

ABSTRACT

Title of Thesis: RELATIONSHIPS BETWEEN THE FREQUENCY OF FAMILY MEALS, OVERWEIGHT, DIETARY INTAKE AND TV VIEWING BEHAVIORS AMONG WHITE, HISPANIC, AND BLACK MARYLAND ADOLESCENT GIRLS

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Objective: Examine relationships between frequency of family meals (FFM) and overweight, dietary intake (DI) and TV viewing behaviors, and examine relationships by race/ethnicity among adolescent girls.

Methods: Secondary analysis of TAAG 2 data was conducted. Participants categorized in two groups based on overweight status. Personal data, DI and TV viewing behaviors were collected. Multivariate logistic regression used to estimate parameters.

Results: No association between FFM and overweight or between FFM and overweight by race/ethnicity; significant associations found in the relationships between FFM and specific DI and TV viewing behaviors; and effect modification plays role in the relationship between FFM and weekly breakfast intake only.

Conclusion: Findings suggest that additional research is needed to establish if FFM has an effect on overweight, families who have \geq three FM may promote positive DI behaviors and watch less TV, and more studies exploring the racial/ethnic differences in FFM and DI behaviors relationship are needed.

Relationships between the Frequency of Family Meals, Overweight, Dietary Intake and
TV Viewing Behaviors among White, Hispanic, and Black Maryland Adolescent Girls

by

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Chapter 1: Introduction

I. Background

More than one third of children and adolescents were overweight or obese in 2008 and childhood obesity has increased, tripling over the past thirty years (1). Childhood obesity is now a global problem and affects many low and middle income countries, especially in urban settings. Over 1.5 billion people worldwide are overweight or obese and over 40 million children under the age of 5 are overweight (2). According to National Health and Nutrition Examination Survey (NHANES) data, the prevalence of obesity in children and adolescents in the U.S. ages 2-19 years is 16.9% (3). Also, according to 2007-2008 NHANES data, the percent of male adolescents (12-19 years) with BMI-for-age at the 95th percentile or higher was 19.3% and for females of the same age group, 16.8% (4). Results from the Youth Risk Behavior Surveillance System (YRBS) survey found that 15.3% of female youths were overweight and 10.5% of female youths were obese (5).

Childhood overweight has increased rapidly since 1986 in all races and ethnicities (6). The prevalence of obesity in adolescents differs by ethnicity with 21.0% of Hispanic children and adolescents and 24.0% of Black children and adolescents being obese compared to 14.0% of White children and adolescents (3). Furthermore, NHANES data shows that between 1999 and 2010, the odds of being obese were significantly higher for Black males and females and Mexican American males and females compared with White males and females after controlling for age and survey period (3).

One of the factors associated with adolescent overweight may be the frequency of family meals together. Families that eat together regularly are more likely to have

children who do better in school, are of average weight, are less likely to use drugs and alcohol at an early age, and consume more fruits and vegetables (7). Some previous studies have shown that children and adolescents who eat dinner as a family regularly are at lower risk of being overweight (8, 9). Children and adolescents who share at least three family meals per week are more likely to be at a healthy weight, and it improves their nutrition and helps encourage healthy eating habits, thus reducing the risk of being obese (9). However, there are multiple studies that do not show a significant relationship between the frequency of family meals and overweight(10).

Although there are a limited number of studies that examine the relationship between frequency of family meals and dietary intake and TV viewing behaviors, studies have shown that frequent family dinners are positively correlated with fruit and vegetable intake and negatively correlated with soft drinks intake (11, 12). Furthermore, frequent family dinners is positively associated with grains and calcium-rich foods (11), limits on television use, consuming five fruits and vegetables a day, eating breakfast, and bringing lunch from home (13). Research is needed to explore the racial differences in the association between family meals and proximate determinants of overweight – dietary intake and TV viewing behaviors.

II. Objectives

The overall objective of this study is to describe the relationships between the frequency of family meals and overweight, dietary intake, and TV viewing behaviors among adolescent girls and examine these relationships by race/ethnicity.

III. Importance of Current Study

It is important to investigate overweight in adolescents as 26% to 75% of overweight youths become obese adults (14).

The findings of this study contributed to the body of knowledge on adolescent overweight in the U.S in three ways:

First, findings of this study added to the current body of knowledge that examines the relationship between frequency of family meals and overweight in adolescent girls. A recent systematic review of studies examined the association between frequency of family meals and childhood and adolescent overweight found that only a limited number of studies examining this relationship have included all of the important potential confounders – socio-demographic, physical activity, and diet-related variables – in their studies (10). This shows the importance of the current study as it examined the relationship described above while controlling for all of the potential confounders.

Second, findings may lead to the implementation of preventative programs to decrease the prevalence of overweight. For example, if findings indicate that there is a negative relationship between the frequency of family meals and overweight in White adolescent girls, programs may be developed and implemented in communities to increase the frequency of family meals for White adolescent girls.

Third, to the researcher's knowledge, only a few studies have examined the dietary intake and TV viewing behaviors and associated with eating more family meals and why eating more family meals is inversely related to overweight, so this study informed researchers of proximate determinants of overweight which are associated with frequent family meals. For example, if findings indicate that those who eat more family meals are

less likely to drink sugar-sweetened beverages (e.g., soda) and more likely to eat fruits and vegetables, researchers can implement programs that promote the beneficial aspects of family meals in adolescent girls' families.

Finally, to the researcher's knowledge, no studies have examined the relationship between frequent family meals and dietary intake and TV viewing behaviors by race/ethnicity, so this study will add to the body of knowledge. Programs may be developed and implemented to lower overweight in specific races/ethnicities with the findings from this study.

IV. Specific Aims

There are four specific aims of this study with associated hypotheses below.

1. Examine the association between frequency of family meals and overweight in adolescent girls from Maryland

Hypothesis: There will be a negative association between the frequency of family meals and overweight amongst adolescent girls

2. Examine the association between the frequency of family meals and overweight by race/ethnicity in adolescent girls from Maryland

Hypothesis 1: There will be a difference in the frequency of family meals by race/ethnicity

Hypothesis 2: The association between the frequency of family meals and overweight will vary by race/ethnicity

3. Describe the dietary intake and TV viewing behaviors associated with the frequency of family meals together in adolescent girls from Maryland

Hypothesis 1: There will be a positive association between the frequency of family meals and positive dietary behaviors in Maryland adolescent girls

Hypothesis 2: There will be a negative association between frequency of family meals and TV viewing behaviors in Maryland adolescent girls

4. Examine the association between dietary intake and TV viewing behaviors and frequency of family meals by race/ethnicity among Maryland adolescent girls

Hypothesis 1: There will be a difference in the frequency of family meals and dietary intake by race/ethnicity. A greater percentage of White adolescent girls will eat more family meals and have positive dietary behaviors compared to Black and Hispanic adolescent girls in Maryland

Hypothesis 2: There will be a difference in the frequency of family meals and TV viewing behaviors. A greater percentage of White adolescent girls will eat more family meals and watch less TV compared to Blacks and Hispanic adolescent girls in Maryland

Chapter 2: Literature Review

I. Childhood Obesity in the U.S.

Obesity now affects 17.0% of all children and adolescents in the United States – triple the rate from just one generation ago (15). The percentage of adolescents aged 12-19 years who were obese increased from 5.0% to 18.0% between 1980 and 2008 (1). A study in 1996 found that overweight prevalence for girls who had family dinners “never or some days” was 19.4%, 16.6% for those who had family dinners “most days”, and 16.7% for those who had family dinners “everyday”. For boys the overweight prevalence in these same categories was 24.6%, 23.3%, and 22.7%, respectively (16).

II. Health Effects of Overweight and Obesity

There is a plethora of data that shows short-term and long-term detrimental health effects due to childhood and adolescent obesity. Diseases such as hyperlipidemia, hypertension, and abnormal glucose tolerance occur with increased frequency in obese children and adolescents; and many cardiovascular consequences that characterize adult-onset obesity are preceded by abnormalities that begin in childhood (17, 18). In a study that examined the associations between childhood obesity and adult disease, researchers found that all-cause mortality and cardiovascular mortality were associated with higher childhood body mass indices (BMIs) (19). Obese youth are also more likely to have high cholesterol and/or high blood pressure (20), both of which are risk factors for cardiovascular disease. Furthermore, 70.0% of obese youth had at least one risk factor for cardiovascular disease (21). When compared to thinner children, overweight children have moderately elevated levels of lipids and blood pressure and are at increased risk for becoming obese adults (22). According to the 2001-2002 NHANES data, when compared

to healthy weight children, overweight children have significantly increased risk for high total cholesterol levels, high low-density lipoprotein or borderline low-density lipoprotein cholesterol levels, low high-density lipoprotein cholesterol levels, high triglyceride levels, high fasting glucose levels, high glycohemoglobin levels, and high systolic blood pressure (20), along with obstructive sleep apnea, metabolic syndrome, and type 2 diabetes (23). When compared to healthy weight children, overweight children have a significantly lower prevalence of excellent health, even after controlling for multiple confounders (20). Given the numerous adverse health effects of overweight, it is important to investigate the factors associated with being overweight so strategies can be implemented to decrease the likelihood of adolescent overweight.

