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Evaluating the Effects of Nutritional Intake During Adolescence on Educational Attainment and Labor Market Earnings as an Adult

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Abstract

In this thesis, I analyze whether nutritional intake at the time of adolescence can impact academic attainment and earnings later on in life. Millions of children in the United States are living in food insecure households and do not have access to an adequate nutritious diet. Since adolescence is a time period of intense growth and development, it is essential to meet nutritional needs at this time. Using data from the Longitudinal Study of Adolescent to Adult Health (Add Health), I measure the nutrition of a nationally representative sample of youth in the United States through their daily food intake, and test the effects nutrition during adolescence has on future outcomes. I find a positive relationship between healthy eating and educational achievement, as well as a negative relationship between unhealthy eating and educational attainment. Nutrition has a smaller effect on earnings, but the results show that there is a minor negative relationship between healthy eating and earnings.

I. Introduction

In 2014 more than 15.3 million children lived in a food-insecure household in the United States (Brookings, 2016). Poor diet, hunger and food insecurity are eating patterns that, particularly during the age of adolescence, determine future outcomes by affecting proper growth and development (CDC, 2017). Income inequality has become a defining social and political obstacle facing the United States (Saez, 2016). One particular driving factor that fosters the divide between wealthier Americans and lower class Americans is that low-income households often have less nutritious diets when compared to their wealthier counterparts (Drewnowski, 2010). Many Americans are left struggling to make ends meet, and thus depend on government assistance food programs to feed their families on a daily basis (Bradbard, 1997). The enormous wealth gap has generated contention among economists and many Americans about the source of this imbalance (Matthews, 2014). One impetus for the stark contrast between rich and poor Americans is the varied level of education achieved between the two groups, which directly parallels the strong connection between income levels and educational attainment established in previous research (Strauss, 2012). Moreover, the correlation between education and health studied in previous research suggests that higher educational attainment is associated with better health and a healthier lifestyle (O., 2013).

In the past decade, adolescent obesity has reached a striking 17% among adolescents in the US, causing researchers and policy makers to become increasingly drawn to the impact adolescent obesity has on individuals' health, longevity, employment, education, and other economic outcomes (CDC, 2017; Amis, 2014). That being so, many studies have examined the relationship between health and education or health and labor market outcomes, and overall these studies have established a positive relationship between health and these two outcomes (Suhrcke,

2011). Since health is a multifaceted subject, it can be analyzed and measured in many ways, for example, through the effects of obesity or other chronic health conditions, as well as health behaviors such as alcohol drinking, smoking, or physical exercise. The purpose of this study is to add to existing literature by specifically focusing on the effect early life nutrition has on later educational achievement and labor market outcomes. To the best of my knowledge, this is the first study to estimate these multiple outcomes in adult life from early adolescent's nutritional and consumption habits using a nationally representative dataset.

Adolescence is the pivotal time period in which many future educational opportunities are determined and health habits are formed (Adolescent Health, 2017). The overall purpose of this study is to determine whether nutritional intake at the time of adolescence can predict academic attainment and earnings later on in life. Some of the thresholds of academic achievement measured in this study include high school graduation, college attendance, earning a college degree, and earning a master's degree. Prior research shows chronic health conditions in adolescence such as obesity can have adverse effects on youth academic performance, including high school graduation rates and the probability of attending college (Amis, 2014). Since education is strongly and positively associated with lifetime earnings and other quality of life indicators, child or adolescent health and nutrition may therefore affect adult earnings and other outcomes indirectly, even if no direct relationship exists (Amis, 2014). This study identifies how nutrition is a driving factor to help improve levels of education achieved, and sequentially lead students to acquire more skills and higher paying jobs in the future. Generally, children are not in control of their socioeconomic status, and so they may be in a situation where the proper nutrients are not available to them. By examining a nationally representative sample of adolescents' nutritional intake, inclusive of varying levels of income, the results demonstrate

how nutrition affects several outcomes, thus demonstrating the importance of providing sufficient nutrition for every socioeconomic level. Nutrition has proven to be an issue in low-income families, who also happen to typically live in areas where high school dropout rates are higher than areas of high-income families (Rumberger, 2013).

Using data from the National Longitudinal Study of Adolescent Adult Health (Add Health), I estimate the effect of nutritional intake at the ages 11-21, on educational achievement and earnings at ages 23-33. I find that there is indeed a relationship between nutritional intake during adolescence and the education level attained later on in life. In particular, higher healthy food consumption leads to greater educational attainment and higher junk food consumption leads to lesser educational attainment. Moreover, no such effect is found for fast food consumption. Perhaps surprisingly however, the consumption of healthy and junk food during adolescence does not have the same effect on earnings as an adult.

The results of the statistical testing show a positive relationship between eating healthy and educational outcomes, along with a negative relationship between eating junk food and educational outcomes. However, with the addition of covariates in the regression, such as GPA, smoking cigarettes or drinking alcohol, the results differ and the estimated coefficients of healthy food and junk food are not statistically significant. The consumption of healthy food shows a small negative impact on earnings, while the consumption of junk food and fast food does not have an effect on earnings. These findings add to the existing relationship between health and education or labor market outcomes, and show that nutritional eating habits have a small effect on these outcomes later on in life.

