engaged in eating outside, watching television, and playing video/computer games than young children (see Figure 1). For eating outside the home more than once a day, more adolescents (6.92%) reported this than children (3.29%; $p=0.0002$). More adolescents (16.34%) than children (12.60%) watched television or played video games for more than three hours a day ($p=0.0033$). The largest difference was computer use for more than three hours per day with about 8% adolescents and 2% of young children ($p<0.0001$). There were no significant differences in insurance status and poverty level status between children and adolescents.

Slightly more than a quarter of young children were obese or at-risk, while more than a third of adolescents were obese or at-risk. For both age groups, the difference amongst the race/ethnicities in regards to obesity prevalence was significant ($p\leq 0.0001$). The proportion of children aged 2-11 years who were obese was greater for those uninsured (37.84%) than those who were insured (27.49%; $p=0.0195$). More young children who watched more than three

hours of television daily (40.04%) were obese than those who watched less (27.02%; $p= 0.0013$). Among adolescents aged 12-18 years, the proportion of those living below poverty level and obese (43.15%) was greater than those living above poverty level and obese (32.01%; $p= 0.0006$). The proportion of adolescents who watched television for more than three hours and were obese (42.15%) was higher than the proportion of those who watched television less and were obese (32.66%; $p= 0.0122$).

Table 2 summarizes the likelihood of children being obese or at-risk while living in a food insecure household. Children aged 2-18 years were 1.41 times more likely to be obese or at-risk if they lived in a food insecure household (95% CI= 1.14, 1.75). After adjusting for race/ethnicity, children aged 2-18 years were 1.27 times more likely (95% CI= 1.01, 1.59) and young children aged 2-11 years are 1.20 times more likely (95% CI= 0.86, 1.68) to be obese or at-risk if they live in a food insecure household. After adjusting for poverty level status, adolescents aged 12-18 are 1.25 times more likely to be obese or at-risk if they live in a food insecure household (95% CI= 0.91, 1.73). However, no significant associations were found for food insecurity and obesity for younger children in crude or adjusted models. Food insecurity was also not significant for adolescents after adjusting for poverty level.

Because no significant associations were found for either age group, Table 3 summarizes the association of obesity in children with the other confounding characteristics. Of the other variables, the prevalence of obesity in children was significantly associated with race/ethnicity, the frequency of watching television, insurance status, and poverty level status. Hispanic children aged 2-11 years were 1.78 times more likely to be obese (95% CI= 1.32, 2.41) and Hispanic children aged 12-18 years were 1.70 times more likely to be obese (95% CI= 1.28, 2.27) than non-Hispanic white children. Also young children were 1.80 times more likely to be

obese (95% CI= 1.26, 2.59) and adolescents were 1.50 times more likely to be obese (95% CI= 1.09, 2.07) if they watched more than three hours of television daily than if they watched less. Uninsured children aged 2-11 years were 1.61 times more likely to be obese than insured children (95% CI= 1.08, 2.40). Adolescents living below the poverty level were 1.61 time more likely to be obese than those living above the poverty level (95% CI= 1.23, 2.12).

Discussion

In this study, we found that children overall (aged 2-18 years) were 1.27 times more likely to be obese or at-risk when living in a food insecure household after adjusting for race/ethnicity. Similarly in a cohort study, Dubois et al. (2006) found an interaction between food insecurity among preschoolers in Canada, where food insecurity tripled the rates of obesity within three years. The children's BMI was assessed using the same CDC Sex- and Age-Specific Growth Charts, but food security was determined by a single question survey regarding food quality and quantity (Dubois et al., 2006). Also, Jyoti et al. (2005) found a significant association among kindergarteners in the United States from the ECLS-K Longitudinal study. Although Dubois et al. and Jyoti et al. findings support our finding of association between food insecurity and obesity, these studies concentrated on the young children population and varied from our study in their method of categorizing the variables: food security and obesity.

However, the same results were not found when the sample was split into younger children (aged 2-11 years) and adolescents (aged 12-18 years). Although the absolute rate of obesity/at risk was higher for food insecure households across both age groups, the crude difference was only significant for adolescents, who were 1.47 times more likely to be obese/at-risk when living in a food insecure household. Among adolescents, food insecurity was not significant after adjusting for poverty level. From NHANES data and stratifying the age groups

(2-7 years and 8-16 years), Alaimo et al. (2001) found no significance in the overall population but found significance with food insecurity and overweight among more specific subgroups; for example, adolescent females living in food insecure households were more likely to be overweight. Casey et al. (2001) also found no significant association of food security with obesity or television watching, looking at children aged 0-17 years in low-income housing from 1994-1996 Continuing Survey of Food Intakes by Individuals, but the sample size of children in low-income, food insecure households was small.

There are several mechanisms that could possibly explain the association of the overall population and the difference between the age groups. There are two levels of being food insecure: food insecurity without hunger and food insecurity with hunger (Bickel et al., 2000). Because the USDA assesses food insecurity by way of food access, quantity, and quality, food insecure households in this study were less likely to eat fruits and vegetables and more likely to eat carbohydrates, sugars, and fats (Kendall, Olson, & Frongillo, 1996). However, households that have food insecurity with hunger are more likely to have a decreased intake of food overall, which results in weight loss (Bickel et al., 2000). It is possible that inconsistencies in findings are due to an inability to determine what in proportion of the sample limited access to food results in a lack of food (i.e., food insecurity with hunger) versus a substitution of high fat foods (food insecurity without hunger).