III. Risk Factors for Overweight

In recent years, a significant amount of research has been conducted to identify potential factors associated with childhood and adolescent overweight, such as diet, physical inactivity (24, 25), screen time (26), and lack of sleep (27, 28). Early life risk factors for obesity in childhood such as birth weight, parental obesity, sleep duration, television viewing, size in early life, weight gain in infancy, catch-up growth, and BMI rebound have been found to be associated with the risk of obesity in children (29).

Table 1. Adverse Outcomes in Childhood Obesity

Metabolic
Type 2 diabetes mellitus
Metabolic syndrome
Orthopedic
Slipped capital femoral epiphysis
Blount's disease
Cardiovascular
Dyslipidemia
Hypertension
Left ventricular hypertrophy
Atherosclerosis
Psychological
Depression
Poor quality of life
Neurological
Pseudotumor cerebri
Hepatic
Nonalcoholic fatty liver disease
Nonalcoholic steatohepatitis
Pulmonary
Obstructive sleep apnea
Asthma (exacerbation)
Renal
Proteinuria

SOURCE: "Overweight in Children and Adolescents: Pathophysiology, Consequences, Prevention, and Treatment", Daniels, Arnett 2005 (23)

A. Diet

There are a number of dietary factors associated with obesity, below is a summary of the research. Increasing rates of childhood overweight has been linked to the rising energy density of the diet, and energy density is positively associated with total energy intakes (30). When comparing to those who do not eat fast-food, children who eat fast-food consumed more total energy, more energy per gram of food, more total fat, more total carbohydrate, more added sugars, more sugar-sweetened beverages, less fiber, less milk, and fewer fruits and nonstarchy vegetables (31). The consumption of sweetened beverages (32, 33); sweets; meats; and total consumption of low-quality foods is positively associated with overweight status. The total amount of food consumed, specifically from snacks, is also positively associated with overweight status (32). Additionally, Black children who report a low preference for fruits and vegetables were

more likely to be categorized as “at risk for overweight” or “overweight” than Black children who reported a high preference for fruits and vegetables (34). Some of the recommended suggestions for a healthy weight for school children are to avoid dieting and unhealthy weight-control behaviors and adopting lifelong healthy eating behaviors such as increasing fruit and vegetable intake, decreasing sweetened beverage intake, eating breakfast daily, and paying attention to internal signs of hunger and glut (35).

B. Sedentary Behaviors (Physical Inactivity)

Sedentary behaviors are generally more strongly and consistently associated with obesity than physical activity (36), however, studies have shown contradicting results in the sedentary behaviors and overweight relationship. Low active-high sedentary boys were more likely to be overweight than high active-low sedentary boys and girls who were low active-high sedentary or high active-high sedentary were more likely to be overweight, when compared to high active-low sedentary girls (37). Larger increases in BMI were found among girls who had less physical activity (38). Furthermore, researchers using Trial of Activity for Adolescent Girls (TAAG) data, from the University of Maryland, College Park, concluded that 6th grade girls with higher BMI and body fat have greater sedentary behavior than those with less than 85th percentile BMI or less than 30% body fat (39).

However, one study found that increasing sedentary activity is not associated with an adverse effect on BMI or present body fat in adolescent girls (40). Another study in France found that physical activity was not associated with adiposity indicators in both sexes (41).

C. Screen Time (ST)

ST – television viewing, computer games and video games – may influence energy balance through displacement of physical activity, increased energy intake, or reduced metabolic rate, however studies are inconsistent in their results.

Some studies have shown that ST has been linked to obesity among adolescents, the research is below. Nationally representative longitudinal data from Waves II (1995) and Waves III (2001) of the National Longitudinal Study of Adolescent Health found that in males, adjusted odds of prevalent obesity was strongly predicted by ST and in females, lower ST correlated with lower prevalent obesity. Additionally, longitudinally, adolescent ST hours had a stronger influence on obesity in females than males (36). In a randomized control school-based trial, children in one elementary school received 18 lessons, 6-month classroom curriculum to reduce television, videotape, and video game use and children in the other school were the control group that did not receive any intervention. Researchers found that children in the intervention group had a decrease in BMI when compared to the control group children (42). Studies have shown that adolescent boys and girls exceed recommended ST of two hours (43), and a study in 2010 found that mean ST for all students was 3.1 hours/day on average with adolescents watching 2.6 hours/weekday and 4.4 hours/weekend day (44). Boys were more likely to exceed ST guidelines than girls. After adjusting for potential confounders, boys who exceeded ST guidelines on weekdays were more likely to have elevated homeostasis model assessment of insulin resistance and insulin levels, however, there were no significant associations among girls (44). Additionally researchers have found that the likelihood of being overweight and/or obese rose as ST increased (26).

However, previous studies have also shown no relationship between TV viewing and obesity. For example, a study in the U.S. found no relationship between TV viewing and change in BMI of adolescents (45).

IV. Frequency of Family Meals and Overweight

Another factor that may be associated with overweight among adolescents is the frequency of family meals. Studies have shown mixed results examining frequency of family meals and overweight.

Research has shown that children and adolescents who share at least three family meals/week are more likely to be at a healthy weight than those who share fewer than three family meals (9). Additionally, children who eat dinner together with their family three or more times a week were at decreased risk of overweight (8). Furthermore, studies have shown the inverse relationship between the frequency of family meals and overweight (9, 16, 46). The frequency of eating family dinner has been found to be negatively associated with overweight prevalence at baseline but not with likelihood of becoming overweight in longitudinal analyses (16, 46). Possible mechanisms for why eating family meals together are associated with obesity are because family meals are said to improve nutrition and help encourage healthy eating habits (9).

Studies have also shown no relationship between frequency of family meals and overweight, and furthermore, recent research has highlighted that previous studies have not included all of the important potential confounders in this relationship (10).

V. Race/Ethnicity and Overweight

Ethnicity and gender are significantly associated with overweight status (32). The Center for Disease Control and Prevention (CDC) cites that “there are significant racial

and ethnic disparities in obesity prevalence among U.S. children and adolescents” (47). In 2007-2008, Hispanic boys, aged 2 to 19 years were significantly more likely to be obese than non-Hispanic White boys, and non-Hispanic Black girls were significantly more likely to be obese than non-Hispanic White girls (48). The odds of being overweight for European American males were 1.2 times higher than for African American females (32).

VI. Frequency of Family Meals and Dietary Intake

The limited studies examining the relationship between frequency of family meals and dietary intake behaviors have shown a positive relationship between the frequency of family dinners and adolescent diet. However, there is a need to explore this relationship further. Researchers in a New Zealand study (13) found that the frequency of family meals was associated with certain positive nutrition behaviors and home food environment such as parental support for healthy eating, eating breakfast, limited television use, having fruit available at home, consuming five fruits and vegetables a day, and bringing lunch from home. They also found that there was no relationship between the frequency of family meals and accessibility and consumption of high fat and high sugar foods. These findings suggest that the “positive effect of family meals may reflect an overall positive home food environment. Families that have meals together have more healthful foods available at home and support their child in eating healthfully” (13). Additionally, a study found that frequent family dinners were positively associated with fruit and vegetable intake and negatively associated with soft drink intake (12). Researchers in Canada described the association of frequency of family dinners with overall diet quality of adolescents. They found that 65.0% of participants that reported

eating family dinners 6-7 days/week, 20.0% for 3-5 days/week, and 15.0% for 0-2 days/week; and those who ate 6-7 family dinners/week had a healthier diet (49).

Project EAT, longitudinal data, reported that regular family meals (five or more family meals/week) were associated with frequency of breakfast, lunch, dinner meals, and more fast-food intake for males and breakfast and dinner meals for females. Frequent family meals are also associated with fiber, magnesium, potassium, iron, zinc, folate, and vitamins A and B₆ intake in both sexes (50). Family meals were positively associated with intake of fruits, vegetables, grains, and calcium-rich foods and negatively associated with soft drink consumption (11, 50).