This paper is structured as follows. Section 2 briefly reviews some of the evidence shown in existing literature for the linkage between health, education, and economic outcomes. Section

3 discusses the data used, and Section 4 discusses the use of empirical methodology and presents the results. Following the analysis of the results, concluding comments and policy implications of the study are summarized.

II. Literature Review

Assessing Nutritional Adequacy

Physicians, nutritionists, policy makers and government officials have been concerned about the nutritional adequacy of diets for decades, and particularly within the last ten years federal agencies and regulators have been highly active in improving food and nutrition policy in the U.S. (Slavin, 2015). Federal, state and local governments have instituted significant changes to the school food environment, proposed state and local initiatives to tax or ban certain foods and beverages, and published proposed rules to significantly change nutrition labeling regulations (Slavin, 2015). The need for establishing these policy changes stems from measuring the nutritional adequacy of the public. Moreover, despite these improvements in nutrition policy, there are still Americans that tend to relinquish their control over their nutritional intakes, especially when relying on government assistance. Government Food Assistance programs such as Supplemental Nutrition Assistance Program (SNAP) and Women, Infants, and Children (WIC) are designed to benefit people living below or near the poverty line, which happen to be at higher risk for nutritional inadequacies and obesity. Research has shown that there is a need for funding to be maintained and re-allocated towards healthier choices for WIC and SNAP participants to combat the prevalence of obesity, diabetes, etc. (Richards, 2013).

The complexity of human feeding and its correlation with health require the creation of tools to assess diet quality, and over the last century there has been a progression in measuring nutritional adequacy (Lucia, 2016). Beginning in 1968, daily nutrient intakes of individuals were observed and compared to the FDA's recommended dietary allowances (RDA) (Dietary Reference, 2003). The most recent measure used to note nutrient adequacy are Dietary reference intakes (DRIs). DRIs cover age-specific requirements ranging from infants to those older than

70, for key vitamins, minerals, elements, macronutrients, electrolytes, and water (Dietary Guidelines, 2015). Additionally, researchers have also supplemented the more traditional nutritional adequacy measurements with energy density calculations, healthy eating indices, and diversity charts (Drewnowski, 2004).

With respect to youth, because childhood and adolescence is a phase of intense growth and development, nutritional needs are increased and adequate nutrition is essential (Adolescent Health, 2017). Research has shown that in this stage, the foods preferentially consumed are those high in fat, sugar and salt. Most of these foods provide high energy content yet low nutritional value, while the intake of fruits and vegetables remains low. The Healthy Eating Index (HEI) is an educational and preventative instrument created by the United States Department of Agriculture, which aims to assess the changes in population dietary patterns (Lucia, 2016).

Link between Socioeconomic Status and Poor Nutrition

Numerous studies in the past have examined the link between poverty, poor dietary nutrition, and obesity, which have established socioeconomic disparities (Aggarwal, 2011). In particular, there is a strong connection between poverty and obesity. Studies have shown that the rise of obesity and the increase in the number of type 2 diabetes cases in the United States follow a socioeconomic gradient, such that the burden of disease falls disproportionately on people with limited resources, racial-ethnic minorities, and people who are at an economic disadvantage (US Department of Health, 2000). Poverty and food insecurity are typically associated with lower food expenditures, low fruit and vegetable consumption, and lower-quality diets (Why Low-Income, 2017). In linear programming models, spending less on food consumption leads to a diet enriched with high-fats and energy dense foods; therefore, such diets are more affordable and more prevalent among low-income individuals than prudent costly diets based on lean meats,

fish, fresh vegetables and fruit (Drewnowski, 2004). Moreover, in a similar study, the social gradient in diet quality is explained by diet costs, such that, by examining indices of overall diet quality, the results show that higher income and education are each associated with lower energy density diets and higher Mean Adequacy Ratio (MAR) scores. In other words, having a lower socioeconomic status can prevent people from attaining the proper nutrition they need (Aggarwal, 2011).

Furthermore, Drewnowski (2004) examines how prices and incomes affect food choices, dietary habits, and diet quality by utilizing the Healthy Eating Index (HEI). The results of his research demonstrate how income disparities have a major effect on diet quality. Also, the results show that HEI scores are higher for the wealthier and better-educated groups, in fact, education has a stronger effect on diet quality than income does (Drewnowski, 2004). Next, evidence is provided to support that the highest rates of obesity occur among population groups with the highest poverty rates and the least education. This may be because of the observed links between socioeconomic variables and obesity, in particular, how the variables of taste, dietary energy density, and diet costs impact food consumption decisions. In other words, obesity and becoming overweight typically stems from consuming more added sugars and fats, which often occurs when people spend a lower percentage of their disposable income on food out of necessity (Drewnowski, 2004). While low-income individuals struggle to maintain nutritious diets and to reach certain recommended daily nutrient requirements, their wealthier counterparts are able to spend more on expensive, healthier foods to create balanced meals.

