Adult Obesity and Household Food Insecurity: Empirical Evidence from NHIS, 1997-2013

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Abstract:

To better understand who is at risk for obesity, this research will analyze how demographic factors, such as gender, race, ethnicity, age, marital status, and citizenship as well as socio-economic factors, such as educational attainment, employment status and income, affect household food insecurity and adult obesity. This research will use the National Health Interview Survey (NHIS) survey data from 1997-2013 to study obesity prevalence trends among various demographic and socio-economic groups in the United States. Overall, NHIS data on obesity prevalence and household food insecurity reveals significant associations between obesity and race, ethnicity, age, sex, SNAP eligibility, educational attainment, and poverty-income ratio. Those most affected by racism and sexism, as well as economic disadvantage and a lack of educational opportunities are far more likely to be obese.

Introduction:

What demographic and socio-economic factors affect the relationship between adult obesity and household food insecurity?

Over the past few decades, obesity prevalence has been increasing within the United States at alarming rates. At first glance, the relationship between adult obesity and household food insecurity seems paradoxical. Food insecurity results when households have inadequate economic resources to purchase food and obesity is often framed as a consequence of overconsumption. However, poor diets are often rooted in structural inequalities that limit access to healthy food and have little to do with individual behaviors. To better understand who is at risk for obesity, this research will analyze how demographic factors, such as gender, race, ethnicity, age, marital status, and citizenship as well as socio-economic factors, such as educational attainment, employment status and income, affect household food insecurity and adult obesity.

This research will use the National Health Interview Survey (NHIS) survey data from 1997-2013 to study obesity prevalence trends among various demographic and socio-economic groups in the United States. The NHIS is a cross-sectional, national survey designed to monitor the health of the United States non-institutionalized civilian population; data are collected through household interviews using computer assisted personal interviewing technology. NHIS collects information on demographic

characteristics, health status, health care services, and health behaviors. These data will allow us to discern trends in obesity and household food insecurity.

Studies posit that low-income, ethnic minority, and female-headed households exhibit the greatest risk for food insecurity. In addition, participation in the Supplemental Nutritional Assistance Program (SNAP, formerly called the Food Stamps program) has also been linked to increased likelihood of household obesity. This research identifies demographic and socio-economic factors that increase obesity prevalence and household food insecurity. The implications of this research can provide a richer conceptual framework for the development of obesity prevention programs, federal food assistance programs, and public health policies.

Background Literature:

A review of published literature reveals correlations between household food insecurity and obesity among adults, especially women. Attention to the relationship between food insecurity and obesity first received academic attention with the publication of an article in *Pediatrics* by Dr. William H. Dietz in 1995. Adult obesity is defined as a body mass index (BMI) of 30 or greater, calculated from weight in kilograms divided by height in meters squared.[1] Obesity prevalence is tracked through national health surveys that include measured heights and weights. The US Department of Agriculture (USDA) defines food security as the ability of a household to "access by all members at all times enough food for an active, healthy life" and food insecurity as a "limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways."[2] Socially acceptable ways implies that nutritionally adequate and safe foods can be obtained without stealing, accessing emergency food supplies, or utilizing other coping strategies, such as skipping meals,

eating less, etc. Members of food insecure household often consume foods that are high in calories but nutritionally poor.[3]

The upward trend of adult obesity over the past few decades has recently been exacerbated by the global financial crisis of 2007-08. In the United States, unemployment remained high through 2013 and the recession has been especially difficult for low-income families. In 2012, 14.5 % or 17.6 million US households were food insecure.[4] The U.S. Department of Agriculture, Economic Research Service also reports that rates of food insecurity are substantially higher for households with incomes near or below the poverty line, households headed by single women or single men, and Black and Hispanic households.