Also, to look at the whole children population (ages 2-18 years) fails to account for the developmental differences that occur specifically for differing age groups. To account for the differences in the associations based on the age groups, we can look at the behaviors that are typical to the age groups. Young children are more apt to model their behavior after their parents and their surroundings, and their food choices are almost entirely determined by caregivers.

Therefore, factors focused on the behavior of the parents and the surroundings that they provide would be more relative to analyze with this population. It would be helpful to identify the child's primary caregiver in the data for the opportunity to analyze other confounding variables, such as the influences of maternal age and education and marital status in regards to the food security (Dubois et al., 2006). Knowledge of child care arrangements would be useful to determine the frequency that meals were eaten outside the home.

Television and computer use, transportation, and school are additional influences that may be conducive to an obesogenic lifestyle. Television and computer use are often referred to as "screen time" and are indicative of sedentary behavior. In the current study, more adolescents engaged in watching television, playing video/computer games, and eating outside than young children with the most significant difference in the computer use of more than three hours. This is consistent with Sisson et al. (2009) who found that 56.0% of 12-15 year old adolescents watched television and played on the computer for more than two hours a day, compared to 35.3% of 2-5 year old children and 49.1% of 6-11 year old children (Sisson et al., 2009). Transportation enables acquiring of restaurant food. Food prepared outside the home is determined to be higher in calories, higher in fat, lower in dietary fibers, and served in larger portions (Woodward-Lopez et al., 2006). Children also spend a large portion of their day in school, where more than 95% are enrolled into public schools (CDC, 2009). The percentage of high school students that "exercise vigorously" each day has decreased more than 20% from 1979 to 2001 (Haskins, 2009). In 2006, the School Health Policies and Programs Study has found that 95% of high schools in the United States require students to take physical education, but only 2% of high schools require students to take it daily (DHHS, 2007).

One of the strengths of this study is that the data were derived from a nationally representative sample living in the United States with the National Center of Health Statistics, where the Hispanic population was oversampled to overcome underreporting. The sample population was chosen by random sample. The large sample size of 3,432 children aged 2-18 years ensured the power of the statistics reported, lowering the potential for variability. Generalization is possible due to the method of sample selection and large sample size. Also body measurements for the body mass index variable were directly measured to prevent the misreporting of height and weight.

There were several limitations to this study. Although the child's weight status could be calculated from obtaining direct body measurements, the questionnaires obtaining other characteristics, like eating outside the home and computer use, relied on participants' recall. With recall bias, the information may be different from what actually is and what is reported. Due to confidentiality reasons, it was not possible to assess whether the sampled children lived within the same household, thereby overestimating household variables. Based on the literature, other confounding variables could not be assessed for the same reason. For future studies, the children should be identified to determine whether they live in the same household as another sample person, especially when collecting household information.

Conclusions

The findings from this study provide modest support for the association between food insecurity and obesity in children, but the lack of significant differences in adjusted models when examining children and adolescents separately indicates the need for further research. This study, however, does add further evidence for the role of socio-demographic and lifestyle factors on childhood obesity. There are already several programs that implement interventions focused on

increasing the participation of physical activity and reinforcing healthy, nutritional eating among the youth, but obesity is a multifaceted public health problem with no simple solution. Parents should limit the hours of television watched and video games played and serve healthy meals (Dougherty, 2007). They should also continue to be good role models and “give support, acceptance, and encouragement”, focusing more on the health of the child (DHHS, 2001). Children should be encouraged to eat more slowly, and parents should guide the family choice in foods, decreasing the intake of fat and calories in the diet (CDC, 2009). While one study showed that almost all schools did not meet the dietary guidelines where school breakfast provides 25% of the daily caloric intake and 33% with school lunch, more than 80% of the elementary schools and more than 90% of the high schools did provide food options that made it possible to adhere to the guidelines, if students chose the right foods (Haskins, 2009). Poor nutrition and the lack of exercise cannot be the lone culprits to the epidemic. There are other factors, like social and societal, that influence the trends of obesity. Prevention initiatives such as those currently under way at CDC Division of Nutrition, Physical Activity, and Obesity which work through state programming, training, and surveillance are needed to accomplish a reduction in obesity (CDC, 2009).

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Tables and Figures

Table 1. Obesity/at-Risk (BMI >85th Percentile) Prevalence by Age Group and Other Various Characteristics.

	Children 2-18 Years N = 3433*	Children 2-11 Years N = 1559*	Adolescents 12-18 Years N = 1873*
	Weighted %	Weighted %	Weighted %
Overall	31.21	28.61	34.03
Household Food Security Status			
Food Secure	30.07	27.63	32.70
Food Insecure	37.75	34.26	41.61
Age Group			
Young Children (2-11 years)	28.66	---	---
Adolescents (12-18 years)	34.06	---	---
Race/Ethnicity			
White, Non-Hispanic	28.96	26.26	31.67
Black, Non-Hispanic	35.44	31.87	39.28
Hispanic	41.15**	38.84**	44.12**
Other/Multiracial	19.55	18.05	21.68
Gender			
Male	32.26	31.08	33.53
Female	30.17	26.16	34.64
Insurance Status			
Insured	30.17	27.49	33.13
Uninsured	39.19	37.84**	40.50
Poverty Level Status			
Above Poverty Level	29.75	27.57	32.01
Below Poverty Level	37.07	32.46	43.15**
Eating Outside the Home			
Once a Day or Less	31.24	28.75	34.20
More than Once a Day	30.48	26.15	32.72
Television Use			
3 Hours per Day or Less	29.60	27.02	32.66
More than 3 Hours per Day	41.19**	40.04**	42.15**
Computer Use			
3 Hours per Day or Less	30.99	28.87	33.55
More than 3 Hours per Day	36.74	19.05	41.75
School Lunch			
Offered	---	---	34.61

	Not Offered	---	---	22.01
School Breakfast				
	Offered	---	---	36.07
	Not Offered	---	---	27.58

* Sample sizes (N) reported are unweighted
** Denotes significant differences within characteristic (p< 0.05)

Table 2. Crude and Adjusted Risk for Obesity/At-Risk by Food Insecurity.