Link Between Health and Education

Studies have estimated the effects of being obese during adolescence to be directly related to the likelihood of high school graduation, post-secondary educational attainment and

labor market earnings as an adult, finding that for some demographic groups, adolescent obesity has significant negative effects on college graduation and future income (Amis, 2014). Since obesity is a chronic condition that incubates other health conditions such as depression, cancer, and cardiovascular disease, being obese as a child is a health risk that can have adverse effects that reach far into adulthood. The results indicate a negative correlation between obesity as an adolescent and education level, and obese adolescents earn 7.5% less as adults, on average, than do non-obese adolescents (Amis, 2014). Much of the economics research on obesity has focused on outcomes associated with adult overweight or obesity, and depending on the research method and data used, results range from finding substantial negative effects of obesity on current earnings or employment to the absence of labor market penalties (Amis, 2014). Research has explored the impact of health behaviors and health conditions on educational outcomes, such as alcohol drinking, smoking, nutrition and physical exercise; however, nutritional problems are often linked or assumed to be associated with obesity or lack of physical exercise, and the examination of food intake is overlooked (Suhrcke, 2011).

The positive association between education and health is well established, despite a lack of explanations for this connection (Population Health, 2015). Studies have shown that well educated people experience better health than the poorly educated people as indicated by high levels of self-reported health and physical functioning, low levels of morbidity and disability, whereas, low educational attainment is associated with higher rates of infectious disease, chronic noninfectious disease, shorter life expectancy, and self-reported poor health (Ross, 1995). The complexity of the relationship between health and education differs between developing and high-income countries, such that the role of health has been more extensively studied in developing countries in comparison to high-income countries (Suhrcke, 2011; Currie, 2008).

Moreover, previous research that examined the relationship between health and education, for children and adolescents in particular, often faced challenges when empirically estimating this complicated relationship due to external factors, such as the family background or individual characteristics of children, that may play a significant role in the child's outcomes (Suhrcke, 2011). These unobservable characteristics need to be taken into account in order to avoid bias on the coefficients tested (Suhrcke, 2011). Despite these challenges, when children's education, health, and third-party factors are taken together, they account for differences in employment status and income when they become adults, as well as adult health outcomes and other results such as the educational achievement of their own children (Smith, 2005).

Factors that Affect the Level of Education Achieved

When looking at high school dropout rates, poverty is a major factor to take into consideration. There are several factors that contribute to educational attainment. Specifically, the most common factors that influence the high school dropout rate involve demographics and performance, such as the family income-level race or ethnicity, age, gender, and school attendance patterns (Burrus, 2012). An alternative perspective to understanding the global effect of underachieving a high school degree is that it is not only the individual that suffers economically. High school dropouts may, added together, represent billions of dollars annually in lost revenue for the U.S. economy because of the high estimated percentages of high school dropouts that receive some form of government assistance or turn to drugs or crime; thus, determining factors that affect high school drop-out rates is crucial for improving economic conditions for the whole population in the United States (Burrus, 2012).

Shortfalls of Existing Literature

After reviewing evidence of potential impacts of health and nutrition among children and adolescents in the United States, there are several noticeable gaps in the existing literature, some of which are addressed by this study. First, what has been observed before with complete certainty is the correlation between health and education. However, prior studies either assume or show that education determines health rather than the reverse, and this is often due to the complexity in the causal relationship between health and education (Suhrcke, 2011). While extensive research has documented the impact of health on education in poor countries, there is room for expanding research (Suhrcke, 2011). Moreover, there are no prior studies examining the impact of nutritional adequacy on educational attainment in a nationally representative sample of households from across the socio-economic spectrum. Many health disparities in the United States are linked to inequalities in education and income (Drewnowski, 2004). This study expands on the effects of these nutritional disparities, by showing how nutrition may act as a barrier to students gaining sufficient levels of education or personal earnings as an adult. While studies have shown that youth obesity, which is strongly related to poverty or lack of available nutrients, can have long-lasting effects on the economic well-being of individuals (Amis, 2014), the study of nutrition on future outcomes is often grouped together with obesity or lack of physical exercise. By exploring the daily food intake and measuring the nutritional adequacy of adolescents' diets, this study goes beyond prior studies that show obesity or lack of physical exercise to have negative effects on educational outcomes. It is evident in existing literature that the health of adolescents is crucial in determining their future outcomes and successes later on in life. Thereby, this study adds to existing literature by specifically focusing on the effects of nutrition and food intake of adolescents on educational and economic outcomes as an adult.

III. Data

This study extracts longitudinal data from The National Longitudinal Study of Adolescent to Adult Health (Add Health), conducted by the Carolina Population Center of the University of North Carolina at Chapel Hill in the National Opinion Research Center (NORC). This data source contains a nationally representative sample of adolescents in the United States, observed over a 14-year period (Add Health, 2017). The first wave survey occurs in 1994, which is accompanied by three subsequent waves of follow-up interviews that occur in 1996, 2001 and finally in 2008. During the Wave II interviews, where the samples' nutritional habits are observed, the samples' age ranges from 11 to 21 and the mean age is 16. During the final wave of interviews, Wave IV, the samples' age ranges from 23-33 and the mean age is 28. The process of selecting high schools in the United States was random, but in order for a high school to be selected for the sample it needed to include an eleventh grade and have a minimum enrollment of 30 students.