Furthermore, frequent family dinners are positively associated with eating at least five servings/day of fruits and negatively associated with eating any fried foods away from home and drinking any soda (12). Finally, increased frequency of family dinners was also associated with higher intake of nutrients folate, vitamins B12, C, and E; lower glycemic load; and lower intake of saturated and trans fat as a percentage of energy (12).

VII. Frequency of Family Meals and TV Viewing

There is limited research examining the relationship between family meals and TV viewing behaviors. One study of third graders found that children who watched more TV, ate fewer family meals, and lived in neighborhoods perceived by parents as less safe for outdoor play were more likely to be persistently overweight (51). It is important to see if there is a relationship between the frequency of family meals and TV viewing among adolescents.

VIII. Frequency of Family Meals and Overweight by Race/Ethnicity

There is limited and contradicting research examining the racial/ethnic differences in the frequency of family meals and overweight by race/ethnicity relationship. For Whites, higher frequency of family dinners was associated with reduced odds of being overweight in 1997, and by 2000, higher frequency of family dinners was associated with reduced odds of becoming overweight and increased odds of ceasing to be overweight and no association was found for Blacks and Hispanics (52). Forty-two point two percent of Whites report eating family meals 3-6 times a week and 22% report eating family meals 7 plus times a week. In African Americans, 33.3% reported eating family meals 3-6 times a week and 25.7% report 7 plus times a week. The percentage of Asian Americans reported eating family meals 3-6 times in the past week was 35.6% and 39.6% report eating 7 plus meals together. The number of Hispanics reported eating 3-6 family meals together in the past week was 44.2% and 26.6% report eating 7 plus meals together. Fifth, 36.2% of Native Americans report eating 3-6 meals together in the past week, and 31.9% report eating 7 plus meals together, and finally, for the mixed/others category, 41.6% report eating 3-6 meals together, and 26.7% report eating 7 plus meals with their families (11). A study found that family meals seem to be protective of obesity in White children and Black boys, however, family meals may put Hispanic boys living in low-education households at risk of obesity (53).

IX. Frequency of Family Meals and Dietary Intake and TV Viewing Behaviors by Race/Ethnicity

To the researcher's knowledge, no studies have examined this relationship.

Chapter 3: Methods

I. Overall Study Design

A secondary analysis of data reported by the Trial of Activity for Adolescent Girls (TAAG) 2, from the University of Maryland, College Park was conducted.

II. Data Source

TAAG 2 is a longitudinal study of adolescent girls. The girls were asked to (1) complete two surveys about their physical activity, (2) have their height, weight and back of their arm measured, and (3) wear a small activity monitor around their waist for seven days. The goal of the study was to identify neighborhood, school, social, and individual-level factors that contribute to the decline in physical activity during early and mid-late adolescence.

III. Description of Participants and Criteria for Selection

In the initial study, TAAG, thirty six schools in six geographically diverse areas of the United States were included. Random cross-sectional samples from schools were drawn in 6th grade (2003), 8th grade (2005), and 8th grade (2006) (14). TAAG 2 consists of the participants from the 2006 Maryland site. In 2006, 730 eighth grade Maryland girls were recruited. In 2009, 589 of the 730 Maryland girls were re-recruited in their 11th grade year and measured for the TAAG 2 study. Recruitment of the Maryland girls for TAAG 2 occurred by mailings, school visits, and social media (54).

IV. Human Subjects

Institutional Review Board approval was obtained prior to starting this study, as data from human subjects was used. Precautionary steps to safeguard the data maintaining personal information of subjects by using computers that are password-protected and

limiting the use of the computers to persons who were a part of the study team were used. Written consent was obtained by parents and girls prior to the beginning of the TAAG 2 study.

V. Independent and Dependent Variables

This analysis included variables that assess overweight, dietary intake, sedentary behaviors, physical activity, race/ethnicity, and family meals. TAAG 2 questions and response categories can be found on Table 2.

A. Overweight (dependent variable)

Girls’ height was measured to the nearest 0.1 cm using a Shorr Productions portable stadiometer by trained officials. Body weight was measured to the nearest 0.1 kg using a Seca 880 digital scale. Three assessments were taken and the average was used in the analysis. Body mass index (BMI) was calculated using weight (kg) divided by height squared (m²) and age at the time of measurement. Participants’ BMIs were then categorized into two groups - overweight, which include all participants in the 85th percentile and above, and not overweight, which includes all participants in the 84th percentile and below - using the CDC BMI for Age Chart/Growth Chart (55).

BMI-for-Age Chart

Less than 5th percentile	Underweight
5th percentile to less than the 85th percentile	Healthy weight
85th percentile to less than the 95th percentile	Overweight (*at risk of overweight)
95th percentile or greater	Obese (*overweight)

Note: The CDC recommends the use of the terms “at risk of overweight” and

“overweight” rather than the terms overweight and obese for children. For the purposes

of this study, the term overweight was used to describe those who are overweight (at risk of overweight) and obese (overweight), so those in the 85th percentile and above.

B. Frequency of Family Meals (independent variable)

Participants were asked how often their family ate a meal together in the past week, and then frequency of family meals was dichotomized into two groups – <3 family meals/week and ≥ 3 family meals/week.

C. Dietary Intake Behaviors (dependent variables)

Participants were asked about their weekly intake of fruit and vegetable, sugar-sweetened beverages, breakfast, milk consumption, and fast-food consumption as shown below.

i. Daily fruits and vegetables intake

For fruits and vegetables intake, an additive scale combining all questions relating to fruits and vegetables was created. To calculate total fruits and vegetables intake, the frequency of each variable was summed. Furthermore, similar to YRBS (56), weekly intake was converted into daily intake. For example, 1-3 times during past 7 days was converted to 0.29 times/day (2 divided by 7), 4-6 times during the past 7 days was converted to 0.71 times/day by dividing 5 by 7, 2 times per day was kept as 2 times/day, and ≥ 4 times per day was kept as 4 times/day. For logistic regression analysis, total fruits and vegetables intake was dichotomized into <5 times/day and ≥ 5 times/day.

ii. Daily sugar sweetened beverage intake

For daily sugar sweetened beverage (SSB) intake, an additive scale combining questions on soda, coffee drinks, sports drinks, energy drinks, and sweetened beverages were created. To calculate total SSB intake, the frequency of each variable was summed.

Furthermore, similar to YRBS (57), weekly intake was converted to daily intake. For example, 1 time per month was converted to .0333 times/day (1 divided by 30), 2-3 times per month was converted to .0833 times/day (2.5 divided by 30), 1-2 times per week was converted to .214 times/day (1.5 divided by 7), 3-4 times per week to .5 times/day (3.5 divided by 7), 5-6 times per week to .786 times/day (5.5 divided by 7), 1 time per day was kept, 2 times per day and 3 or more times per day were kept as 1 time/day, 2 times/day, and 3 times/day, respectively. For logistic regression analysis, total SSB was dichotomized into <3 times/day and ≥ 3 times/day.

iii. Daily milk intake

Participants were asked how many glasses of milk they drank (including milk from a glass, cup, carton, or with cereal). To calculate total milk intake, the frequency of each variable was summed and similar to YRBS (57), weekly intake was converted to daily intake. Furthermore, similar to YRBS (56), we reported those who drank three or more glasses of milk per day during the past seven days. For logistic regression analysis, total milk intake was dichotomized into <3 times/day and ≥ 3 times/day.

iv. Breakfast intake

Participants were asked how often they ate breakfast in the past week. Similar to previous studies, breakfast variable was dichotomized into <3 times/day and ≥ 3 times/day.

v. Fast-Food Intake

Participants were asked how often they ate fast-food in the past week. The American Academy of Family Physicians recommends eating fast-food no more than one time per

week (58), thus this was used as the cut-off point in this study. For logistic regression analysis, total fast-food intake was dichotomized into <2 time/week and ≥ 2 time/week.

D. TV Viewing Behaviors

Participants were asked their average daily hours spent watching TV, including watching DVDs and videos. As recommended by the American Academy of Pediatrics, older children should watch no more than two hours of screen time per day (59), thus this was used as the cut-off point. For logistic regression analysis, total time spent watching TV DVDs, and videos was dichotomized into ≤ 2 hours/day and >2 hours/days.

E. Average Daily Minutes of Moderate to Vigorous Physical Activity (MVPA)

Physical activity was measured using accelerometers. Participants wore an Actigraph accelerometer during waking hours for 7 consecutive days, and data was collected and stored in 30-second intervals. Accelerometry data were reduced using methods previously described by Pate 2008 (60).