Food insecurity is highly correlated with poverty.[5] Several studies demonstrate the association between participation in the federal Supplemental Nutritional Assistance Program (SNAP), obesity, and household food insecurity. Obesity may be a physiological adaptation which results from episodic food insecurity, or a cycle that can lead to binge eating habits when food is plentiful and an involuntary restriction of calories when food is not.[6] Cyclic food restriction has been associated with an increase in body fat, decrease in lean muscle mass, and a quicker weight gain in response to increased food intake.[7] This "feast-famine" type of cycle has been linked to food stamps. The "food stamp cycle" refers to a three-week period of overeating because food stamps and money are available, followed by a one-week long food restriction due to a depletion of resources, followed again by a period of overeating when the food stamp cycle has been restored.[8,9,10,11] In addition to the physiological adaptions to the feast/famine cycle, food insecurity may suggest a variety of psychological issues, such as depression and stress that may also be

related to economical food choice. Various demographic and socio-economic factors also affect the physiological response to household food insecurity.

Gender plays a role in the complex relationship between household food insecurity and obesity prevalence. Although results vary somewhat between subgroups, Caucasian, African-American, Hispanic, and American Indian women are consistently more likely than their male counterparts to be obese. This increased incidence of obesity for women holds for every age group.[12] Biological differences alone cannot explain why women are more prone to clinical obesity. There is a statistically significant association between food insecurity and being overweight or obese for mothers, but not for child-free women or all men.[13] Some research suggests that the increased rate of obesity observed among women of limited economic resources may be a direct consequence of U.S. social welfare policies and pressures that are imposed almost exclusively on impoverished women.[14]

Methodology:

The National Health Interview Survey uses a multi-stage area probability design that represents the US non-institutionalized civilian population. The current NHIS sample design oversamples African-American, Hispanic, and Asian persons. Data are collected in personal household interviews conducted by interviewers trained and supervised by the U.S. Census Bureau. Since 1997, NHIS interviews have used computer-assisted personal interviewing (CAPI) technology for data collection. Interviewers administer the survey using a laptop computer and enter responses directly into the computer during the interview. This method improves data quality and timeliness of data collection for analysis.

For this analysis, only adults aged 18 and older are included. Using version 13.1 of STATA, bivariate tables and chi square tests were calculated to determine the nature and significance of associations between variables. In addition to the literature review, this testing helped determine the variables that should be included in our final logistic regression models.

Results:

NHIS data on BMI from 1997 to 2013 shows an alarming upward trend of obesity for men and women age 18 to 85 in the United States. In 1997, obesity prevalence among adults was only 19% and increased to 28.6% as of 2013. The odds ratio of 1.03 represents the linear trend of obesity prevalence, or that for every passing year, the odds of obesity increases by a factor of 1.03. The interaction test variable estimates whether linear annual trends in obesity are equivalent for both sexes. The result is failure to reject the null hypothesis that annual trends in obesity are equivalent for males and females.

Table 1. Prevalence of Obesity in U.S. Population ages 18 to 85 by Year and Gender

	Obesity Prevalence (%)		
Year	**All**	**Male**	**Female**
ALL YEARS	24.9	25.1	24.6
1997	19.0	18.9	19.2
1998	20.0	20.0	20.0
1999	21.1	21.7	20.6
2000	21.4	21.1	21.6
2001	22.5	22.7	22.3
2002	23.5	24.1	23.0
2003	23.2	23.1	23.4
2004	24.0	24.2	23.8
2005	24.9	25.3	24.5
2006	25.8	25.7	25.9
2007	26.2	26.9	25.5
2008	27.4	27.1	27.8
2009	27.6	28.1	27.1
2010	28.0	28.3	27.7
2011	28.3	28.8	27.8
2012	28.4	28.8	28.1
2013	28.6	29.1	28.1
P(categorical)	0.00	0.00	0.00
P(linear)	0.00	0.00	0.00
Odds Ratio for linear annual trend (S. E)	1.03365 (0.0008965)	1.034812 (0.0013237)	1.032508 (0.0011415)

Interaction Test (a)	0.1745

(a) Test of null hypothesis that linear annual trends in obesity are equivalent for males and females.