Add Health tracks the social, economic, physiological and physical well-being of the respondents from adolescence to adulthood, thus, providing unique opportunities to study how social environments and behaviors in adolescence are linked to health and achievement outcomes in young adulthood. Additionally, since the data is observed over a fourteen-year period, with a sample of respondents dispersed across all 50 states, this data is ideal for this study. I use data from three survey waves, Wave I, Wave II, and Wave IV. Wave I: In-Home Questionnaire is the first source of data that includes information about the respondents' daily habits and behaviors both in school and outside of school, as well as their family, neighborhood, and school environment. I use this data to create several control variables, which I refer to below and in table 1 in the appendix. Next, I use data from the Wave II: In-Home Questionnaire. From this

dataset, I use information about the respondents' food consumption and the respondents' demographic variables. Lastly, the Wave IV: In-Home Questionnaire is conducted, and from this dataset I use information about the respondents' educational outcomes and earnings as of 2008. In order to track the outcomes of respondents, I narrowed down the data by only including individuals who responded to Wave I, Wave II and Wave IV, creating a sample size of 3,924 respondents. The sample size is limited further as the number of variables I control for in the statistical testing increases. This is due to fewer respondents answering particular questions in the survey. Thus, for each statistical test I run, there is a different sample size.

The dependent variables examined in this study are years of education completed and personal earnings. Add Health indicates the highest level of education achieved for each respondent, including thresholds such as high school attendance, high school graduation, college attendance, college graduation, completion of master's degree, completion of post baccalaureate professional education, etc. From this data, I create the variable years of education, by calculating the total amount of years the respondent is educated based on his or her response to their highest level of academic achievement. Moreover, each respondent also reports their personal earnings before taxes. The mean for years of education is about 14, and the mean for earnings is about $33,546.

Furthermore, I create several explanatory variables to account for the respondents' nutritional habits, demographics, family environment, prior academic successes or difficulties, and behavioral habits. The Nutrition section of the Wave II Survey data gathers information about adolescents' food and drink consumption. The survey asks the participants to think about the food and drink they consume in the previous twenty-four hours, including snacks as well as regular meals. Using the reported data on nutritional intake, I create eating indices. These indices

are created in a similar manner to the composition of the Healthy Eating Index (HEI). HEI is a measure of diet quality that assesses conformance to the Dietary Guidelines for Americans, where there is a maximum score for each dietary component observed such as fruit, vegetables, or dairy. For the purposes for this study, I characterize each food consumed by the respondents as healthy food or junk food. In addition, there is a separate category for how often each respondent consumes fast food during the previous week. For instance, the respondents indicate whether they consume a certain type of food like sodas, cookies and chocolate bars, which are then categorized as junk food. Whereas, foods and drinks like water, fruits and vegetables are categorized as healthy food. Within each food category, the respondents' food index increases as they eat more of that category of food. Table 2 reveals that on average, the respondents scored about a 7 out of 25 on the healthy eating index, indicating that on a daily basis, the respondents consume approximately 27% of the healthy food choices they were asked about during the interview. On the other hand, on average, the respondents scored about a 6 out of 18 on the junk food eating index, indicating that on a daily basis, the respondents consume approximately 34% of the junk food choices they were asked about during the interview. Additionally, on average, the respondents reported to consume fast food about 2 days per week.

Besides those three nutritional scales, I control for several other variables. In regards to the demographics of the respondent, I include the variables age, gender, and race. The mean age of the respondents during the Wave IV Interviews is 28, and the ages ranged from 23 to 33. Approximately half of the respondents in the original sample (N=3,924) are female (54.5%), the rest being male. I create variables for each race represented in the sample, including White, African American, Native American, Asian, and Hispanic. There are also separate categories for those who responded with multiple races and those who categorize themselves as an other race.

Next, taken from Wave I data, I include variables for the family environment of the respondents. This is information about the respondents' parents like whether they are employed, as well as how close the child feels to each of their parents. I also take data from Wave I about the respondents' academics such as their GPA, how often the respondent skips school without an excuse, and if the respondent repeats a grade. Additionally, I create variables to account for the respondents' behaviors like how often they watch TV, play video games, play sports or hang out with their friends, as well as whether or not they smoke or do drugs. Lastly, I create variables regarding the neighborhood environment for the respondent which includes whether or not they live in an urban area and whether they feel safe at their school or in their neighborhood. Since adolescents are likely to differ in many ways that may be related to future academic and economic outcomes, it is important to control for these potential confounding factors. The complete list of variables along with their definitions is presented in Table 1 in the appendix. Additionally, the summary statistics for each variable is presented for each of the models tested in Tables 2-5.