Activity intensity thresholds established for the TAAG study were 50 counts/30 seconds for sedentary behavior, 51–1,499 counts/30 seconds for light activity, and 1,500 counts/30 seconds for MVPA. The threshold of 1,500 counts/30 seconds for MVPA corresponded approximately to the lower bound for a 3.5-mph walk and represents an activity intensity of 4.6 metabolic equivalents (METs) (61). The YRBS (56) and the CDC (62) recommend using the cut-off point of 60 minutes per day for adolescents. However, previous TAAG researchers used 30 minutes/day as the cut-off point as the distribution of results in the <60 minutes category was too low using this cut-off point. The 30 minute cut-off was based on the American College of Sports Medicine's recommendation of

achieving 30 minutes of sustained MVPA on all or most days per week (63). In this study MVPA was dichotomized into two groups, <30 minutes/day and \geq 30 min/day.

F. Race/Ethnicity

Participants were asked to self-identify their ethnicity. Past TAAG studies have categorized race into three categories, “White”, “Black”, and “Hispanic” because of limited study subjects. This study will also use these categories and an additional “Other” category.

G. Socioeconomic Status

Socioeconomic status (SES) was measured by asking students if they received free or reduced lunches at school.

Table 2 provides a description of each variable and the coding for the variable in my analysis, organized by aim. Additionally, Table 3 provides information on independent, dependent variables, confounders, and effect modifiers by aim.

Chapter 4: Data Analysis

SAS 9.3 was used for all data analyses. First, descriptive statistics were calculated to summarize the distribution of independent and dependent variables, potential confounders, and effect modifiers by frequency of family meals (<3 times/week and ≥ 3 times/week). Additional chi-squared analysis was conducted of categorical independent and dependent variables to check for differences in the proportions/means between the two (see Table 4). Fisher's exact test was used for categorical variables where chi-squared analysis was not appropriate.

For specific aim 1, logistic regression modeling was used to test the hypothesis that there will be a negative association between the frequency of family meals and overweight. Univariate logistic regression modeling was run to calculate the unadjusted odds ratios (ORs), 95% confidence intervals, and p-values for the independent variable. Multivariate logistic regression analysis was also run. The first multivariate analysis was run adjusting for race/ethnicity, SES, and MVPA, the three most common potential confounders as identified by the literature. The second multivariate analysis was run adjusting for important potential confounders identified by recent literature as important, but missing in studies - race/ethnicity, SES, parental education, MVPA, and specific dietary intake variables (daily fruit and vegetable intake, daily sugar-sweetened beverages, weekly breakfast intake, and weekly fast-food intake).

For specific aim 2, logistic regression modeling was used to test the hypotheses that the frequency of family meals differs by race/ethnicity and that the association between frequency of family meals and overweight varies by race/ethnicity. To test for effect modification by race/ethnicity, the interaction term (frequency of family

meals*race/ethnicity) was calculated in the relationship between the independent variable (frequency of family meals) and dependent variable (overweight status), controlling for SES and MVPA, and also controlling for SES, MVPA, parental education, and the specific dietary intake variables described above. The interaction term was not significant ($>.05$), therefore stratum-specific ORs and 95% confidence intervals were not calculated. For specific aims 3, logistic regression modeling was used to test the hypotheses that there will be a positive association between the frequency of family meals and positive dietary behaviors and that there would be a negative association between frequency of family meals and TV viewing behavior. Univariate logistic regression modeling was run to calculate the unadjusted ORs, 95% confidence intervals, and p-values for the independent variable (frequency of family meals) and each dependent variable (dietary intake and ST behaviors) individually. Furthermore, multivariate logistic regression modeling was run for each dietary intake and TV viewing behaviors adjusting for race/ethnicity and SES.

For specific aim 4, logistic regression modeling was used to test the hypotheses that there will be a difference in the frequency of family meals and dietary intake and frequency of family meals and TV viewing behaviors by race/ethnicity. To test for effect modification by race/ethnicity, the interaction term (frequency of family meals*race/ethnicity) was calculated for each individual frequency of family meals and dietary intake and ST behavior models described above. If the p-value of the interaction term (IT) was significant, stratum-specific ORs and 95% confidence intervals were calculated. The IT term was significant in the relationship between frequency of family

meals and weekly breakfast intake, thus stratum specific ORs and 95% confidence intervals were calculated for this model only.

Chapter 5: Results

The final study sample included 589 adolescent girls, with 279 (47.4%) Whites, 126 (21.4%) Blacks, 78 (13.2%) Hispanics, and 106 (18.0%) girls in the Other category. In total, the average BMI of participants was 23.9 kg/m², 320 girls (54.3%) ate family meals three or more times/week and overall, and 29.5% of the participants were categorized as overweight (Table 5).

Table 4 provides demographic characteristics information by frequency of family meals. The variables significantly associated with eating three or more family meals per week were: race/ethnicity ($p < .01$), socioeconomic status ($p < .01$), parental education ($p < .01$), eating five or more servings of fruits and vegetables ($p < .01$), drinking three or more glasses of milk/day ($p = .02$), drinking sugar sweetened beverages less than three times/week ($p = .03$), eating less than two fast-food meals/week ($p < .01$), eating breakfast three or more times/week ($p < .01$), and watching two or less hours of TV/day ($p = .01$).

I. Relationship between Frequency of Family Meals and Overweight

There was no statistically significant relationship between frequency of family meals and overweight status in the unadjusted and adjusted models ($p = .60$) (Table 6).

II. Relationship between Frequency of Family Meals and Overweight by Race/Ethnicity

The interaction term (Race*FamilyMeals) was not significant in the adjusted model, ($p = .34$) (Table 7). Therefore, the relationship between frequency of family meals and overweight was not stratified by race/ethnicity.

III. Relationship between Frequency of Family Meals and Dietary Intake and TV Viewing Behaviors

In each of the independent logistic regression models, participants who ate three or more family meals had higher odds of drinking milk ≥ 3 times a day, eating fruits and vegetables ≥ 5 times a day, eating < 2 fast-food meals a week, eating breakfast ≥ 3 times a week, and watching ≤ 2 hours of TV a day, when compared to those who eat less than three family meals a week (Table 8).

IV. Relationship between Frequency of Family Meals and Dietary Intake and TV Viewing Behaviors by Race/Ethnicity

The interaction term (Race*FamilyMeals) was only statistically significant in the model with the independent variable of frequency of family meals and dependent variable of daily breakfast intake (p-value of the interaction term $< .01$) (Table 9). Since the interaction term was significant, stratum specific odds ratios were calculated for this relationship. The odds of eating breakfast three or more times/week is higher in Whites who eat three or more family meals/week compared to Blacks, Hispanics, and Others who eat three family meals/week (Table 10).

Chapter 6: Discussion

The purpose of this study was to (1) examine the association between frequent family meals and overweight, (2) examine the dietary intake and TV viewing behaviors associated with frequent family meals, and (3) examine the relationships above by race/ethnicity to test for effect modification. Findings of this study indicate that there is no association between frequency of family meals and overweight. However, there are significant associations in the relationships between family meals and specific dietary intake and TV viewing behaviors. Moreover, this study found that effect modification by race/ethnicity is playing a role in the relationship between frequency of family meals and weekly breakfast intake.

I. Relationship between Frequency of Family Meals and Overweight

No association was found in the relationship between the frequency of family meals and overweight in the unadjusted and adjusted models. Previous studies have found mixed results in the relationship between frequency of family meals and overweight (9, 10). Valdes et al. found that very few studies have adjusted for all of the potential confounding factors – socio-demographic, physical activity, and diet-related variables, when examining overweight status and the frequency of eating family meals (10). This study was able to control for race/ethnicity, SES, parental education, MVPA, daily fruit and vegetable intake, daily SSB intake, weekly fast-food intake, and weekly breakfast intake signifying the importance of this study in contributing to the current body of knowledge. The lack of association in the unadjusted model of this study compared to the association found in some previous studies may be due to inconsistencies in what was being measured in each of the studies. Some studies used frequency of family meals (9,

51) while others use frequency of family dinners (52), and therefore, the significance of the association with overweight may have differed in each of the cases. Another possible explanation of the lack of association may be due to the type of meals being measured in each of the studies – is a family meal one that is cooked at home or can a fast-food meal be brought to the home and eaten as a family sufficient – these questions are important when addressing the association. Lastly, the average age of the adolescents in previous studies may vary from the current study (9, 51-53), thus results may not be comparable.