Table 2 presents obesity trends in prevalence among adults in the United States by race and ethnicity. Compiling all data from 1997-2013, obesity prevalence is approximately 25.5%. Sampling weights have been applied to estimate minority racial and ethnic groups based on the U.S. Census. Since 1997, in accordance with the Office of Management and Budget, national surveys (including the NHIS) have collected data for multiple race persons. Since 1995, NHIS has over-sampled Hispanic and African-Americans households to increase the precision of estimates and improve data quality. In addition, NHIS has implemented oversampling of Asian households since 2006. NHIS does not report oversampling American Indian households so obesity prevalence data for American Indians may be affected by NHIS sampling rates and data collection.

Obesity prevalence is greatest among the American Indian population (39.6%), African-Americans (35%), those identifying as other or multiple races (30%), and Hispanics (27.7%). The white population is just under the average obesity prevalence for all races. The Asian population has drastically lower rates of obesity prevalence (8%). More research should be conducted to discern social, environmental, biological, and cultural factors that influence why the Asian American community is so unlikely to become obese; however, that is outside the scope of this particular research paper.

We reject the null hypothesis that increases in obesity are equivalent across race-ethnic groups with p-values of 0.022. This means that certain ethnic and racial groups (American-Indians, mixed or other race, Blacks, and Hispanics) were more likely to become obese over time than others. This alarming trend of increased obesity prevalence has not affected all racial and ethnic groups and communities proportionately.

Historically, African-American, Hispanic, mixed-race, and American Indian groups have been disadvantaged politically, economically, and socially due to racist systems of power and domination so these findings can be interpreted as another example of racial and ethnic disadvantage in the United States.

Table 2. Prevalence and Trends in Obesity by Race-Ethnicity[*]

Race/ Ethnicity:	Obesity Prevalence (%)	95% Confidence Interval	OR for Linear Annual Change (s.e.)	P-value
ALL[†]	25.5	25.3, 25.7	1.03228 (0.0010707)	0.00
White	24.3	24.1, 24.5	1.032209 (0.0013698)	0.00
Black	35.0	34.6, 35.5	1.026472 (0.0024361)	0.00
American Indian	39.6	36.8, 42.5	1.050162 (0.0144872)	0.00
Asian	8.1	7.7, 8.6	1.045299 (0.0081443)	0.00
Multiple Races & Other	30.2	28.5, 31.9	1.012791 (0.009057)	0.155
Hispanic	27.7	27.3, 28.1	1.036541 (0.00203)	0.00
P for Interaction Test (a)		0.0022		

(a) Test of null hypothesis that annual linear trends in obesity are equivalent across race ethnic groups.

In order to understand the complex factors affecting this disadvantage, Tables 3.1 and 3.2 examine the variation in overall obesity prevalence by race and ethnicity for men and women. While Table 1 showed that overall annual trends in obesity were equivalent for men and women, Table 3 explains how race and ethnicity affect odds of obesity differently for men and women. In Table 3.1, American Indian men have the greatest obesity prevalence (41.6%), followed by men of multiple races (31%), and African-

[*] Estimates of linear annual change derived separately by logistical regressions for each racial or ethnic group.

[†] Note: some NHIS respondents refused to answer, could not answer, or skipped questions regarding racial identity and ethnicity, which is why obesity prevalence in Table 2 differs from reported obesity prevalence (24.9%) in Table 1.

American men (29.5%). Using white men as the statistical reference group, the odds ratio shows that American Indian men are 2.05 times more likely to be obese, men of multiple or other races are 1.3 times more likely to be obese, and black men are 1.2 times more likely to be obese. Hispanic men (26.9%) are only slightly more likely to be obese than white men (1.06 times more likely) and Asian men are highly unlikely to be obese. Only 8.9% of Asian men are obese and this group is 0.28 less likely to be obese than all other racial and ethnic groups.

