Distribution Agreement

Elizabeth Schechter March 21, 2016

Food for Thought: A Quantitative Analysis of the Effects of the National School Lunch Program

by

Elizabeth Schechter

Dr. Deric Shannon

Adviser

Department of Sociology

Dr. Deric Shannon

Adviser

Dr. Jeff Mullis

Committee Member

Ms. Patricia Simonds

Committee Member

2016

Food for Thought: A Quantitative Analysis of the Effects of the National School Lunch Program

By

Elizabeth Schechter

Dr. Deric Shannon

Adviser

An abstract of
a thesis submitted to the Faculty of Emory College of Arts and Sciences
of Emory University in partial fulfillment
of the requirements of the degree of
Bachelor of Arts with Honors

Department of Sociology

2016

Abstract

Food for Thought: A Quantitative Analysis of the Effects of the National School Lunch Program
By Elizabeth Schechter

This paper assesses whether National School Lunch Program participation results in different health and academic effects compared to non-participants. Using the most recent data from the 2010 cohort of the Early Childhood Longitudinal Study, I employ statistical methods to compare the BMIs and test scores of program participants to non-participants. National School Lunch Program participation results in higher BMIs and lower academic test scores, on average. The results hold true, even when controlling for a variety of background variables. These results confirm that children who receive a school provided lunch experience different outcomes than those who do not receive a school lunch.

Food for Thought: A Quantitative Analysis of the Effects of the National School Lunch Program

By

Elizabeth Schechter

Dr. Deric Shannon
Adviser

A thesis submitted to the Faculty of Emory College of Arts and Sciences
of Emory University in partial fulfillment
of the requirements of the degree of
Bachelor of Arts with Honors

Department of Sociology

2016

Acknowledgments

I would like to thank each one of my committee members for their invaluable support to me throughout the process of writing my thesis.

To Dr. Shannon, thank you so much for first giving me the opportunity to do research with you my sophomore year and agreeing to advise me, yet again, on writing my honors thesis. You have been an incredible mentor to me throughout my experience at Emory and cultivated my passion for Sociology. I so appreciate all of the guidance you have given me throughout the process.

To Dr. Mullis, thank you for all you have taught me in your classes and the extra help you provided me on my thesis. I could not have undertaken this without the valuable skills I learned as your student. Your expertise and overseeing of the honors program has provided me with so much support along the way.

To Ms. Simonds, thank you for teaching me everything I know about nutrition and emphasizing how integral healthy food is in life. The experience in your class added so much to my insight as I wrote my thesis.

Table of Contents

List of Tables

Introduction

Nearly one out of every five children or adolescents in the United States is obese ("Childhood Obesity Facts" 2015). This troubling statistic has forced the Unites States to critically examine the underlying causes of childhood obesity and make policy changes to reverse them. Growing nutritional awareness has led to a reevaluation of US food programs and steps to change them in recent years.

Evidence of nutritional behavior change can be seen in the private market. In recent years, Americans have grown more aware of the health risks associated with poor diet and inactivity. This awareness has propelled sales in the organic market with 83% of families purchasing organic products sometimes ("Policy Conference 2015 Infographic" 2015). In 2014 the organic industry exceeded $39 billion dollars, a remarkable growth in the past decade ("Policy Conference 2015 Infographic" 2015). This number does not include all of the United States, though. In that same year, 14% of US households were food insecure, meaning that they did not have adequate access to nutritionally sufficient foods (Singh et al. 2015). Numerous reports have linked the risk of being obese with one's income. Childhood obesity, especially, is particularly prevalent among minority groups who have less capital to purchase healthy food for their children.

While obesity certainly does not only affect children, an emphasis has been placed on childhood obesity. At the launch of her Let's Move campaign to combat childhood obesity, Michelle Obama said that, "The physical and emotional health of an entire generation and the economic health and security of our nation is at stake" ("About Let's Move" 2016). Instilling healthier food and exercise habits in children often sets a precedent for adulthood.

In addition to the practical aspects of childhood habit change, a special emphasis is placed on generational change. Changing the norms of the generation of children has the potential to change the norms of the future. There is a unique aim to target children so that they grow up in and create as adults a society in which healthy habits are the norm. This echoes aims of the anti-smoking campaign following the 1964 Surgeon General warning. While many adults quit smoking as well, sending the message to children early on in life prevented them from ever becoming smokers, dramatically reducing smoking rates as those children became adults who resisted tobacco products.