	Odds Ratio (95% CI)	
	Crude	Adjusted
Children (2-11 years old)		
Living in Food Secure Household	1.00	1.00
Living in Food Insecure Household	1.36 (0.99-1.88)	1.20 (0.86-1.68)*
Adolescence (12-18 years old)		
Living in Food Secure Household	1.00	1.00
Living in Food Insecure Household	1.47 (1.09-1.97)	1.25 (0.91-1.73)**

*adjusted for race/ethnicity

**adjusted for poverty level status

Table 3. Crude Odds Ratios for Obesity/As-Risk by Various Characteristics.

	Odds Ratio (95% CI)	
	Children (2-11 years old)	Adolescents (12-18 years old)
Race/ethnicity		
Non-Hispanic White	1.00	1.00
Non-Hispanic Black	1.31 (0.97-1.778)	1.40 (1.08-1.80)
Hispanic	1.78 (1.32-2.41)	1.70 (1.28-2.27)
Other	0.62 (0.33-1.16)	0.60 (0.33-1.07)
Gender		
Female	1.00	1.00
Male	1.27 (0.96-1.69)	0.95 (0.73-1.24)
Insurance Status		
Insured	1.00	1.00
Uninsured	1.61 (1.08-2.40)	1.37 (0.97-1.95)
Poverty Level Status		
Above Poverty Level	1.00	1.00
Below Poverty Level	1.26 (0.95-1.69)	1.61 (1.23-2.12)
Eating Outside		
Once a Day or Less	1.00	1.00
More than Once a Day	0.88 (0.37-2.07)	0.94 (0.57-1.54)
Television Use		
3 Hours per Day or Less	1.00	1.00
More than 3 Hours per Day	1.80 (1.26-2.59)	1.50 (1.09-2.07)
Computer Use		
3 Hours per Day or Less	1.00	1.00
More than 3 Hours per Day	0.58 (0.22-1.51)	1.42 (0.88-2.29)

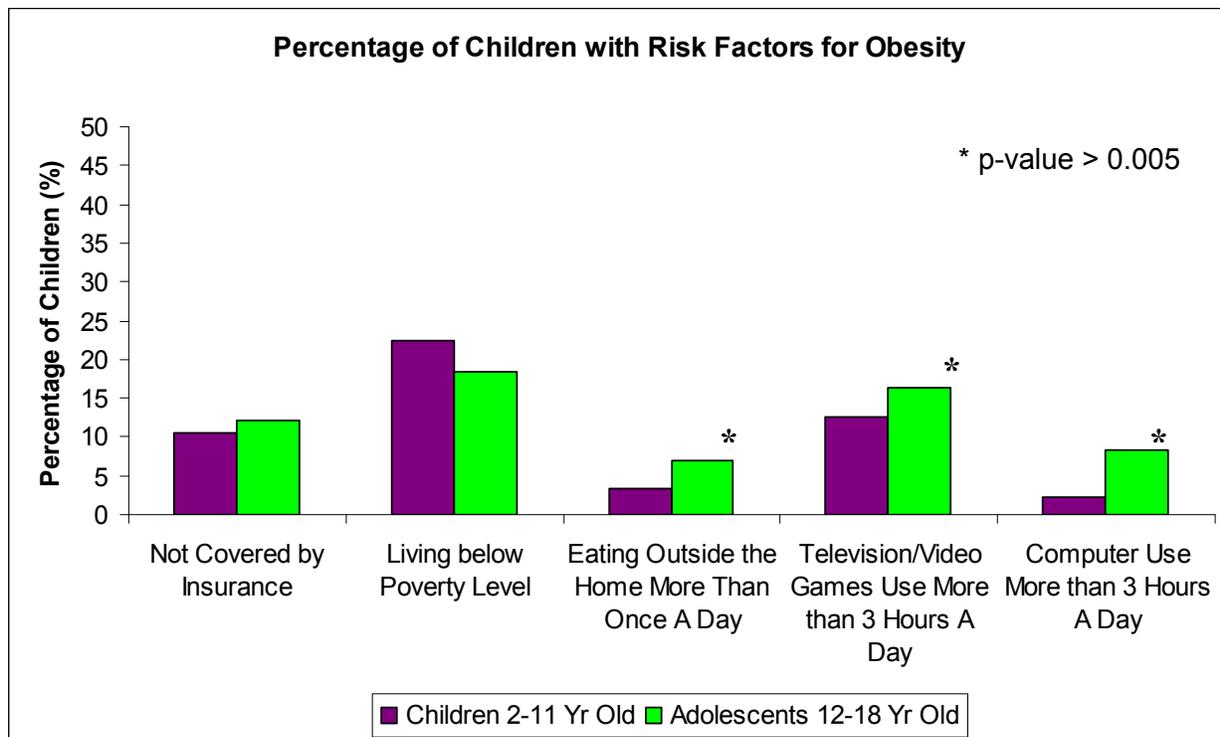


Figure 1. Comparison between the age groups with potential confounding variables to obesity/at-risk for obesity.