II. Relationship between Frequency of Family Meals and Overweight by Race/Ethnicity

No association was found between frequency of family meals and overweight by race/ethnicity. The interaction term, when controlling for confounders, was not significant ($p=.34$). Findings of this study are not consistent with the very limited research examining this relationship. One study found that for Whites, higher frequency of family dinners was associated with reduced odds of being overweight in 1997, and by 2000, higher frequency of family dinners was associated with reduced odds of becoming overweight and increased odds of ceasing to be overweight and no association was found for Blacks and Hispanics (52). Another study found that family meals seem to be protective of obesity in White children and Black boys, however, family meals may put Hispanic boys living in low-education households at risk of obesity (53). The lack of association in this study may be due to the fact that the present study did not find a significant association between frequency of family meals and overweight. The previous research did not control for all of the confounders included in this study, and again, the

average age of some of the previous research participants is younger (52, 53) than this study, so results may not be comparable.

III. Relationship between Frequency of Family Meals and Dietary Intake and TV Viewing Behaviors

In this study, adolescent girls who ate three or more family meals/week were more likely to have eaten five or more servings of fruits and vegetables/day, to have drunk three or more glasses of milk/day, eaten breakfast three or more times/week, eaten less than two fast-food meals/week, and watch less than two hours of TV/day. These findings are consistent with previous research, in that, children and adolescents who have three or more family meals are more likely to have a healthier dietary intake and eating patterns than those who share fewer than three family meals/week (9, 11, 50). Results of this study are also consistent with a study that examined the relationship between TV viewing and frequency of family meals. Study found that children who watched more television, ate fewer family meals, and lived in neighborhoods perceived by parents as less safe for outdoor play, were more likely to be persistently overweight (51).

There was no significant association between frequency of family meals and sugar-sweetened beverages, however. This finding was contrary to some previous studies (32). The majority of the participants, 540 of the 589, drank the recommended SSB of three times or less/day. Although a significant relationship was found in the univariate model, the lack of association in the multivariate model may be because participants in this study ate more meals at home and thus, less SSB, while participants in other studies had more fast-food family meals, and so drank more SSB. Also, more of the low SES participants drank three or more SSB compared to those not in the low SES category.

IV. Relationship between Frequency of Family Meals and Dietary Intake Behaviors and TV viewing by Race/Ethnicity

While researchers of this study hypothesized that each of the associations between frequency of family meals and dietary intake behaviors and TV viewing would differ by race/ethnicity, researchers only found an association in one of the relationships, the relationship between frequency of family meals and weekly breakfast intake. The study found that the odds of eating breakfast three or more times/week was higher in Whites who eat three or more family meals/week compared to Blacks, Hispanics, and Others who eat three family meals/week.

To the researcher's knowledge, no previous study has examined the relationship between frequency of family meals and dietary intake and TV viewing behaviors by race/ethnicity. The lack of studies examining the relationship between frequency of family meals and dietary intake and TV viewing behaviors by race/ethnicity and this study finding no association may be because race/ethnicity is not an effect modifier in these relationships, and is only a confounder.

Overall, these findings show that: 1) there is no association between the frequency of family meals and overweight when controlling for confounders, 2) there is no association between the frequency of family meals and overweight by race/ethnicity, when controlling for confounders, 3) significant associations were found in the relationships between frequency of family meals and specific dietary intake and TV viewing behaviors when controlling for confounders, and 4) effect modification plays a role in the relationship between frequency of family meals and weekly breakfast intake only.

The current study highlights the importance of additional studies examining the relationship between frequency of family meals and overweight, when controlling for confounders, examining the relationship between frequency of family meals and specific dietary intake and TV viewing behaviors, and third, examining the relationships above by race/ethnicity.

V. Study Strengths and Limitations

A. Strengths:

This study attempted to address gaps in current research by measuring the association between frequency of family meals and overweight and evaluating the degree to which the association differs by race/ethnicity among Maryland adolescent girls. It also attempted to address gaps in current research by examining the association between frequency of family meals and dietary intake and TV viewing behaviors and evaluating the degree to which these associations differ by race/ethnicity among adolescent girls in Maryland. To my knowledge, very few studies have conducted the analyses above.

Previous research examining the relationship between frequency of family meals and overweight has been contradictory. Many studies did not include important potential confounders such as SES, average daily minutes of MVPA, race/ethnicity, parental education, and specific dietary intake behaviors in their model (10), however, this study did include these potential confounders, thus highlighting the importance of the current study.

Lastly, this study is generalizable to all adolescent girls in Maryland due to the nature of the original TAAG 2 study design and collection of data; height and weight measurements were collected by a trained professional and not just asked of the

participants; and frequency of family meals, dietary intake behaviors, and screen time behaviors were asked directly of each participant, and not parents.

B. Limitations:

As a cross-sectional study, no temporal relationship could be established. Researchers could not demonstrate which came first, frequency of family meals or overweight in specific aims 1-2 and frequency of family meals or dietary intake or TV viewing behaviors in specific aims 3-4. Furthermore, the variables included in our analysis were restricted to those included in the original data source.

Frequency of family meals was measured for a very short period of time (7 days), so it may have been hard to examine the relationship between frequency of family meals and overweight. Further, participants may have realized that they are overweight, so they may have already been trying to decrease their risk of overweight, so ate more family meals before the questionnaire was asked of the participants.

This study did not differentiate between families that bring meals home versus families who cook meals at home, nor do we account for the number of people in the family. A standardized definition of “family meals” and “frequent family meals” needs to be established for further studies.

Although this study includes specific dietary intake behaviors as confounders in the relationship between frequency of family meals and overweight, future studies should include more detailed information such as energy intake in the model and the healthiness of the meal being consumed at home.

Due to the limited sample size, it is not possible to examine all races in this data analysis, so I examined White, Black, Hispanic, and Other Maryland adolescent girls.

Finally, studies use overweight, risk of overweight, and obese in various ways. The CDC, recommends the use of the terms “at risk of overweight” for those in the 85th to 94th percentile and “overweight” for those in the 95th percentile and above rather than the terms overweight and obese for children. Some researchers follow this method when reporting data, while others do not. I did not distinguish the differences in the literature review above. For the purposes of this study, I used the term overweight to describe those who are overweight (at risk of overweight) and obese (overweight), so those in the 85th percentile and above.

A ST variable was planned to be included in this study as information on TV viewing, computer, Internet, and video game use was collected. However, the questions were not mutually exclusive, so someone who was watching TV could also be on the computer, and hours spent doing both would be counted twice and technically someone could have watched more than 24 hours of ST, thus, this question was not used. To the researcher’s knowledge no previous study was found to examine the relationship between ST and frequency of family meals. Future studies should test the relationship between frequency of family meals and ST.

VI. Public Health Significance

Adolescent overweight is a growing problem. The current study attempted to address gaps in current research by examining the association between the frequency of family meals and overweight and the frequency of family meals and dietary intake and ST behaviors; and evaluating the degree to which these associations differed by race/ethnicity among adolescent girls in Maryland. It is important to examine these

relationships so targeted programs and interventions can be developed and utilized to ultimately decrease overweight in adolescents.

VII. Conclusions

While this study did not show a relationship between the frequency of family meals and overweight status when controlling for SES, race/ethnicity, parental education, average daily minutes of MVPA, and specific dietary intake behaviors, it did find a positive association between the frequency of family meals and positive dietary behaviors and a negative association between frequency of family meals and TV viewing. In terms of race/ethnicity, the only difference was that Whites who ate three or more family meals/week were more likely to eat breakfast three or more times/week than Blacks and Hispanics.

Our findings suggest that there are a number of positive dietary intake behaviors and TV viewing behavior associated with eating three or more family meals, thus possibly promoting healthier habits in adolescents. Interventions and programs to promote eating more family meals should be developed. Barriers to eating family meals should be explored, identified, and reduced. Finally, more studies exploring the racial/ethnic differences in the frequency of family meals and dietary intake and TV viewing behaviors relationship would be helpful to inform future research.

More research needs to be conducted to include the potential confounders of SES, race/ethnicity, parental education, physical activity, and dietary intake information in the relationship between frequency of family meals and overweight and examine the relationship by race/ethnicity. Further, it would be helpful to examine the relationships

described above longitudinal, thus improving the study design and providing more robust findings.