Table 3.1. Variation in Overall Obesity Prevalence by Race/Ethnicity for Men

Race/ Ethnicity:	Obesity Prevalence (%)	Odds Ratio	95% Confidence Interval	P Overall Effect
White	25.7	REF		<0.0001
Black	29.5	1.21***	1.16, 1.26	
American Indian	41.6	2.05***	1.74, 2.43	
Asian	8.9	0.28***	0.26, 0.31	
Multiple Races & Other	31.0	1.30***	1.15, 1.47	
Hispanic	26.9	1.06***	1.03, 1.10	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3.2 shows how overall obesity prevalence by race and ethnicity varies for women. African-American women (39.6%), American Indian women (37.8%), and women of multiple races (29.3%) are most likely to be obese. Using white women as the statistical reference group, black women are 2.2 times more likely to be obese, followed by American Indian women at 2.04 times more likely to be obese. Women of multiple or other races are 1.39 more times likely to be obese, similar to Hispanic women, who were

1.34 times more likely to be obese. Asian women were the least likely to be obese (only 7.4%).

Table 3.2. Variation in Overall Obesity Prevalence by Race/Ethnicity for Women

Race/Ethnicity:	Obesity Prevalence (%)	Odds Ratio	95% Confidence Interval	P Overall Effect
White	23.0	REF		<0.0001
Black	39.6	2.20***	2.13, 2.27	
American Indian	37.8	2.04***	1.73, 2.39	
Asian	7.4	0.27***	0.24, 0.30	
Multiple Races & Other	29.3	1.39***	1.24, 1.55	
Hispanic	28.6	1.34***	1.30, 1.38	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Comparing Tables 3.1 and 3.2, African-American women are much more likely than African-American men to be obese (39.6% vs. 29.5%). Whereas obesity prevalence was relatively similar for men and women within each race or ethnic group, the difference between African-American men and women was the greatest. While obesity prevalence among Hispanic men and white men was comparable (26.9% and 25.7%), obesity prevalence between Hispanic women and white women was greater (28.6% and 23%). Both Asian men and women were least likely to be obese.

To further examine other elements associated with the disadvantage of obesity, Tables 4 through 6 investigate how other demographic variables, socio-economic

variables, and indicators of household food insecurity affect obesity prevalence. Table 4 examines trends in overall obesity prevalence over the entire time period 1997-2013 by other demographic variables, such as age, marital status, citizenship, and whether a household has children living there under age 18. The distribution of obesity prevalence according to age shows that obesity is lower (only 18%) among those age 18-29 and higher among older people. Those age 45-60 are most likely to be obese (29.7%), followed by those age 30-44 (26%). This finding is somewhat surprising considering that even though most middle-aged individuals are unaffected by mobility or other severe health issues, this age group is least likely to be of adequate physical weight. We will later examine how obesity prevalence is affected by hours worked, employment status, and income. The greater obesity prevalence at age 30-60 may be tied to the high demands

Demographics	Obesity Prevalence (%)	Odds Ratio	95% Confidence Interval	P* Overall Effect

of work, family obligations, and other responsibilities that increase stress (assuming those age 60 and older may be preparing for retirement and those under age 30 may not experience such difficulties). Related to lower obesity prevalence at younger ages, those with children under age 18 living at home are slightly less likely to be obese (24%) than those who do not (26%). An examination of obesity prevalence by marital status reveals

Table 4. Variation in Overall Obesity Prevalence by Other Demographic variables

Age	**18-29**	18.0	REF		<0.0001
	30-44	26.0	1.60***	1.56, 1.65	
	45-60	29.7	1.92***	1.87, 1.97	
	61-85	24.2	1.45***	1.41, 1.49	
Have Kids under 18	**Yes**	25.9	1.09***	1.07, 1.11	<0.0001
	No	24.3	REF		
Martial Status	**Married**	25.6	REF		<0.0001
	Widowed	23.8	0.90***	0.88, 0.93	
	Divorced	27.8	1.12***	1.09, 1.14	
	Separated	30.2	1.26***	1.20, 1.31	
	Never married	21.6	0.80***	0.78, 0.82	
Citizenship	**US**	25.8	1.17***	1.15, 1.19	<0.0001
	Other	18.6	REF		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

that those most likely to be obese are those separated (30%) or divorced (28%). This may reflect the emotional (and often economic) turmoil experienced by individuals at the dissolution of a marriage and household. Yet, the differences are slight as obesity prevalence for married (26%), widowed (24%), and never married (22%) individuals are not highly variable. Those who are U.S. citizens are much more likely to be obese than non-citizens living in the United States (25.8% vs. 18.6%). This finding is particularly important for public health policy as it distinguishes those at greatest risk for obesity as American citizens.