The public sector is perhaps less equipped to change food behavior choices among adults. While many low income Americans may be recipients of food stamp benefits, the majority of the country is not. Even among those who do receive food stamps, the government cannot intervene in what people choose to consume in addition to what they are entitled to with food stamps. Though different access issues may limit their choices, US adults' food choices are largely a matter of personal choice, not government provision. Children have the unique characteristic of majorly attending public schools and consuming at least one meal a day there. This has brought special attention to the National School Lunch Program ("National School Lunch Program (NSLP)" 2013). Supervised by the USDA, the NSLP served 30.3 million daily school lunches in 2014 ("National School Lunch Program" 2015). Available in almost all public schools and many private schools, the program aims to provide children with a nutritionally dense daily meal. While all students at participating schools are eligible to receive it, the program particularly affects low-income students by offering them a free or reduced price lunch.

The NSLP's original aim was to support farmers who had agricultural surplus and benefit children by offering a government provided lunch in schools with this surplus. At its start in

1946, the program was mostly absent in low-income schools and primarily served to white, middle-class children. Today, the program overwhelmingly serves low-income students. While all students have the option to purchase a school lunch, many of the middle and upper class students instead bring a home-packed lunch to school (Schanzenbach 2009). Because of this, many think of the NSLP as a welfare program, bringing with it stigma and criticism consistent with other American welfare programs.

The NSLP has not been met without challenges. Many studies have found little evidence that the NSLP has improved children's health outcomes (Dunifon and Kowaleski-Jones 2003; Millimet, Tchernis, and Husain 2010). Schanzenbach's 2009 study even found that participants were more likely to be overweight after just two years of participating in the program. Previous research on the lack of benefits from the NSLP and a growing cultural movement towards healthier eating has led to significant reevaluation of the program. In 2010, President Obama founded the Childhood Obesity Task Force to reduce childhood obesity by five percent in 2030 ("White House Task Force on Childhood Obesity Report to the President" 2016). Among other efforts, one of the aims of the task force was to change the nutritional requirements of the NSLP.

My research aims to evaluate whether these changes to the NSLP may have affected children in terms of their Body-Mass Index (BMI – one particular measure of health) and the results of standardized academic testing. I will be using the most recent data from the Early Childhood Longitudinal Study to evaluate whether NSLP participants have higher BMIs and differing academic test scores compared to non-participants. The Early Childhood Longitudinal Study follows a Kindergarten class cohort starting in Fall of 2010 up until Spring of their fifth grade year in school. Because some of the data are still being collected or not yet available to the public, I will only be analyzing data recorded up to the Spring of their first grade year, or June 2012.

When studying the NSLP, it is important to consider exogenous selection factors among participants vs. their non-participant counterparts. Different results found between both groups can often be dismissed because of lurking variables pertinent to whether or not a child participates in the NSLP. Part of my decision in choosing to analyze data from the Early Childhood Longitudinal Study derives from the study's wealth of demographic information available on the participants and their families. My analysis will control for race, household income, and parental education in an effort to separate these factors' influence on whether a child becomes a NSLP participant or not.

In my analysis, I hope to see if changes to the NSLP have produced an effect on childhood obesity, as measured by BMI. My decision to also study children's test scores is because of the program's important setting in schools. The program may potentially alter students' academic experience. Perhaps eating a nutritious lunch results in students having higher engagement in the classroom. A school's lunch period not only takes time away from the school day, but also requires a significant amount of federal and state education budgets. My analysis seeks to find out whether the effects of what aims to be a nutritional program intersect with the important academic portion of schools.

In this thesis, I will first begin with a historical overview of the NSLP. I will then offer a literature review of previous research on the program. This review offers a mix of different timeframes and study designs, giving a broad overview of previous findings on the NSLP. I then will go over my methods used to conduct my data analysis before presenting the results of my secondary data analysis of the Early Childhood Longitudinal Study's data. My thesis will conclude with a discussion of my results and recommendations for future studies and policy changes.

Literature Review

Context

At the 1946 congressional hearing for the National School Lunch Act, Major General Lewis B. Hershey testified that 16% of the World War Two registrants were rejected from military service. Estimates blamed malnutrition for between 40-60% of the cases (Hinrichs 2010). The NSLP was conceived as a result of this startling realization that Americans were, indeed, not consuming adequate diets. In addition to this, the United States welcomed both economic and agricultural abundance following World War One. The creation of a school lunch program would not only benefit children, but also American farmers who had an abundance of agricultural commodities. At the hearing, congress voted in favor of creating a nationally funded lunch program as a "measure of national security to safeguard the health and wellbeing of the Nation's children and to encourage domestic consumption of nutritious commodities and other food" (*National School Lunch Act* 1946). After passing the National School Lunch Act, the federally-funded and state-run program began.