Appendix A

U.S. HOUSEHOLD FOOD SECURITY SURVEY MODULE: THREE-STAGE DESIGN, WITH SCREENERS Economic Research Service, USDA July 2008

Revision Notes: The food security questions are essentially unchanged from those in the original module first implemented in 1995 and described previously in this document.

July 2008:

- Wording of resource constraint in AD2 was corrected to, "...because there wasn't enough money for food" to be consistent with the intention of the September 2006 revision.
- Corrected errors in "Coding Responses" Section

September 2006:

- Minor changes were introduced to standardize wording of the resource constraint in most questions to read, "...because there wasn't enough money for food."
- Question order was changed to group the child-referenced questions following the household- and adult-referenced questions. The Committee on National Statistics panel that reviewed the food security measurement methods in 2004-06 recommended this change to reduce cognitive burden on respondents. Conforming changes in screening specifications were also made. NOTE: Question numbers were revised to reflect the new question order.
- Follow up questions to the food sufficiency question (HH1) that were included in earlier versions of the module have been omitted.
- User notes following the questionnaire have been revised to be consistent with current practice and with new labels for ranges of food security and food insecurity introduced by USDA in 2006.

Transition into Module (administered to all households):

These next questions are about the food eaten in your household in the last 12 months, since (current month) of last year and whether you were able to afford the food you need.

Optional USDA Food Sufficiency Question/Screeners: Question HH1 (This question is optional. It is not used to calculate any of the food security scales. It may be used in conjunction with income as a preliminary screener to reduce respondent burden for high income households).

HH1. [IF ONE PERSON IN HOUSEHOLD, USE "I" IN PARENTHEICALS, OTHERWISE, USE "WE."]

Which of these statements best describes the food eaten in your household in the last 12 months: —enough of the kinds of food (I/we) want to eat; —enough, but not always the kinds of food (I/we) want; —sometimes not enough to eat; or, —often not enough to eat?

- [1] Enough of the kinds of food we want to eat
- [2] Enough but not always the kinds of food we want
- [3] Sometimes not enough to eat
- [4] Often not enough to eat
- [] DK or Refused

Household Stage 1: Questions HH2-HH4 (asked of all households; begin scale items).

[IF SINGLE ADULT IN HOUSEHOLD, USE "I," "MY," AND "YOU" IN PARENTHETICALS; OTHERWISE, USE "WE," "OUR," AND "YOUR HOUSEHOLD."]

HH2. Now I'm going to read you several statements that people have made about their food situation. For these statements, please tell me whether the statement was often true, sometimes true, or never true for (you/your household) in the last 12 months—that is, since last (name of current month).

The first statement is "(I/We) worried whether (my/our) food would run out before (I/we) got money to buy more." Was that often true, sometimes true, or never true for (you/your household) in the last 12 months?

- Often true
- Sometimes true
- Never true
- DK or Refused

HH3. "The food that (I/we) bought just didn't last, and (I/we) didn't have money to get more." Was that often, sometimes, or never true for (you/your household) in the last 12 months?

- Often true
- Sometimes true
- Never true
- DK or Refused

HH4. "(I/we) couldn't afford to eat balanced meals." Was that often, sometimes, or never true for (you/your household) in the last 12 months?

- Often true
- Sometimes true
- Never true
- DK or Refused

Screener for Stage 2 Adult-Referenced Questions: If affirmative response (i.e., "often true" or "sometimes true") to one or more of Questions HH2-HH4, OR, response [3] or [4] to question HH1 (if administered), then continue to *Adult Stage 2*; otherwise, if children under age 18 are present in the household, skip to *Child Stage 1*, otherwise skip to *End of Food Security Module*.

NOTE: In a sample similar to that of the general U.S. population, about 20 percent of households (45 percent of households with incomes less than 185 percent of poverty line) will pass this screen and continue to Adult Stage 2.

Adult Stage 2: Questions AD1-AD4 (asked of households passing the screener for Stage 2 adult-referenced questions).

AD1. In the last 12 months, since last (name of current month), did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food?

- Yes
- No (Skip AD1a)
- DK (Skip AD1a)

AD1a. [IF YES ABOVE, ASK] How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

- Almost every month
- Some months but not every month
- Only 1 or 2 months
- DK

AD2. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?

- Yes
- No
- DK

AD3. In the last 12 months, were you every hungry but didn't eat because there wasn't enough money for food?

- Yes
- No
- DK

AD4. In the last 12 months, did you lose weight because there wasn't enough money for food?

Yes

No

DK

Screener for Stage 3 Adult-Referenced Questions: If affirmative response to one or more of questions AD1 through AD4, then continue to *Adult Stage 3*; otherwise, if children under age 18 are present in the household, skip to *Child Stage 1*, otherwise skip to *End of Food Security Module*.

NOTE: In a sample similar to that of the general U.S. population, about 8 percent of households (20 percent of households with incomes less than 185 percent of poverty line) will pass this screen and continue to Adult Stage 3.

Adult Stage 3: Questions AD5-AD5a (asked of households passing screener for Stage 3 adult-referenced questions).

AD5. In the last 12 months, did (you/you or other adults in your household) ever not eat for a whole day because there wasn't enough money for food?

- Yes
- No (Skip 12a)
- DK (Skip 12a)

AD5a. [IF YES ABOVE, ASK] How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

- Almost every month
- Some months but not every month
- Only 1 or 2 months
- DK

Child Stage 1: Questions CH1-CH3 (Transitions and questions CH1 and CH2 are administered to all households with children under age 18) Households with no child under age 18, skip to *End of Food Security Module*.