IV. Empirical Strategy and Results

In order to determine how nutrition and food intake patterns of adolescents affect their associated level of education achieved and earnings as adults, I estimate a linear (OLS) regression model of the following form:

$$Y_{i_t} = \alpha + \beta_1 HF_{i_{t-12}} + \beta_2 JF_{i_{t-12}} + \beta_3 FF_{i_{t-12}} + \delta X_{i_{t-14}} + \delta X_{i_t} + \varepsilon_i$$

where Y is either the highest level of education achieved or personal earnings before taxes, HF represents the healthy food index, JF represents the junk food index, FF represents the fast food index, $X_{i_{t-14}}$ is a vector of observables characteristics that are observed during the Wave I Survey such as the respondents' family and neighborhood environment, academic success, and behavioral characteristics, X_i is a vector of other observable characteristics including gender, age, and race, i refers to individuals, and ε is an error term with the usual properties.

For the purpose of presenting the results in a clear manner, I have broken up the model into two parts. In model 1, Y is the highest level of education achieved. In model 2, Y is personal earnings before taxes. Once more, I create two specifications for each model. The sample sizes of each specification differ due to the inclusion of additional covariates. In both models, specification 1 does not include as many covariates as specification 2 does. Since the responses to the survey data used to test the models vary, for instance, some questions receive less of a response than others, by including additional variables, fewer respondents have answered all the questions and thus the sample size decreases.

The results from model 1 are presented in Tables 6 and 7. In the first specification, the model only controls for nutrition and demographic variables, and the results show a positive relationship between healthy eating and educational outcomes that is statistically significant ($P<0.01$). Also, there is a negative relationship between eating junk food and educational

outcomes that is statistically significant ($p<0.01$). In this sample, educational achievement increases with age, and Asians achieve the highest level of education, followed by Whites, African Americans, multi-race individuals, Hispanics, and Native Americans, respectively. Moreover, specification 2 shows that after the inclusion of other covariates, the results change. While the point estimates in the second regression of specification 2 suggest a small negative relationship between adolescents eating junk food and eating fast food and educational achievement, the estimated coefficients are not statistically significant. The results also demonstrate a negative association between grade repetition, living in an urban neighborhood, sex, smoking cigarettes, and alcohol consumption and the years of education achieved. GPA was the only statistically significant positive coefficient. Overall, these results are consistent with previous literature that has established a positive link between health and education.

Moreover, the results from model 2 are presented in Tables 8 and 9. The results differ from the expected outcomes based on previous literature. In the model that only controls for nutrition, demographic, and education variables, the results indicate that healthy food, junk food, and fast food all have small negative estimated coefficients and healthy food is the only coefficient that is statistically significant ($p<0.10$). The educational thresholds included in the model are high school graduate, some college, college graduate, and beyond college, and they all show a positive relationship with earnings ($p<0.01$). Furthermore, in specification 2, when all the other covariates are included in the second regression, there are small negative coefficients for healthy food, junk food, and fast food, and healthy food and junk food are statistically significant at the 90% confidence interval ($p<0.10$). Additionally, in both regressions of specification 2, earnings increase as years of education increase. Also in both specifications, it is shown that females' earnings are significantly less than males' earnings.

V. Discussion

Millions of adolescents in the United State are subject to a poor diet, and even food insecurity and hunger (Brookings, 2016). Typically, those who succumb to feeding their families insufficient amounts of food or low quality diets are facing socioeconomic barriers (Aggarwal, 2011). Adolescent health is a substantial factor in youth development because during the time of adolescence, individuals are maturing and developing and their consumption habits become a trend for their adult life (Arain, 2013). Thus, it is crucial to pay attention to the effects inadequate nutrition has on children, which is the focus of this study.

Several previous studies have examined the relationship between health, education, and economic status. Studies have shown that lower socioeconomic status can prevent people from attaining the proper nutrition needed, along with that, unhealthy eating habits or youth obesity is directly related to educational attainment (Amis, 2014). For instance, research has found that youth obesity has negative effects on labor market outcomes, such that, compared to non-obese adolescents, on average, obese adolescents earn 7.5% less as adults (Amis, 2014). While the positive association between education and health is well established, there is a lack of explanation for this connection. Many health disparities in the US are linked to inequalities in education and income. This study expands on the effects of these health disparities, particularly the impact of different nutritional intakes has on students aiming to achieve a certain academic threshold or earnings as an adult.

The results I find in this study are mostly consistent with existing literature. By analyzing longitudinal data from the National Longitudinal Study of Adolescent to Adult Health (Add Health), I test for the relationship between the consumption of various types of food during the time of the Wave II Survey, on the outcomes the respondents report during the final Wave IV

Survey. The empirical strategy I use to find the results of this study involve linear (OLS) regressions. I create eating indices to measure the amounts of healthy and junk food consumed by the respondents. What I find is that, the consumption of healthy food and junk food has an impact on educational attainment, such that, healthy food consumption leads to more years of education and junk food consumption leads to fewer years of education. The results for the effect on earnings differed, as only healthy food shows a small negative relationship with earnings while junk food and fast food do not have a significant effect. This study expands previous research on the topic of health, education, and economic outcomes, and finds that adolescents who consume healthy foods more often than consuming junk foods, on average, will have greater educational attainment.