Table 5 explores the relationship between obesity prevalence and socio-economic variables, such as poverty-income ratio, educational attainment, work status, hours worked, home ownership, and whether or not individuals lived in a household with government subsidized rent. As shown in Table 5, although many observed differences

are small, there is a statistically significant association between each variable in the table and obesity prevalence. This reflects our very large sample size.

The poverty-income ratio result indicates that obesity prevalence decreases as household income increases. Those most likely to be obese are individuals living below the federal poverty line (28%) and low-income households (28%), with incomes above the poverty line but only by 100-199%. Those with household incomes greater than 500% of the poverty level are least likely to be obese (21%).

Obesity prevalence also decreases as the level of education increases. Using those without a high school diploma as a statistical reference group, the odds ratio indicates that high school graduates are 0.97 times less likely to be obese, those with some college are 0.9 time less likely to be obese, and those with a college degree are 0.6 times less likely to be obese. Those with a graduate or professional degree are only slightly less

Table 5. Variation in Overall Obesity Prevalence by Socio-economic variables

Socio-economic variables	Obesity Prevalence (%)	Odds Ratio	95% Confidence Interval	P* Overall Effect
Below Poverty:				
Income < 100% Poverty	28.3	REF		<0.0001
Low-Income:				
Income between 100% & 199% of Poverty	28.2	0.99***	0.96, 1.02	
Middle-Income:				
Income between 200% & 399% of poverty	26.8	0.93***	0.90, 0.95	
High-Income:				
Income between 400% & 499% of poverty	24.1	0.80***	0.78, 0.83	
Higher-Income:				
Income > 500% of poverty	21.5	0.69***	0.67, 0.71	
Education:				
No high school diploma	28.2	REF		<0.0001
High school graduate	27.6	0.97***	0.95, 0.99	
Some college	26.1	0.90***	0.88, 0.92	
College graduate	19.1	0.60***	0.58, 0.62	
Graduate/professional school graduate	17.2	0.53***	0.51, 0.55	
Work Status:				
Employed	24.4	REF		<0.0001
Unemployed	27.3	1.16***	1.11, 1.21	

Not in the labor force	25.6	1.06***	1.04, 1.08	
Hours Worked				
Less than 35 hours per week	22.1	REF		<0.0001
More than 35 hours per week	25.2	1.19***	1.16, 1.22	
Home Type				
Rented	25.3	REF		<0.0001
Owned or being bought	24.7	0.97***	0.95, 0.99	
Other	25.7	1.02***	0.97, 1.08	
Government Subsidized Rent?				
No	24.9	REF		<0.0001
Yes	34.7	1.60***	1.54, 1.66	

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

likely than college graduates to be obese (17% vs. 19%). The greatest difference in obesity prevalence occurs between college and high school graduates. College graduates are less likely to be obese than those with only a high school diploma (19% vs. 27.6%). All educational attainment variables are strongly correlated with obesity prevalence and are highly statistically significant.

There is little variation in obesity prevalence according to employment status. Unemployed have the greatest obesity prevalence (27%), followed by those not currently in the labor force (26%). Those not currently in the labor force could be full-time students, retired individuals, or others on disability. Employed individuals (24%) were least likely to be obese in this category, but the difference is not significant. Among employed individuals, those working more than 35 hours per week were more likely to be obese than those working less (25% vs. 22%).

Home type variables show little association with obesity prevalence. Those who reported that their home is neither rented, owned, or being bought were most likely to be obese (26%), followed by those who rented their homes (25.3%). Obesity prevalence among those who rented and those who owned their homes was similar (25.3% vs. 24.7%). Those living in homes or apartments with government subsidized rent were most likely to be obese (35%) compared to those with no government rent subsidy (25%). This difference supports the relationship between increased obesity prevalence among those with limited economic means.