SELECT APPROPRIATE FILLS DEPENDING ON NUMBER OF ADULTS AND NUMBER OF CHILDREN IN THE HOUSEHOLD.

Transition into Child-Referenced Questions:

Now I'm going to read you several statements that people have made about the food situation of their children. For these statements, please tell me whether the statement was OFTEN true, SOMETIMES true, or NEVER true in the last 12 months for (your child/children living in the household who are under 18 years old).

CH1. "(I/we) relied on only a few kinds of low-cost food to feed (my/our) child/the children) because (I was/we were) running out of money to buy food." Was that often, sometimes, or never true for (you/your household) in the last 12 months?

- Often true
- Sometimes true
- Never true
- DK or Refused

CH2. "(I/We) couldn't feed (my/our) child/the children) a balanced meal, because (I/we) couldn't afford that." Was that often, sometimes, or never true for (you/your household) in the last 12 months?

- Often true
- Sometimes true
- Never true
- DK or Refused

CH3. "(My/Our child was/The children were) not eating enough because (I/we) just couldn't afford enough food." Was that often, sometimes, or never true for (you/your household) in the last 12 months?

- Often true
- Sometimes true
- Never true
- DK or Refused

Screener for Stage 2 Child Referenced Questions: If affirmative response (i.e., "often true" or "sometimes true") to one or more of questions CH1-CH3, then continue to ***Child Stage 2***; otherwise skip to ***End of Food Security Module***.

NOTE: In a sample similar to that of the general U.S. population, about 16 percent of households with children (35 percent of households with children with incomes less than 185 percent of poverty line) will pass this screen and continue to Child Stage 2.

Child Stage 2: Questions CH4-CH7 (asked of households passing the screener for stage 2 child-referenced questions).

NOTE: In Current Population Survey Food Security Supplements, question CH6 precedes question CH5.

CH4. In the last 12 months, since (current month) of last year, did you ever cut the size of (your child's/any of the children's) meals because there wasn't enough money for food?

- Yes
- No
- DK

CH5. In the last 12 months, did (CHILD'S NAME/any of the children) ever skip meals because there wasn't enough money for food?

- Yes
- No (Skip CH5a)
- DK (Skip CH5a)

CH5a. [IF YES ABOVE ASK] How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

- Almost every month
- Some months but not every month
- Only 1 or 2 months
- DK

CH6. In the last 12 months, (was your child/were the children) ever hungry but you just couldn't afford more food?

- Yes
- No
- DK

CH7. In the last 12 months, did (your child/any of the children) ever not eat for a whole day because there wasn't enough money for food?

- Yes
- No
- DK

END OF FOOD SECURITY MODULE

Appendix B

SAS Code for CDC Growth Chart

```
%let datalib='F:\Spring 2010 Research\2005-2006 data';    *subdirectory for
your existing dataset;
%let datain=bmirecode;          *the name of your existing SAS dataset;
%let dataout=dmfsbc;          *the name of the dataset you wish to put the results
into;
%let saspgm='F:\Spring 2010 Research\2005-2006 data\gc-calculate-BIV.sas';
*subdirectory for the downloaded program gc-calculate-BIV.sas;

Libname mydata &datalib;

data _INDATA; set mydata.&datain;

%include &saspgm;

data mydata.&dataout; set _INDATA;
proc means;

run;
```

Appendix C

SAS Code for Analysis

```

libname zpfinal 'F:\Spring 2010 Research\2005-2006 data';
proc sort data=zpfinal.demofsec;
by seqn;
run;
proc sort data=bmx_d;
by seqn;
run;
DATA zpfinal.forbmi;
MERGE zpfinal.demofsec
      bmx_d (IN=A);
BY SEQN;
IF A; /*if "a" then keep*/
RUN;

data zpfinal.bmirecode; set zpfinal.forbmi;

agemos = ridagemn;
sex = riagendr;
weight = bmxwt;
headcir= bmxhead;

if bmxht = . and bmxrecum = . then height = .;
else if bmxht = . and bmxrecum ne . then height = bmxrecum;
else if bmxht ne . and bmxrecum = . then height = bmxht;

if bmxht = . and bmxrecum = . then RECUMBNT = .;
else if bmxht = . and bmxrecum ne . then RECUMBNT = 1;
else if bmxht ne . and bmxrecum = . then RECUMBNT = 0;

run;

proc sort zpfinal.dmfsbc;
by seqn;
run;

proc sort hiq_d;
by seqn;
run;

data zpfinal.dmfsbchiq;
merge hiq_d (keep= hiq011)
      zpfinal.dmfsbc (in=a);
by seqn;
if a;
run;

proc contents data=zpfinal.dmfsbchiq;
run;

proc sort data= zpfinal.dmfsbchiq;
by seqn;