As an extension of existing literature, this study continues to examine the relationship between health and education. While previous research has proven a correlation between adolescent obesity and future outcomes, or in general, a strong relationship between health and education, this study reinforces those findings by proving the effect of nutritional intake at the time of adolescence impacting future educational attainment. The results show that as the index for healthy food increases, the level of education increases, while, as the index for junk food increases, the level of education decreases. These results are in support of existing literature which shows an overall negative correlation between risky health behaviors and ill health conditions and education as measured through both educational achievement and academic performance (Suhrcke, 2011). These findings suggest that investments in health would lead to better labor market outcomes when these adolescents reach adulthood (Suhrcke, 2011).

The dataset from Add Health used for this study is ideal because the respondents are observed over a 14 year period, which allows for the testing of outcomes later on in life from the

habits of adolescents. However, there are some ways this study could have been improved, perhaps, by using different data. The disadvantage to this dataset is that although it indicates whether or not individuals consume certain types of food within the past week, for the purpose of this study it would have been more helpful to indicate the individual's consumption in general or over a longer time period to get an overall estimate of their eating habits. Additionally, it would have been more helpful for the data to quantify the different types of foods they ate instead of solely asking if they had consumed it or not.

Since there is a strong possibility of unobservable characteristics playing a significant role in the outcomes of the adolescents in this study, including family socioeconomic status, neighborhood characteristics, friends' habits, etc., it is difficult to control for all these factors. For future research, it would be interesting to examine a cross-regional variation in nutrition and educational related policies and programs which can provide natural experiments that might more reliably identify a causal relationship between health, nutrition, and education.

Health is a crucial economic asset for any person, especially people with lower economic status whose livelihoods depend on being healthy and capable of working (Poverty and Health, 2003). If a poor person becomes injured or ill, often times they become trapped in a downward spiral of lost income and high healthcare costs. To prevent this from happening, there is a strong need to invest in health and recognize that maintaining improving health is a means for economic development which may help break the cycle of poverty (Poverty and Health, 2003).

Furthermore, families struggling to creatively budget and survive off of a low-income salary are often forced to shift their food choices toward less nutritious diets, which aim to maximize calories and minimize costs (Drewnowski, 2010). While the U.S Federal government provides benefits to low-income families through the Temporary Assistance for Needy Families

(TANF) program and the Food Stamp program, in 2015, an estimated 15.8 million households in the U.S. were food insecure (U.S. Hunger Facts, Poverty Facts, 2016). Recent data reports have noted that in May of 2017, the number of households across the United States that utilize the Supplemental Nutrition Assistance Program (SNAP) is 41,489,433 (SNAP, 2017). It is evident that many Americans are having difficulty affording the food and nutrients they need to survive and feed their families and children. Providing adequate financial resources for health should be a priority for all Americans, which even includes resources for proper nutrition.

Appendix

Table 1. Variable Definitions	
Dependent Variables	
Years of Education	Total years of education achieved
Earnings	Total personal earnings before taxes
Independent Variables	
Healthy Food	Healthy Food Eating Index indicating measure of healthy food consumption
Junk Food	Junk Food Eating Index indicating measure of junk food consumption
Fast Food	Fast Food Eating Index indicating how often fast food is consumed per week
Age	Age of respondent
Age^2	Age of respondent squared
Female	Dummy variable indicating gender of respondent is female
White	Dummy variable indicating race of respondent is White
African American	Dummy variable indicating race of respondent is African American
Native American	Dummy variable indicating race of respondent is Native American
Asian	Dummy variable indicating race of respondent is Asian
Hispanic	Dummy variable indicating race of respondent is Hispanic
Multi-Race	Dummy variable indicating respondent is of multiple races
Other Race	Dummy variable indicating respondent is of another race not listed
Parents Work	Dummy variable indicating if one of respondent's parent is employed
Mother-Child Relationship	Dummy variable indicating if respondent feels close to their mother
Father-Child Relationship	Dummy variable indicating if respondent feels close to their father
GPA	Average of respondent's self-reported grades in Math, English, Science & History (4 point GPA scale, 4=A, 1=D)
School Skipped	Number of times skipped school without excuse
Grade repeated	Dummy variable indicating if respondent ever repeated a grade
Watch TV	Number of hours per week respondent watches TV (range 0-99 hours)
Play Videogames	Number of hours per week respondent plays computer or video games (range 0-99 hours)
Sports	Dummy variable indicating if respondent plays sports 3 or more times per week
Hangs with friends	Dummy variable indicating if respondent hangs with friends 3 or more times per week
Smoke	Dummy variable indicating whether the respondent smokes cigarettes
Alcohol	Dummy variable indicating whether respondent consumed alcohol in past year
Sex	Dummy variable indicating whether respondent has ever engaged in sexual activities
Drugs	Dummy variable indicating whether respondent has ever used drugs (marijuana or cocaine)
Urban	Dummy variable indicating whether respondent lives in an urban

	neighborhood
Neighborhood Safety	Dummy variable indicating whether respondent feels safe in their neighborhood
School Safety	Dummy variable indicating whether the respondent feels safe at their school
General Health	Self-reported health indicator (1:healthy, 0:unhealthy)