Table 6. Variation in Overall Obesity Prevalence by Socio-Economic Variables

Household Food Insecurity Indicators		Obesity Prevalence (%)	Odds Ratio	95% Confidence Interval	P‡ Overall Effect
Authorized to receive SNAP (Food Stamps)	**No**	23.4	REF		<0.0001
	Yes	36.5	1.88***	1.82, 1.95	
WIC Eligible	**No**	25.3	REF		<0.0001
	Yes	26.6	1.07	1.05, 1.09	

* p < 0.005, ** p < 0.01, *** p < 0.001

Table 6 examines the relationship between obesity prevalence and household food insecurity, as signified by supplemental nutritional assistance program (SNAP) and WIC eligibility. The Special Supplemental Nutrition program for Women, Infants, and Children (WIC) provides federal support for low-income pregnant, breastfeeding, and non-breastfeeding postpartum women, and to infants and children up to age five who are found to be at nutritional risk. Those WIC eligible are only slightly more likely to be obese than those ineligible (25% vs. 27%). But there is a drastic discrepancy between those authorized to receive food stamps and those ineligible. There is a 37% obesity prevalence among those authorized to receive SNAP, compared to 23% obesity prevalence of those not receiving SNAP benefits.

Tables 6.1 and 6.2 further examine the variations in overall obesity prevalence by household food insecurity for men and women. The number of women who are eligible to receive SNAP benefits and are also obese is far greater than for men (39.2% vs. 29.7%). The total for both sexes was 36.5%, but this masks the gendered dimension of inequality associated with SNAP benefits. The majority of clients receiving governmental nutritional assistance are predominantly female. For men who are authorized to receive

‡ P for overall effect tests the null hypothesis that obesity prevalence was equivalent across categories of the household food insecurity variables (e.g. snap eligible vs. ineligible, etc.).

food stamps, there are 1.33 higher odds that they will be obese; for women, the odds are 2.2 times higher. Looking at WIC eligibility, for men the trend is consistent that those who are eligible are slightly more likely to be obese (27.8% vs. 24.6%). However, for women who are WIC eligible, this is not the case (25.7% vs. 26.3%). However for both men and women, SNAP eligibility remains a significant indicator of obesity prevalence and household food insecurity.

Table 6.1. Variation in Overall Obesity Prevalence by Household Food Insecurity Indicators for Men

Household Food Insecurity Indicators		Obesity Prevalence (%)	Odds Ratio	95% Confidence Interval	P[§] Overall Effect
Authorized to receive SNAP (Food Stamps)	**No**	24.1	REF		<0.0001
	Yes	29.7	1.33***	1.24, 1.43	
WIC Eligible	**No**	24.6	REF		<0.0001
	Yes	27.8	1.18***	1.15, 1.21	

* p < 0.005, ** p < 0.01, *** p < 0.001

Table 6.2. Variation in Overall Obesity Prevalence by Household Food Insecurity Indicators for Women

Household Food Insecurity Indicators		Obesity Prevalence (%)	Odds Ratio	95% Confidence Interval	P[**] Overall Effect
Authorized to receive SNAP (Food Stamps)	**No**	22.7	REF		<0.0001
	Yes	39.2	2.20***	2.11, 2.27	
WIC Eligible	**No**	26.3	REF		<0.0001
	Yes	25.7	0.97***	0.94, 1.0	

* p < 0.005, ** p < 0.01, *** p < 0.001

Table 7. Logistic Regression predicting odds of obesity as a function of socio-demographic variables and food insecurity

[§] P for overall effect tests the null hypothesis that obesity prevalence was equivalent across categories of the household food insecurity variables (e.g. snap eligible vs. ineligible, etc.).

[**] P for overall effect tests the null hypothesis that obesity prevalence was equivalent across categories of the household food insecurity variables (e.g. snap eligible vs. ineligible, etc.).