```

```

run;

proc sort data= paq_d;
by seqn;
run;

data zpfinal.dmf sbc inspa;
merge paq_d (keep= pad590 pad600)
zpfinal.dmf sbc h iq (in=a);
by seqn;
if a;
run;

proc sort zpfinal.dmf sbc inspa;
by seqn;
run;

proc sort dbq_d;
by seqn;
run;

data zpfinal.dmf sbc in padb;
merge dbq_d (keep= dbq370 dbq400 dbd091)
zpfinal.dmf sbc inspa (in=a);
by seqn;
if a;
run;

proc contents data=zpfinal.dmf sbc in padb;
run;

libname zpfinal 'F:\Spring 2010 Research\2005-2006 data';
data zpfinal.recode; set zpfinal.dmf sbc in padb;
where 2 le ridageyr le 18 and ridexprg ne 1 and bmipct ne . and fsdhh ne .;

if 2 le ridageyr le 11 then ageyr cat=1; /*Young children*/
else if 12 le ridageyr le 18 then ageyr cat=2; /*Adolescents*/
else ageyr cat=.;

if fsdhh in (1 2) then foodsec=1; /*Food Secure Household*/
else if fsdhh in (3 4) then foodsec=2; /*Food Insecurity Household*/
else foodsec=.;

if 0 le bmipct lt 85 then bmi=1; /*Not obese/at-risk*/
else if 85 le bmipct le 100 then bmi=2; /*Obese/at-risk*/
else bmi=.;

if ridreth1=3 then race=1; /*Non-Hispanic White*/
else if ridreth1=4 then race=2; /*Non-Hispanic Black*/
else if ridreth1 in (1 2) then race=3; /*Hispanic*/
else if ridreth1=5 then race=4; /*Other*/
else race=.;

if indfmpir lt 1 then poverty=2; /*Below Poverty Level*/
else if indfmpir ge 1 then poverty=1; /*Above Poverty Level*/
else poverty=.;

```

```

if dbq370=1 then lunch=1; /*School Lunch Offered*/
else if dbq370=2 then lunch=2; /*School Lunch Not Offered*/
else lunch=.;

if dbq400=1 then schoolbf=1; /*School Breakfast Offered*/
else if dbq400=2 then schoolbf=2; /*School Breakfast Not Offered*/
else schoolbf=.;

if 0 le dbd091 le 7 or dbd091= 6666 then outside=1; /*Eating Outside Less
Than 1 Time/Day*/
else if 8 le dbd091 le 21 or dbd091=5555 then outside=2; /*Eating Outside
More than Once/Day*/
else outside=.;

if hiq011=1 then insurance=1; /*Covered by Insurance*/
else if hiq011=2 then insurance=2; /*Not Covered by Insurance*/
else insurance=.;

if pad590 in (0 1 2 3 6) then tvvid=1; /*TV/Video Games 3 Hours or Less Per
Day*/
else if pad590 in (4 5) then tvvid=2; /*TV/Video Games More Than 3 Hours Per
Day*/
else tvvid=.;

if pad600 in (0 1 2 3 6) then comp=1; /*Computer Use 3 Hours or Less Per
Day*/
else if pad600 in (4 5) then comp=2; /*Computer Use More Than 3 Hours Per
Day*/
else comp=.;

run;
proc freq data=zpfinal.recode; /*For sample description in Methods section,
DO NOT RUN*/
tables sex poverty insurance;
run;

proc format;
value ageyrcat
1='Young Children'
2=' Adolescents';
value foodsec
1='Food Secure Household'
2=' Food Insecure Household';
value bmi
1='Not obese/at-risk'
2=' Obese/at-risk';
value race
1='Non-Hispanic White'
2=' Non-Hispanic Black'
3=' Hispanic'
4=' Other';
value poverty
1='Above Poverty Level'
2=' Below Poverty Level';
value outside
1='Eating Outside the Home Once/Day'
2=' Eating Outside the Home More Than Once/Day';

```

```

value insurance
1='Covered by Insurance'
2=' Not Covered by Insurance';
value tvvid
1='TV/Video Games 3 Hours or Less Per Day'
2=' TV/Video Games More Than 3 Hours Per Day';
value comp
1='Computer Use 3 Hours or Less Per Day'
2=' Computer Use More Than 3 Hours Per Day';
value lunch
1='School Lunch Offered'
2=' School Lunch Not Offered';
value schoolbf
1='School Breakfast Offered'
2=' School Breakfast Not Offered';
value sex
1=' Male'
2='Female';
run;
data zpfinal.format; set zpfinal.recode;
format ageyr cat ageyr cat.;
label ageyr cat="Age Group";
format foodsec foodsec.;
label foodsec="Food Security Status";
format bmi bmi.;
label bmi="Weight Status";
format race race.;
label race="Race/Ethnic Group";
format poverty poverty.;
label poverty= "Poverty Level Status";
format outside outside.;
label outside="Frequency Eating Outside the Home";
format insurance insurance.;
format tvvid tvvid.;
format comp comp.;
format lunch lunch.;
format schoolbf schoolbf.;
format sex sex.;
run;
proc freq data=zpfinal.format;
tables ridageyr*ageyr cat riagendr*sex fsdhh*foodsec bmipct*bmi ridreth1*race
indfmpir*poverty dbd091*outside hiq011*insurance pad590*tvvid;
run;

proc surveyfreq data=zpfinal.format order=formatting missing;
tables bmi foodsec/nostd row;
strata sdmvstra;
weight wtmec2yr;
run;
proc surveyfreq data=zpfinal.format order=formatting missing;
tables foodsec*bmi/nostd row;
strata sdmvstra;
weight wtint2yr;
run;

proc surveyfreq data=zpfinal.format order=formatting missing;
tables foodsec*bmi ageyr cat*bmi race*bmi sex*bmi/nostd row;