Table 2. Summary Statistics for Model 1
Specification 1 **(N=3918)**

Variable	Mean	Standard Deviation
Years of Education	14.141	2.035
Healthy Food	6.763	3.869
Junk Food	6.074	2.555
Fast Food	2.162	1.780
Age	27.994	1.614
Female	0.545	0.498
White	0.604	0.489
African American	0.208	0.406
Native American	0.005	0.073
Asian	0.026	0.158
Hispanic	0.108	0.310
Multi-Race	0.042	0.200
Other Race	0.007	0.084

Table 3. Summary Statistics for Model 1
Specification 2 **(N=2082)**

Variable	Mean	Standard Deviation	Mean	Standard Deviation
Years of Education	14.422	2.01	14.422	2.01
Healthy Food	7.029	3.869	7.029	3.869
Junk Food	6.109	2.553	6.109	2.553
Fast Food	2.073	1.693	2.073	1.693
Age	27.862	1.597	27.862	1.597
Female	0.531	0.499	0.531	0.499
White	0.642	0.480	0.642	0.480
African American	0.186	0.389	0.186	0.389
Native American	0.003	0.058	0.003	0.058
Asian	0.023	0.150	0.023	0.150
Hispanic	0.097	0.295	0.097	0.295
Multi-Race	0.039	0.193	0.039	0.193
Other Race	0.01	0.100	0.01	0.100
Parents Work			0.571	0.495
Mother-child relationship			0.886	0.318
Father-child relationship			0.628	0.483
GPA			2.790	0.860
School skipped			1.166	5.031
Repeated grade			0.174	0.379
TV			15.427	14.128
Videogames			2.837	6.368
Sports			0.490	0.500
Hang with friends			0.680	0.467
Smoke			0.103	0.304
Alcohol			0.372	0.484
Sex			0.185	0.389
Drugs			0.110	0.229
Urban			0.295	0.456
Neighborhood Safety			0.916	0.277
School Safety			0.873	0.333
General Health			0.924	0.266

Table 4. Summary Statistics for Model 2
Specification 1 **(N=3434)**

Variable	Mean	Standard Deviation
ln(earnings)	10.114	1.084
Healthy Food	6.818	3.874
Junk Food	6.103	2.544
Fast Food	2.165	1.771
Age	27.965	1.605
Female	0.526	0.499
White	0.623	0.485
African American	0.193	0.395
Native American	0.005	0.07
Asian	0.025	0.156
Hispanic	0.105	0.306
Multi-Race	0.043	0.204
Other Race	0.006	0.08
Less than HS	0.073	0.26
HS Grad	0.15	0.355
Some College	0.431	0.495
College Grad	0.218	0.413
Greater than College	0.131	0.337

Table 5. Summary Statistics for Model 2
Specification 2 **(N=1834)**

Variable	Mean	Standard Deviation	Mean	Standard Deviation
ln(earnings)	10.191	1.041	10.191	1.041
Healthy Food	7.074	3.867	7.074	3.867
Junk Food	6.144	2.561	6.144	2.561
Fast Food	2.077	1.678	2.077	1.678
Age	27.838	1.589	27.838	1.589
Female	0.514	0.500	0.514	0.500
White	0.665	0.472	0.665	0.472
African American	0.173	0.379	0.173	0.379
Native American	0.003	0.057	0.003	0.057
Asian	0.022	0.146	0.022	0.146
Hispanic	0.089	0.285	0.089	0.285
Multi-Race	0.039	0.194	0.039	0.194
Other Race	0.008	0.090	0.008	0.090
Less than HS	0.061	0.239	0.061	0.239
HS Grad	0.126	0.332	0.126	0.332
Some College	0.403	0.491	0.403	0.491
College Grad	0.250	0.433	0.250	0.433
Greater than College	0.160	0.367	0.160	0.367
Parents Work			0.573	0.495
Mother-child relationship			0.885	0.319
Father-child relationship			0.640	0.319
GPA			2.827	0.845
School skipped			1.131	5.045
Repeated grade			0.161	0.368
TV			15.361	13.870
Videogames			2.800	5.879
Sports			0.498	0.500
Hang with friends			0.682	0.466
Smoke			0.100	0.300
Alcohol			0.367	0.482
Sex			0.185	0.400
Drugs			0.110	0.229
Urban			0.290	0.454
Neighborhood Safety			0.920	0.271
School Safety			0.881	0.324
General Health			0.932	0.253

Table 6. Estimates of Effects of Adolescent Nutritional on Educational Attainment

Specification 1 **(N=3918)**

	Years of Education	Standard Error
Healthy Food	0.060***	0.009
Junk Food	-0.050***	0.014
Fast Food	0.018	0.019
Age	2.248***	0.588
Age^2	-0.041***	0.010
Female	0.496***	0.065
White	0.787***	0.105
African American	0.470***	0.120
Native American	-0.684	0.444
Asian	1.223***	0.221
Multi-Race	0.366**	0.183
Other Race	0.991**	0.388
Constant	-17.686**	8.251

Notes: *** indicate coefficient is statistically significantly different from zero at the 1% level, **indicate coefficient is statistically significantly different that zero at the 5% level, and * indication coefficient is statistically significantly different than zero at the 10% level.