Predictor	Adjusted OR	s.e.	95% CI
Race			
White	REF	--	--
Black	1.60***	0.03	1.54 - 1.65
American Indian	1.67***	0.14	1.42 - 1.96
Asian	0.33***	0.02	0.30 - 0.37
Multiple & Other	1.33***	0.08	1.20 - 1.49
Hispanic	1.32***	0.03	1.27 - 1.38
Sex			
Male	REF	--	--
Female	0.92***	0.01	0.90 - 0.95
Age Group			
18-29	REF	--	--
30-44	1.76***	0.04	1.70 - 1.83
45-60	2.14***	0.05	2.05 - 2.24
61-85	1.72***	0.05	1.62 - 1.82
Marital Status			
Married	REF	--	--
Widowed	0.84***	0.02	0.80 – 0.89
Divorced	0.91***	0.02	0.88 - 0.95
Separated	0.96	0.03	0.89 - 1.02
Never married	0.91***	0.02	0.87 - 0.94
Work Status			
Employed	REF	--	--
Unemployed	1.00	0.03	0.94 – 1.07
Not in Labor Force	0.99	0.02	0.96 - 1.02
US Citizenship			
No	REF	--	--
Yes	1.72***	0.05	1.63 - 1.82
Children Under 18 in HH			
No	REF	--	--
Yes	0.99	0.02	0.96 - 1.02
Poverty to Income Ratio			
<100%	REF	--	--
100% to 199%	1.11***	0.02	1.07 - 1.17
200% to 399%	1.07**	0.02	1.03 - 1.12
400% to 499%	0.97	0.03	0.92 - 1.03
500% +	0.87***	0.02	0.83 - 0.92
Educational Attainment			
No HS diploma	REF	--	--
HS diploma or GED	0.98	0.02	0.95 - 1.02
Some College	0.97	0.02	0.93 - 1.00
College degree	0.68***	0.02	0.65 - 0.72
Graduate or Prof. degree	0.58***	0.02	0.55 - 0.61
Government subsidized rent		--	--
No	REF	--	--
Yes	1.15***	0.03	1.09 - 1.22
SNAP Eligible			
No	REF	--	--
Yes	1.51***	0.04	1.44 - 1.60
WIC Eligible			
No	REF	--	--
Yes	1.13***	0.02	1.09 - 1.18
Constant	0.132***	0.01	
N	216,542		

* p < 0.005, ** p < 0.01, *** p < 0.001

Table 7 presents

results of a logistic regression predicting the odds of obesity as a function of socio-demographic variables, and household food insecurity indicators. The "adjusted odds ratios (AORs)" shown in Table 7 are estimates of the association between the odds of a subject being obese and each independent variable *net of the impact of the other variables in the model equation*. To streamline presentation in the text below, the p-values for each coefficient are shown with 1, 2, or 3 asterisks to indicate that: $p < 0.05$; $p < 0.01$; or $p < 0.001$ respectively. If no asterisks are shown with an AOR, then the result was not statistically significant (i.e., $p > 0.05$).

Using white as the statistical reference group for race, all racial and ethnic groups had highly statistically significant differences in the odds of obesity. Compared to whites, American Indians have 1.67^{***} higher adjusted odds of being obese, African-Americans have 1.60^{***} higher adjusted odds of being obese. Hispanics and those identifying as other or multiple races have 1.32^{***} and 1.33^{***} higher adjusted odds of being obese. Asians are least likely to be obese with 0.33^{***} lower adjusted odds of being obese.

Among age groups, the statistical reference group is those age 18-29. Older folks are more likely to be obese. In comparison to the reference group, those age 45 to 60 are most likely to be obese, with 2.14^{***} higher adjusted odds. Those who are age 61 to 85 have 1.72^{***} higher adjusted odds of being obese, and those who are age 30 to 44 have 1.76^{***} higher adjusted odds of being obese. Results for all age groups are highly statistically significant.

For marital status, the statistical reference group is individuals who are married. Only those widowed, divorced or never married had a statistically significant difference in the odds of obesity. Widowed persons have 0.84^{***} lower adjusted odds of being

obese, and both divorced and never married persons have 0.91*** lower adjusted odds of being obese.