```

```
strata sdmvstra;
weight wtint2yr;
run;
```

```
proc surveyfreq data=zpfinal.format order=formatted;
tables foodsec*bmi ageyrcat*bmi race*bmi sex*bmi/nostd row chisq;
strata sdmvstra;
weight wtint2yr;
run;
```

```
proc surveyfreq data=zpfinal.format order=formatted missing;
tables insurance*bmi poverty*bmi outside*bmi tvvid*bmi comp*bmi/nostd row;
strata sdmvstra;
weight wtint2yr;
run;
```

```
proc surveyfreq data=zpfinal.format order=formatted;
tables insurance*bmi poverty*bmi outside*bmi tvvid*bmi comp*bmi/nostd row
chisq;
strata sdmvstra;
weight wtint2yr;
run;
```

```
proc surveyfreq data=zpfinal.format order=formatted missing;
tables bmi/nostd row;
where ageyrcat=1;
strata sdmvstra;
weight wtmecl2yr;
run;
```

```
proc surveyfreq data=zpfinal.format order=formatted missing;
tables foodsec*bmi/nostd row;
where ageyrcat=1;
strata sdmvstra;
weight wtint2yr;
run;
```

```
proc surveyfreq data=zpfinal.format order=formatted missing;
tables foodsec*bmi race*bmi sex*bmi/nostd row;
where ageyrcat=1;
strata sdmvstra;
weight wtint2yr;
run;
```

```
proc surveyfreq data=zpfinal.format order=formatted;
tables foodsec*bmi race*bmi sex*bmi/nostd row chisq;
where ageyrcat=1;
strata sdmvstra;
weight wtint2yr;
run;
```

```
proc surveyfreq data=zpfinal.format order=formatted missing;
tables insurance*bmi poverty*bmi outside*bmi tvvid*bmi comp*bmi/nostd row;
where ageyrcat=1;
strata sdmvstra;
weight wtint2yr;
run;
```

```

proc surveyfreq data=zpfinal.format order=formatted;
tables insurance*bmi poverty*bmi outside*bmi tvvid*bmi comp*bmi/nostd row
chisq;
where ageyrct=1;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveyfreq data=zpfinal.format order=formatted missing;
tables bmi/nostd row;
where ageyrct=2;
strata sdmvstra;
weight wtmecl2yr;
run;

```

```

proc surveyfreq data=zpfinal.format order=formatted missing;
tables foodsec*bmi/nostd row;
where ageyrct=2;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveyfreq data=zpfinal.format order=formatted missing;
tables foodsec*bmi race*bmi sex*bmi/nostd row;
where ageyrct=2;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveyfreq data=zpfinal.format order=formatted;
tables foodsec*bmi race*bmi sex*bmi/nostd row chisq;
where ageyrct=2;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveyfreq data=zpfinal.format order=formatted missing;
tables insurance*bmi poverty*bmi outside*bmi tvvid*bmi comp*bmi/nostd row;
where ageyrct=2;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveyfreq data=zpfinal.format order=formatted;
tables insurance*bmi poverty*bmi outside*bmi tvvid*bmi comp*bmi/nostd row
chisq;
where ageyrct=2;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveyfreq data=zpfinal.format order=formatted missing;
tables lunch*bmi schoolbf*bmi/nostd row;
where ageyrct=2;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveyfreq data=zpfinal.format order=formatted missing;
tables lunch*bmi schoolbf*bmi/nostd row chisq;
where ageyr cat=2;
strata sdmvstra;
weight wtint2yr;
run;

proc surveyfreq data=zpfinal.format missing; /*Code for Charts*/
tables insurance poverty outside tvvid comp;
where ageyr cat=2;
strata sdmvstra;
weight wtint2yr;
run;
proc surveyfreq data=zpfinal.format missing; /*Description of Entire Sample
Population*/
tables race sex insurance poverty outside tvvid comp;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing;
class foodsec/ param=ref;
model bmi=foodsec;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing;
class foodsec/ param=ref;
model bmi=foodsec;
where ageyr cat=1;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing;
class foodsec/ param=ref;
model bmi=foodsec;
where ageyr cat=2;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing;
class race/ param=ref;
model bmi=race;
where ageyr cat=1;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing;
class race/ param=ref;
model bmi=race;
where ageyr cat=2;
strata sdmvstra;
weight wtint2yr;