Table 2. Variables with Associated TAAG Questions and Response Categories

Dietary Intake and TV Viewing Behaviors	Questions in TAAG 2 and Response Categories
Frequency of breakfast	During the past 7 days, how many times did you eat breakfast? Answers: Never, 1-2 days, 3-4 days, 5-6 days, every day
Juice	During the past 7 days, how many times did you drink 100% fruit juices such as orange juice, or grape juice? A: I did not drink any 100% fruit juice during past 7 days, 1-3 times during past 7 days, 4-6 times during the past 7 days, 1 time per day, 2 times per day, 3 times per day, 4 or more times per day
Fresh Fruits	During the past 7 days, how many times did you eat fresh fruit? A: I did not eat fruit during the past 7 days, 1-3 times during the past 7 days, 4-6 times during the past 7 days, 1 time per day, 2 times per day, 3 times per day, 4 or more times per day
Green Salad	During the past 7 days, how many times did you eat green salad? A: I did not eat green salad during the past 7 days, 1-3 times during the past 7 days, 4-6 times during the past 7 days, 1 time per day, 2 times per day, 3 times per day, 4 or more times per day
Potatoes	During the past 7 days, how many times did you eat potatoes? A: I did not eat potatoes during the past 7 days, 1-3 times during the past 7 days, 4-6 times during the past 7 days, 1 time per day, 2 times per day, 3 times per day, 4 or more times per day
Carrots	During the past 7 days, how many times did you eat carrots? A: I did not eat carrots during the past 7 days, 1-3 times during the past 7 days, 4-6 times during the past 7 days, 1 time per day, 2 times per day, 3 times per day, 4 or more times per day
Vegetables	During the past 7 days, how many times did you eat other vegetables (do not count green salad, potatoes, or carrots)? A: I did not eat other vegetables during the past 7 days, 1-3 times during the past 7 days, 4-6 times during the past 7 days, 1 time per day, 2 times per day, 3 times per day, 4 or more times per day
Milk	During the past 7 days, how many glasses of milk did you drink? A: I did not drink mild during the past 7 days, 1-3 glasses during the past 7 days, 4-6 glasses during the past 7 days, 1 glass per day, 2 glasses per day, 3 glasses per day, 4 or more glasses per day
Soda	How often do you drink a can, bottle, or glass of soda or pop, such as Coke, Pepsi, or Sprite? A: Never or rarely, 1 time per month, 2-3 times per month, 1-2 times per week, 3-4 times per week, 5-6 times per week, 1 time per day, 2 times per day, 3 or more times per day.
Sports drinks	How often do you drink sports drinks? A: Never or rarely, 1 time per month, 2-3 times per month, 1-2 times per week, 3-4 times per week, 5-6 times per week, 1 time per day, 2 times per day, 3 or more times per day.
Sweetened beverages	How often do you drink other sweetened beverages (such as sweetened teas, juice drinks, punch, or lemonade) A: Never or rarely, 1 time per month, 2-3 times per month, 1-2 times per week, 3-4 times per week, 5-6 times per week, 1 time per day, 2 times per day, 3 or more times per day.

Dietary Intake and TV Viewing Behaviors	Questions in TAAG 2 and Response Categories
Coffee drinks	<p>How often do you drink coffee drinks such as lattes, mochas, frappuccinos, and macchiatos (not including regular coffee)?</p> <p>A: Never or rarely, 1 time per month, 2-3 times per month, 1-2 times per week, 3-4 times per week, 5-6 times per week, 1 time per day, 2 times per day, 3 or more times per day.</p>
Fast-food	<p>In the past 7 days, how many times did you eat something from a fast-food restaurant, such as McDonald's, Burger King, Domino's, or similar places?</p> <p>A: Never, 1 to 2 times, 3 to 4 times, 5 to 6 times, 7 times, more than 7 times, don't know</p>
TV Viewing Behaviors (included Computer, Television, Videogame uses)	
Television (weekdays)	<p>On average school day, how many hours a day do you spend watching TV, DVD, or videos?</p> <p>A: 0, less than 1, 1, 2, 3, 4, 5, 6 or more</p>
Television time on (weekends)	<p>On average weekend day (Saturday and Sunday), how many hours a day do you spend watching TV, DVD, or videos?</p> <p>A: 0, less than 1, 1, 2, 3, 4, 5, 6 or more</p>

Table 3. Description of Each Variable

Variable	Type	Coding
Frequency of family meals	Binary variable	0= <3 times/week 1= ≥3 times/week
Weight status	Binary variable	0= ≥85 th percentile (overweight) 1= <85 th percentile (not overweight)
SES	Binary variable	0- No 1- Yes
Race/ethnicity	Categorical	r1= White r2= Black r3= Hispanic
Average Daily Minutes of MVPA	Binary variable	0= <30 minutes/day 1= ≥30 minutes/day
Parental Education	Binary variable	0= <1 parent who went to college 1= ≥1 parent who went to college
Daily intake of fruits and vegetables	Binary variable	0= <5 servings of fruits and vegetables 1= ≥5 servings of fruits and vegetables
Daily intake of sugar-sweetened beverages	Binary variable	0= ≥ 3 times/day 1= <3 times/day
Weekly Breakfast intake	Binary variable	0= <3 times/day 1= ≥3 times/day
Weekly Fast-food intake	Binary variable	0= ≥2 times per week 1= <2 times per week
Daily milk intake	Binary variable	0= <3 glasses of milk/day 1= ≥3 glasses of milk/day
Daily TV viewing time	Binary variable	0= >2 hours of TV on an average day 1= ≤2 hours of TV on an average day

Table 4. Description of Each Variable used in the Analysis by Specific Aim

	Specific Aim			
	1	2	3	4
Frequency of Family Meals	E	E	E	E
Weight Status	O	O		
SES	C1, 2	C1, 2	C	C
Race/ethnicity	C1, 2	EM	C	EM
Average Daily Minutes of MVPA	C1, 2	C1, 2	O	O
Parental Education	C2	C2		
Daily fruits and vegetables intake	C2	C2	O	O
Daily sugar-sweetened beverages intake	C2	C2	O	O
Breakfast intake	C2	C2	O	O
Fast-food intake	C2	C2	O	O
Daily milk intake			O	O
Daily TV viewing time			O	O

*E = Exposure

*O = Outcome

*C = Confounder

*EM = Effect Modifier

Table 5. Demographic Characteristics by Frequency of Family Meal

	N= 589	Frequency of Family Meal		P-value
		<3 times/week (%)	≥3 times/week (%)	
Race				<.01
White	279	98 (35.1)	181 (64.9)	
Black	126	77 (61.1)	49 (38.9)	
Hispanic	78	42 (53.9)	36 (46.2)	
Other	106	52 (49.1)	54 (50.9)	
SES				<.01
No reduced or free lunch	464	197 (42.6)	267 (57.4)	
Reduced or free lunch	125	72 (57.6)	53 (42.4)	
Weight status				.08
Overweight	174	89 (51.2)	85 (48.8)	
Not Overweight	415	180 (43.4)	235 (56.6)	
MVPA				.98
<30 min/day	44	20 (45.5)	24 (54.5)	
≥30 min/day	545	249 (45.7)	296 (54.3)	
Parental education				<.01
<1 parent went to college	274	157 (57.3)	117 (42.7)	
≥1 parent went to college	315	112 (35.7)	203 (64.4)	
Daily fruit and vegetable Intake				<.01
<5 times/day	474	230 (48.5)	244 (51.5)	
≥5 times/day	115	39 (33.9)	76 (66.1)	
Daily milk intake				.02
<3 times/day	557	261 (46.9)	296 (53.1)	
≥3 times/day	32	8 (25.0)	24 (75.0)	
Daily sugar sweetened beverage intake				.03
<3 times/day	510	224 (43.9)	286 (56.1)	
≥3 times/day	79	45 (57.0)	34 (43.0)	

	N= 589	Frequency of Family Meal		P-value
		<3 times/week (%)	≥3 times/week (%)	
Weekly fast-food intake				<.01
<2 time/week	441	186 (42.2)	255 (57.8)	
≥2 time/week	148	83 (56.08)	65 (43.92)	
Weekly breakfast intake				<.01
<3 time/week	303	172 (56.8)	131 (43.2)	
≥3 time/week	286	97 (33.9)	189 (66.1)	
Daily TV viewing hours				.01
≤2 hours/day	82	27 (32.9)	55 (67.1)	
>2 hours/day	507	242 (47.7)	365 (52.3)	

*p-values of demographic characteristics by frequency of family meals were generated by conducting Chi-Squared Tests for statistical significance.