For work status, the results are not statistically significant. There is no difference between those unemployed, employed, and not in the labor force in relation to obesity. Compared to non-US citizens, US citizens have 1.72*** higher adjusted odds of being obese and this finding is statistically significant.

Poverty-income ratio adjusted odd ratios support the hypothesis that those economically disadvantaged are more likely to be obese. Using those living below poverty as a reference group, low-income individuals (or those with incomes between 100% and 199% of the poverty threshold) have higher adjusted odds of 1.11*** of being obese. Wealthy individuals, or those with incomes over 500% of the poverty threshold, are less likely to be obese than those living below the poverty line (adjusted OR = 0.87***).

Educational achievement also decreases obesity prevalence. Using those without a high school diploma or GED as a statistical reference group, those with a college or graduate degree were significantly less likely to be obese (adjusted ORs = 0.68*** and 0.58*** respectively).

Those who receive a government subsidy for rent are also more likely to be obese (adjusted OR = 1.15***) compared to those who do not. SNAP eligibility increases the odds of being obese by 1.51*** compared to those not eligible. WIC eligibility increases odds of being obese by 1.13*** compared to those not eligible. Both findings are statistically significant. Overall, obesity prevalence is significantly correlated with a variety of demographic, socio-economic, and household food insecurity variables.

Discussion:

In summary, obesity prevalence was highest among American Indian, African-American, multiple race, and Hispanic persons. Persons age 45-60 showed the highest obesity prevalence. U.S. citizens were more likely to be obese compared to non-citizens. Obesity prevalence increased as the poverty-income ratio and educational attainment decreased. Those authorized to receive SNAP benefits were among the most likely to be obese. This data did not find especially significant or strong associations between obesity prevalence and marital status or work status, but moderate and weak associations could be found for those receiving government subsidized rent and those who worked over 35 hours per week.

This data presents a different portrait of obesity than that popularized by the media. Those most likely to be obese are often from minority racial and ethnic groups with a history of oppression within the United States. Coupled with sexism, the gendered dynamic of obesity especially affects women from minority groups such as African-Americans, American Indians, Hispanics, and those identifying as multiple or other race. United States citizens are far more likely to be obese than non-citizens; this may be due to the uniquely toxic qualities of American cuisine, specifically an overabundance of unhealthy foods.

Educational achievement and income are inversely related to obesity prevalence. This suggests that greater public investment in educational and economic opportunities for those most at risk for obesity might succeed as a public health initiative to decrease obesity prevalence within the United States. In addition for those who are low-income or without educational advantage, those who work over 35 hours per week or receive

government subsidized rent are also at risk for obesity. Encouraging corporate responsibility for the health and welfare of their workers and families might also substantially affect public health outcomes related to obesity.

The gendered dimension of disadvantage as signified by the high obesity prevalence among women who are authorized to receive SNAP benefits highlights the challenges to health faced by low-income, working-class women. The SNAP program should do more to promote nutritional literacy and access to healthy foods for participants to reverse the positive association with obesity prevalence. Further research should investigate what kinds of public health interventions are successful in decreasing obesity prevalence among those eligible for SNAP benefits.

Conclusion:

Overall, NHIS data on obesity prevalence and household food insecurity reveals significant associations between obesity and race, ethnicity, age, sex, SNAP eligibility, educational attainment, and poverty-income ratio. Those most affected by racism and sexism, as well as economic disadvantage and a lack of educational opportunities are far more likely to be obese. Unlike past presentations of gluttony and wealth juxtaposed with deficiency and privation, modern poverty in the United States is significantly associated with obesity. Those with economic and educational privilege have access to health and well being, unlike their poorer and less educated counterparts. While the present research cannot offer definitive policy recommendations, it does illustrate the characteristics of those most at risk for obesity. Those details are needed to formulate any influential and successful policy program. Further research should be conducted to investigate the particular sociological and cultural factors associated with racial and ethnic trends in obesity prevalence. This should include research to investigate the low prevalence of

obesity among Asians and Asian-Americans in the United States.

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