Table 7. Estimates of Effects of Adolescent Nutritional on Educational Attainment

Specification 2 **(N=2082)**

	Regression 1 **Years of Education**	**Standard Error**	Regression 2 **Years of Education**	**Standard Error**
Healthy Food	0.035***	0.012	-0.012	0.010
Junk Food	-0.048**	0.020	-0.010	0.015
Fast Food	0.001	0.027	-0.008	0.022
Age	2.475***	0.824	0.928	0.671
Age2	-0.044***	0.015	-0.014	0.012
Female	0.618***	0.088	0.267	0.077
White	0.921***	0.149	-0.254**	0.129
African American	0.562***	0.171	-0.105	0.146
Native American	-0.790	0.755	-1.416**	0.612
Asian	1.179***	0.315	-0.396	0.260
Multi-Race	0.463*	0.258	-0.197	0.213
Other Race	0.884**	0.450	-0.142	0.365
Parents Work			-0.066	0.073
Mother-child relationship			-0.158	0.112
Father-child relationship			-0.179***	0.077
GPA			0.740***	0.046
School skipped			-0.008	0.007
Repeated grade			-1.087***	0.099
TV			-0.001	0.003
Videogames			-0.019***	0.006
Sports			0.109	0.074
Hang with friends			-0.037	0.076
Smoke			-0.259**	0.123
Alcohol			-0.155**	0.076
Sex			-0.434***	0.101
Drugs			-0.020	0.175
Urban			-0.256***	0.079
Neighborhood Safety			0.083	0.132
School Safety			0.060	0.120
General Health			-0.061	0.135
Constant	-20.980*	11.493	-4.886	9.366

Notes: *** indicate coefficient is statistically significantly different from zero at the 1% level, **indicate coefficient is statistically significantly different that zero at the 5% level, and * indication coefficient is statistically significantly different than zero at the 10% level.

Table 8. Estimates of Effects of Adolescent Nutrition on Adult Earnings Specification 1 (N=3918)

	ln(earnings)	Standard Error
Healthy Food	-0.009*	0.005
Junk Food	-0.008	0.008
Fast Food	-0.001	0.010
Age	0.063	0.330
Age^2	-0.001	0.006
Female	-0.397***	0.036
White	-0.086	0.059
African American	-0.328***	0.068
Native American	-0.529**	0.255
Asian	0.062	0.124
Multi-Race	-0.174*	0.100
Other Race	-0.031	0.891
HS Grad	0.428***	0.079
Some College	0.618***	0.070
College Grad	1.032***	0.076
Greater than College	1.064***	0.082
Constant	8.600*	4.616

Notes: *** indicate coefficient is statistically significantly different from zero at the 1% level, **indicate coefficient is statistically significantly different that zero at the 5% level, and * indication coefficient is statistically significantly different than zero at the 10% level.

Table 9. Estimates of Effects of Adolescent Nutrition on Adult Earnings
Specification 2 (N=1834)

	Regression 1 (N=1,834)		Regression 2 (N=1,834)	
	ln(earnings)	Standard Error	ln(earnings)	Standard Error
Healthy Food	-0.009	0.007	-0.012*	0.007
Junk Food	-0.006	0.010	-0.005	0.010
Fast Food	-0.024*	0.014	-0.027*	0.015
Age	0.266	0.457	0.170	0.460
Age^2	-0.004	0.008	-0.002	0.008
Female	-0.379***	0.048	-0.413***	0.052
White	-0.113	0.083	-0.170**	0.085
African American	-0.271***	0.096	-0.269***	0.098
Native American	-0.806**	0.411	-0.813**	0.414
Asian	0.183	0.175	0.120	0.176
Multi-Race	-0.120	0.140	-0.136	0.141
Other Race	-0.195	0.267	-0.268	0.268
HS Grad	0.409***	0.114	0.340***	0.116
Some College	0.629***	0.101	0.510***	0.106
College Grad	1.039***	0.105	0.860***	0.116
Greater than College	1.012***	0.111	0.813***	0.124
Parents Work			-0.017	0.048
Mother-child relationship			-0.014	0.075
Father-child relationship			-0.030	0.051
GPA			0.099***	0.034
School skipped			0.002	0.005
Repeated grade			-0.203	0.070
TV			-0.005	0.002
Videogames			0.001	0.004
Sports			-0.010	0.050
Hang with friends			0.070	0.051
Smoke			0.042	0.083
Alcohol			-0.025	0.051
Sex			0.001	0.070
Drugs			0.050	0.118
Urban			-0.089*	0.053
Neighborhood Safety			-0.010	0.090
School Safety			-0.023	0.075
General Health			0.004	0.094
Constant			6.861	6.423

Notes: *** indicate coefficient is statistically significantly different from zero at the 1% level, **indicate coefficient is statistically significantly different that zero at the 5% level, and * indication coefficient is statistically significantly different than zero at the 10% level.

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