Table 6. Odds Ratios, 95% Confidence Intervals, and P-values describing the Relationship between Frequency of Family Meals and Overweight Status

	Overweight (85 th percentile and above)					
	Unadjusted		Adjusted 1		Adjusted 2	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Family Meal (≥3 times /week)	.73 (.51-1.04)	.08	.80 (.56-1.16)	.24	.90 (.61-1.33)	.60

***Adjusted 1-** controlling for SES, MVPA, race (reference group=white)

***Adjusted 2-** controlling for SES, MVPA, race (reference group=white), parental education, daily fruit + vegetable intake, daily SSB intake, weekly fast-food intake, and weekly breakfast intake

Table 7. Testing for Significance of Interaction Term in Relationship between Frequency of Family Meals and Overweight

	BMI85			
	β	Adjusted 1 p-value	β	Adjusted 2 p-value
Family Meal (≥ 3 times/week)	-0.51	.06	-0.30	.29
Interaction term (race*≥ 3 family meals/week)	.19	.21	.14	.34

***Adjusted 1**- controlling for SES, MVPA, race (reference group=white)

***Adjusted 2**- controlling for SES, MVPA, race (reference group=white), parental education, daily F+V intake, daily SSB intake, weekly fast-food intake, and weekly breakfast intake

Table 8. Logistic Regression Analysis Describing Dietary Intake and TV Viewing Behaviors Associated with Eating Three or More Family Meals/Week

		Dietary intake, TV Viewing Behaviors and Physical Activity						
		≥3 times/day Milk	≥5 times/day Fruits and Vegetables	<3 times/day SSB	<2 times/week Fast-food	≥3 times/week Breakfast	≤2 TV viewing hours/day	≥30 min./day MVPA
Family Meals (≥3 Family meals/week)	Unadjusted OR (95% CI)	2.65 (1.17-5.99)	1.84 (1.20-2.81)	1.69 (1.05-2.73)	1.75 (1.20-2.55)	2.56 (1.83-3.57)	1.86 (1.14-3.04)	.99 (.54-1.84)
	Unadjusted p-value	.02	.01	.03	<.01	<.01	.01	.97
	Adjusted OR (95% CI)	2.34 (1.02-5.38)	1.90 (1.22-2.95)	1.50 (.91-2.46)	1.61 (1.09-2.37)	2.20 (1.55-3.10)	1.70 (1.02-2.82)	.93 (.50-1.74)
	Adjusted p- value	.04	<.01	.11	.02	<.01	.04	.82

*Adjusted values are controlling for SES and Race/Ethnicity

SSB= Sugar-sweetened beverages

**Independent models between exposure and each outcome variable.

Table 9. Testing for Significance of Interaction Term in the Relationship between Frequency of Family Meals and Daily Breakfast Intake

	Dietary intake variable	
	≥3 times/week Breakfast	
	β	Adjusted p-value
Family Meals (≥3 times /week)	1.49	<.01
Interaction Term (race*≥3 family meals/week)	-.48	<.01

*Adjusted value is controlling for SES.

Table 10. Stratum Specific Odds Ratios by Race/Ethnicity in the Relationship between Frequency of Family Meals and Daily Breakfast Intake

		Dietary intake variable	
		Breakfast ≥3 times/day	
Race		OR (95% CI)	Adjusted p-value
Family Meals (≥3 Family meals/week)	White	3.31 (1.87-5.28)	<.01
	Black	1.87 (.84-4.16)	.12
	Hispanic	.87 (.35-2.18)	.87
	Other	2.18 (.99-4.82)	.05

*Adjusted value is controlling for SES

Appendices

1. MPH Competencies
2. Analysis Details
3. IRB Approval

MPH Competencies Addressed:

MPH Competency	Specifically Addressed
Demonstrate the importance of epidemiology for informing scientific, ethical, economic, and political discussion of health issues.	Measures of association were calculated and used to inform the scientific community to help decrease overweight and BMI among adolescents. Information in this study may also be important in terms of policies, ethical, and economic discussions of the health of our adolescents.
Assess a public health problem in terms of magnitude, person, time and place.	This study sought to assess adolescent overweight in Maryland girls and describe one factor associated with overweight – frequency of family meals. It also described proximate determinants of overweight – dietary intake and TV viewing behaviors.
Distinguish among the basic terminology and definitions of epidemiology	This study distinguished between basic epidemiological terminology and definitions. For example, I discussed p-values, odds ratios, confounders, effect modifiers, 95% confidence intervals, and statistically significant associations.
Discriminate key sources of data for epidemiological purposes.	Key sources of data for the background of this study were from the Youth Risk Behavioral System (YRBS), peer-reviewed scientific literature, and secondary data analysis of TAAG 2 data.
Calculate basic epidemiology measures.	Basic epidemiology measures such as frequencies, percentages, p-values, measures of associations, 95% confidence intervals were all calculated in this study.
Identify principles and limitations of public health screening programs.	This study discussed the limitations of public health screening for overweight and obesity and discussed the shortcomings of YRBS.
Evaluate the strengths and limitations of epidemiologic reports.	In background information of this study, I identified strengths and limitations of epidemiological reports, and further, I evaluated the strengths and limitation of the study I conducted in my research.
Draw appropriate inferences from epidemiologic data.	Measures of associations were used to draw appropriate inferences of association between independent and dependent variables. Causation was not drawn in this study as it is a cross-sectional study design.

Calculate advanced epidemiology measures.	Multivariate logistic regression modeling was used to determine measures of associations and significance in this study.
Communicate epidemiological information to lay and professional audiences	The findings of this study and report are being communicated to a professional audience through the thesis dissertation presentation and defense. In addition, I hope to publish the results of this study in a journal. I plan on completing the manuscript and submitting to journals during the summer of 2013.
Compare basic ethical and legal principles pertaining to the collection, maintenance, use and dissemination of epidemiologic data.	In this study, I received IRB approval for maintaining, using, and disseminating personal information of students in the original TAAG data. Precautionary steps were taken, such as de-identifying student names from the data before analyzing results. I also used a password-protected computer to work on data analysis.
Design, analyze, and evaluate an epidemiologic study.	This study is a retrospective, cross-sectional study. I designed the study, analyzed data for possible associations, evaluated the data, and interpreted and presented results.
Design interventions to reduce prevalence of major public health problems.	In this study, I designed interventions to reduce prevalence of overweight among adolescent girls in Maryland as described in the discussion section of my report.

Detailed Data Analysis

Specific Aim 1

- Examine the association between frequency of family meals and overweight in Maryland adolescent girls

Hypothesis 1: there will be a negative association between the frequency of family meals and overweight amongst adolescent girls.

First, I conducted a **univariate analysis** of the relationship between: The independent variable (Frequency of family meals) and the dependent variable (Overweight Status);

$$\log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_k x_k$$

$$\log\left(\frac{p}{1-p}\right)_{\text{overweight}} = \beta_0 + \beta_k \text{Frequency of family meals}$$

P = probability of being overweight

$1 - p$ = probability of not being overweight

β_0 = intercept

β_k = regression coefficient(s)

x_k = explanatory variable(s)

$k = 1, 2, \dots, n$ (for univariate analysis $k = 1$)

1. Then, additional analysis of **multivariate regression** was conducted to account for the confounders.

$$\log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_1 \dots + \beta_k x_k$$

$$\log\left(\frac{p}{1-p}\right) = \beta$$

$$\log\left(\frac{p}{1-p}\right)_{\text{overweight}}$$

$$\begin{aligned} &= \beta_0 + \beta_1 \text{Frequency of family meals} + \beta_2 \text{Race} + \beta_3 \text{SES} \\ &+ \beta_4 \text{MVPA} \end{aligned}$$

$$\log\left(\frac{p}{1-p}\right)_{overweight} = \beta_0 + \beta_1 \text{Frequency of family meals} + \beta_2 \text{Race} + \beta_3 \text{SES} + \beta_4 \text{MVPA} + \beta_5 \text{Parental Education} + \beta_6 \text{FV intake} + \beta_7 \text{Fastfood intake} + \beta_8 \text{Breakfast intake} + \beta_9 \text{Fastfood intake}$$

Specific Aim 2

- Examine the association between frequency of family meals and overweight by race/ethnicity in Maryland adolescent girls

Hypothesis 1: There will be a difference in the frequency of family meals by race/ethnicity

Hypothesis 2: The association between the frequency of family meals and overweight will vary by race/ethnicity

I believe that there may also be an interaction effect, so I will consider effect modification in my model between frequency of family meals and race. Only a limited number of studies have examined the association of frequency of family meals and overweight by race/ethnicity, so I plan to calculate the interaction term by using the equation below. If the p-value of the interaction term is less than .05, then it is statistically significant, so I will calculate the stratified odds ratios by race/ethnicity.

$$\log\left(\frac{p}{1-p}\right)_{overweight} = \beta_0 + \beta_1 x_1 \dots + \beta_k x_k + (\beta_1 x_1 \times \beta_k x_k)$$

$$\log\left(\frac{p}{1-p}\right)_{overweight} = \beta_0 + \beta_1 \text{Frequency of family meals} + \beta_5 \text{Race} + (\beta_1 \text{Frequency of family meals} \times \beta_5 \text{Race})$$

P = probability of being overweight

$1 - p$ = probability of not being overweight

β_0 = intercept

β_k = regression coefficient(s)

x_k = explanatory variable(s)

$k = 1, 2, \dots, n$

Specific Aim 3

- Describe the dietary intake and TV viewing behaviors associated with the frequency of family meals together in Maryland adolescent girls

Hypothesis 1: There will be a positive association between the frequency of family meals and positive dietary behaviors in Maryland adolescent girls.