```

```

run;

proc surveylogistic data=zpfinal.format order=formatted missing;
class sex/ param=ref;
model bmi=sex;
where ageyr cat=1;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing;
class sex/ param=ref;
model bmi=sex;
where ageyr cat=2;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing;
class insurance/ param=ref;
model bmi=insurance;
where ageyr cat=1;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing;
class insurance/ param=ref;
model bmi=insurance;
where ageyr cat=2;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing;
class poverty/ param=ref;
model bmi=poverity;
where ageyr cat=1;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing;
class poverty/ param=ref;
model bmi=poverity;
where ageyr cat=2;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing;
class outside/ param=ref;
model bmi=outside;
where ageyr cat=1;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveyl logistic data=zpfinal.format order=formatted missing;
class outside/ param=ref;
model bmi=outside;
where ageyr cat=2;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveyl logistic data=zpfinal.format order=formatted missing;
class tvvid/ param=ref;
model bmi=tvvid;
where ageyr cat=1;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveyl logistic data=zpfinal.format order=formatted missing;
class tvvid/ param=ref;
model bmi=tvvid;
where ageyr cat=2;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveyl logistic data=zpfinal.format order=formatted missing;
class comp/ param=ref;
model bmi=comp;
where ageyr cat=1;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveyl logistic data=zpfinal.format order=formatted missing;
class comp/ param=ref;
model bmi=comp;
where ageyr cat=2;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveyl logistic data=zpfinal.format order=formatted missing; /*Only 0.21%
change from crude OR, Because change less than 10%, not retain in Model*/
class foodsec ageyr cat/ param=ref;
model bmi=foodsec ageyr cat;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveyl logistic data=zpfinal.format order=formatted missing; /*Only 0.43%
change from crude OR, Not retain*/
class foodsec sex/ param=ref;
model bmi=foodsec sex;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveylogistic data=zpfinal.format order=formatted missing; /*Only 5.5%
change from crude OR, Not retain*/
class foodsec insurance/ param=ref;
model bmi=foodsec insurance;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing; /*Only 9.14%
change from crude OR, Not retain*/
class foodsec poverty/ param=ref;
model bmi=foodsec poverty;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing; /*Only 0.14%
change from crude OR, Not retain*/
class foodsec outside/ param=ref;
model bmi=foodsec outside;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing; /*Only 4.2%
change from crude OR, Not retain*/
class foodsec tvvid/ param=ref;
model bmi=foodsec tvvid;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing; /*Only 0.07%
change from crude OR, Not retain*/
class foodsec comp/ param=ref;
model bmi=foodsec comp;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing; /*10.06%
change from crude OR, POTENTIAL CONFOUNDER*/
class foodsec race/ param=ref;
model bmi=foodsec race;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing; /*2.97%
change from adj OR, Not retain*/
class foodsec race poverty/ param=ref;
model bmi=foodsec race poverty;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveylogistic data=zpfinal.format order=formatted missing; /*1.61%
change from crude OR, Not Retain*/
class foodsec sex/ param=ref;
model bmi=foodsec sex;
where ageyrct=1;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveylogistic data=zpfinal.format order=formatted missing; /*8.64%
change from crude OR, Not Retain*/
class foodsec insurance/ param=ref;
model bmi=foodsec insurance;
where ageyrct=1;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveylogistic data=zpfinal.format order=formatted missing; /*5.79%
change from crude OR, Not Retain*/
class foodsec poverty/ param=ref;
model bmi=foodsec poverty;
where ageyrct=1;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveylogistic data=zpfinal.format order=formatted missing; /*0.07%
change from crude OR, Not Retain*/
class foodsec outside/ param=ref;
model bmi=foodsec outside;
where ageyrct=1;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveylogistic data=zpfinal.format order=formatted missing; /*4.54%
change from crude OR, Not Retain*/
class foodsec tvvid/ param=ref;
model bmi=foodsec tvvid;
where ageyrct=1;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveylogistic data=zpfinal.format order=formatted missing; /*0.44%
change from crude OR, Not Retain*/
class foodsec comp/ param=ref;
model bmi=foodsec comp;
where ageyrct=1;
strata sdmvstra;
weight wtint2yr;
run;

```

```

proc surveylogistic data=zpfinal.format order=formatted missing; /*12.09%
change from crude OR, POTENTIAL CONFOUNDER*/
class foodsec race/ param=ref;

```

```

model bmi=foodsec race;
where ageyrct=1;
strata sdmvstra;
weight wtint2yr;
run;

proc surveyl logistic data=zpfinal.format order=formatted missing; /*7% change
from adj OR, Not Retain*/
class foodsec race comp/ param=ref;
model bmi=foodsec race comp;
where ageyrct=1;
strata sdmvstra;
weight wtint2yr;
run;

proc surveyl logistic data=zpfinal.format order=formatted missing; /*0.14%
change from crude OR, Not Retain*/
class foodsec sex/ param=ref;
model bmi=foodsec sex;
where ageyrct=2;
strata sdmvstra;
weight wtint2yr;
run;

proc surveyl logistic data=zpfinal.format order=formatted missing; /*14.45%
change from crude OR, POTENTIAL CONFOUNDER*/
class foodsec poverty/ param=ref;
model bmi=foodsec poverty;
where ageyrct=2;
strata sdmvstra;
weight wtint2yr;
run;

proc surveyl logistic data=zpfinal.format order=formatted missing; /*0.14%
change from crude OR, Not Retain*/
class foodsec insurance/ param=ref;
model bmi=foodsec insurance;
where ageyrct=2;
strata sdmvstra;
weight wtint2yr;
run;

proc surveyl logistic data=zpfinal.format order=formatted missing; /*0.07%
change from crude OR, Not Retain*/
class foodsec outside/ param=ref;
model bmi=foodsec outside;
where ageyrct=2;
strata sdmvstra;
weight wtint2yr;
run;

proc surveyl logistic data=zpfinal.format order=formatted missing; /*3.75%
change from crude OR, Not Retain*/
class foodsec tvvid/ param=ref;
model bmi=foodsec tvvid;
where ageyrct=2;
strata sdmvstra;

```

```

weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing; /*0.48%
change from crude OR, Not Retain*/
class foodsec comp/ param=ref;
model bmi=foodsec comp;
where ageyrct=2;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing; /*1.7%
change from crude OR, Not Retain*/
class foodsec lunch/ param=ref;
model bmi=foodsec lunch;
where ageyrct=2;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing; /*3.54%
change from crude OR, Not Retain*/
class foodsec schoolbf/ param=ref;
model bmi=foodsec schoolbf;
where ageyrct=2;
strata sdmvstra;
weight wtint2yr;
run;

proc surveylogistic data=zpfinal.format order=formatted missing;
class foodsec poverty schoolbf/ param=ref;
model bmi=foodsec poverty schoolbf;
where ageyrct=2;
strata sdmvstra;
weight wtint2yr;
run;

proc surveyfreq data=zpfinal.format order=formatted;
tables ageyrct*insurance ageyrct*poverty ageyrct*outside ageyrct*tvvid
ageyrct*comp/nostd row chisq;
strata sdmvstra;
weight wtint2yr;
run;

proc surveyfreq data=zpfinal.format order=formatted;
tables ageyrct*outside ageyrct*tvvid/nostd row chisq;
strata sdmvstra;
weight wtint2yr;
run;

```