Hypothesis 2: There will be a negative association between frequency of family meals and TV viewing behaviors in Maryland adolescent girls.

First, I conducted a **univariate analysis** for each of the following relationships between:

- The independent variable (Frequency of family meals) and the dependent variable (daily fruit intake);
- The independent variable (Frequency of family meals) and the dependent variable (daily vegetable intake);
- The independent variable (Frequency of family meals) and the dependent variable (daily fruit and vegetable intake);
- The independent variable (Frequency of family meals) and the dependent variable (daily sugar sweetened beverages intake);
- The independent variable (Frequency of family meals) and the dependent variable (daily milk intake);
- The independent variable (Frequency of family meals) and the dependent variable (weekly fast-food intake);
- The independent variable (Frequency of family meals) and the dependent variable (weekly breakfast intake);
- The independent variable (Frequency of family meals) and the dependent variable (TV viewing);

$$\log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_1$$

$$\log\left(\frac{p}{1-p}\right)_{\text{Daily fruit intake}} = \beta_0 + \beta_1 \text{Frequency of family meals}$$

$$\log\left(\frac{p}{1-p}\right)_{\text{Daily vegetable intake}} = \beta_0 + \beta_1 \text{Frequency of family meals}$$

$$\log\left(\frac{p}{1-p}\right)_{\text{Daily fruit and vegetable intake}} = \beta_0 + \beta_1 \text{Frequency of family meals}$$

$$\log\left(\frac{p}{1-p}\right)_{\text{Daily sugar sweetened beverage (SSB) intake}}$$

$$= \beta_0 + \beta_1 \text{Frequency of family meals}$$

$$\log\left(\frac{p}{1-p}\right)_{\text{Daily milk intake}} = \beta_0 + \beta_1 \text{Frequency of family meals}$$

$$\log\left(\frac{p}{1-p}\right)_{\text{Daily milk intake}} = \beta_0 + \beta_1 \text{Frequency of family meals}$$

$$\log\left(\frac{p}{1-p}\right)_{\text{weekly fast food intake}} = \beta_0 + \beta_1 \text{Frequency of family meals}$$

$$\log\left(\frac{p}{1-p}\right)_{\text{Daily breakfast intake}} = \beta_0 + \beta_1 \text{Frequency of family meals}$$

$$\log\left(\frac{p}{1-p}\right)_{\text{Daily TV viewing hours}} = \beta_0 + \beta_1 \text{Frequency of family meals}$$

P = probability of eating ≥ 5 servings/day of fruits and vegetables (example)

β_0 = intercept

β_1 = regression coefficient

x_1 = explanatory variable

Additional **multivariate regression analysis** was conducted for each of the dietary intake and TV viewing behaviors to account for confounders (SES and race/ethnicity) in the model.

$$\log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_1 \dots + \beta_k x_k$$

$$\log\left(\frac{p}{1-p}\right)_{\text{Daily fruit and vegetable intake}} = \beta_0 + \beta_1 \text{Frequency of family meals} + \beta_2 \text{Race} + \beta_3 \text{SES}$$

$$\begin{aligned} \log\left(\frac{p}{1-p}\right)_{\text{Daily SSB intake}} \\ = \beta_0 + \beta_1 \text{Frequency of family meals} + \beta_2 \text{Race} + \beta_3 \text{SES} \end{aligned}$$

$$\begin{aligned} \log\left(\frac{p}{1-p}\right)_{\text{Daily milk intake}} \\ = \beta_0 + \beta_1 \text{Frequency of family meals} + \beta_2 \text{Race} + \beta_3 \text{SES} \end{aligned}$$

$$\begin{aligned} \log\left(\frac{p}{1-p}\right)_{\text{Weekly fast food intake}} \\ = \beta_0 + \beta_1 \text{Frequency of family meals} + \beta_2 \text{Race} + \beta_3 \text{SES} \end{aligned}$$

$$\begin{aligned} \log\left(\frac{p}{1-p}\right)_{\text{Daily breakfast intake}} \\ = \beta_0 + \beta_1 \text{Frequency of family meals} + \beta_2 \text{Race} + \beta_3 \text{SES} \end{aligned}$$

$$\log\left(\frac{p}{1-p}\right)_{\text{Daily T.V.viewing hours}} = \beta_0 + \beta_1 \text{Frequency of family meals} + \beta_2 \text{Race} + \beta_3 \text{SES}$$

Specific Aim 4

- Examine the association between dietary intake and screen-time behaviors and frequency of family meals by race/ethnicity among Maryland adolescent girls.

Hypothesis 1: There will be a difference in the frequency of family meals and dietary intake by race/ethnicity.

Hypothesis 2: There will be a difference in the frequency of family meals and screen-time behaviors by race/ethnicity.

I believed that there may have been an interaction effect; therefore, I considered effect modification in my model between frequency of family meals and race/ethnicity in the relationship between frequency of family meals and dietary intake and TV viewing behaviors. Only a limited number of studies have examined the association of frequency of family meals and dietary intake and TV viewing behaviors by race/ethnicity, so I conducted interaction tests to see if the p-value of the interaction term was significant at the .05 level for each dietary intake and TV viewing behaviors. For the interaction terms that are significant, I stratified by race/ethnicity to determine odds ratios for each variable.

$$\log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_1 \dots + \beta_k x_k + (\beta_1 x_1 \times \beta_k x_k)$$

$$\log\left(\frac{p}{1-p}\right)_{\text{Daily fruit and vegetable intake}} = \beta_0 + \beta_1 \text{Frequency of family meals} + \beta_3 \text{SES} + \beta_2 \text{Race} + (\beta_1 \text{Frequency of family meals} \times \beta_2 \text{Race})$$

$$\log\left(\frac{p}{1-p}\right)_{\text{Daily SSB intake}} = \beta_0 + \beta_1 \text{Frequency of family meals} + \beta_3 \text{SES} + \beta_2 \text{Race} + (\beta_1 \text{Frequency of family meals} \times \beta_2 \text{Race})$$

$$\log\left(\frac{p}{1-p}\right)_{\text{Daily milk intake}} = \beta_0 + \beta_1 \text{Frequency of family meals} + \beta_3 \text{SES} + \beta_2 \text{Race} + (\beta_1 \text{Frequency of family meals} \times \beta_2 \text{Race})$$

$$\log\left(\frac{p}{1-p}\right)_{\text{Weekly fast food intake}} = \beta_0 + \beta_1 \text{Frequency of family meals} + \beta_3 \text{SES} + \beta_2 \text{Race} + (\beta_1 \text{Frequency of family meals} \times \beta_2 \text{Race})$$

$$\log\left(\frac{p}{1-p}\right)_{\text{Breakfast intake}} = \beta_0 + \beta_1 \text{Frequency of family meal} + \beta_3 \text{SES} + \beta_2 \text{Race} \\ + (\beta_1 \text{Frequency of family meals} \times \beta_2 \text{Race})$$

$$\log\left(\frac{p}{1-p}\right)_{\text{Daily T.V. viewing hours}} = \beta_0 + \beta_1 \text{Frequency of family meals} + \beta_3 \text{SES} \\ + \beta_2 \text{Race} + (\beta_1 \text{Frequency of family meals} \times \beta_2 \text{Race})$$

IRB Approval



UNIVERSITY OF
MARYLAND

INSTITUTIONAL REVIEW BOARD

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DATE: February 11, 2013

TO: Brit Saksvig
FROM: University of Maryland College Park (UMCP) IRB

PROJECT TITLE: [415664-1] Relationships between the Frequency of Family Meals, Overweight, Dietary Intake, and Screen Time among White, Hispanic, and Black Maryland Adolescent Girls

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF EXEMPT STATUS
DECISION DATE: February 11, 2013

REVIEW CATEGORY: Exemption category # 4

Thank you for your submission of New Project materials for this project. The University of Maryland College Park (UMCP) IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will retain a copy of this correspondence within our records.

If you have any questions, please contact the IRB Office at 301-405-4212 or irb@umd.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Maryland College Park (UMCP) IRB's records.

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