During the NSLP's start in the late 1940s, the program served mostly white, middle-class children. Until the 1960s Civil Rights movement, the NSLP was mainly absent from low-income schools. When Civil Rights leaders campaigned for many political changes in the 1960s, greater access to the NSLP was one of them. The leaders were successful and the NSLP grew to serve African-American children disproportionally. Because of this and Civil Rights leaders campaigning for the NSLP along with welfare programs like food stamps, the media and public came to think of the program as a welfare program. This brought new stigma to the NSLP, thinking of it as a "welfare trap" as opposed to its original inception as a program to provide lunch for all children. Consequently, the NSLP was much less of a priority to politicians and Americans. Along with other welfare programs in the 1980s, the NSLP experienced strong budget cuts during the Reagan administration (Parsons 2010). Today, even when controlled for socio-economic factors, African-American children are almost five times more likely to participate (Dunifon and Kowaleski-Jones 2003).

Understanding the historic racial and socio-economic implications of the program are important to understanding the NSLP today. The history behind it plays into how the program is politically run, perceived, and participated in today. Currently more than two-thirds of the program participants receive a free or reduced-price lunch, due to their household income being 185% at or below the poverty line ("National School Lunch Program" 2015). The research on the NSLP takes this into account. Because lurking variables like race and household income are so tied to program participation, much of the research accounts for this in order to separate the effects of the NSLP from other factors.

My overview of previous research on the NSLP focuses on two of its main consequences, health and academic effects. The results of the previous research are mixed, with many studies finding no effects from program participation and others finding both positive and negative results. While none of the literature I have used for this study is significantly dated, many of the studies use different data sources spanning throughout the twentieth century to many years ago. Some of the studies are very similar to questions my research aims to answer. The literature review provides an overview of findings derived from research on the NSLP. My research aims to complement these previous studies and review more recent data to see if there is any change on the NSLP's effects on program participants.

Academic Effects

Health is undoubtedly an important aspect to living an adequate life. Few would doubt the importance of health in school, demonstrated by school-wide policies and provisions to guarantee this, such as employing school nurses and requiring entrance vaccinations. Children's diets contribute to their overall energy level, which can potentially affect their ability to focus in school. Ickovic et. al's 2014 study collected data on children's health from fifth and sixth graders and found that those with more health assets were more likely to meet grade goal for standardized tests, regardless of race, reduced-price lunch eligibility, absenteeism, and school enrollment. While academic experiences certainly range more than test scores, testing provides a standardized way of being able to examine a student's experience and compare it to other students nationwide.

Dunifon and Kowaski use Child Development Supplement (CDS) data from the Panel Study of Income Dynamics (PSID) to examine outcomes in children who participate in the NSLP. Academic achievement in math and reading scores was analyzed, along with health limitations that affect school participation and child behavioral adjustment. Control measures were put in place to control for both socioeconomic factors, as well as family dynamics that could affect the results. In the first model, they found that participation in the NSLP actually resulted in *lower* math test scores. In the second model, they enacted a sibling comparison test for families whose children had mixed program participation. The results showed that the siblings that participated in the NSLP had higher test scores, in both math and reading. The authors point out that the effects found were very small and that the NSLP's impact on academic achievement, either positive or negative, is very minimal. They admit that the findings in the study may be due to other factors not related to NSLP participation, but instead factors that cause a child to become a program participant.

Hinrich's 2003 research looks at the long-term effects of program participation on adults in a longitudinal study. Using data from 20th century participation, this study aimed to investigate the historical impact on adult health outcomes and educational attainment. While no effect was found on health, Hinrich did discover a possible effect on attending school. This result is somewhat problematic because attendance in school is mandatory for NSLP program participation. Nonetheless, the results suggest that participation in the NSLP could potentially encourage children to stay in school longer.

Health Effects

In addition to studying the academic outcomes of NSLP participation, Dunifon and Kowaleski-Jones' 2003 study also examined factors that encourage NSLP participation and have effects on food insecurity. While child hunger is rare, food insecurity still is fairly prevalent in the United States. Their study found that compared to 5% of nonparticipants, 24% of NSLP participants come from food insecure households. This suggests that children in the program may benefit from the nutritional additions they receive from eating a school lunch because they may not be receiving an adequate diet at home. While socioeconomic factors intuitively relate to NSLP participation because of its provision of free and reduced lunch, Dunifon and Kowaleski-Jones found that a broader range of cultural and attitudinal factors also predict NSLP participation. Households with married parents participate in the NSLP more, while households with drinking parents participate less on average.

When looking at the health effects of the NSLP, Dunifon and Kowaleski-Jones did not find any significant effect. They suggest three reasons for this result. Children may be receiving adequate nutrients in their diet already, the food eaten as participants of the NSLP may not be of enough nutritional value to improve health outcomes, and children who participate may not see nutritional improvement because their parents compensate for this intake by decreasing the food provided to their children at home. Dunifon and Kowaleski-Jones not only provide insight into the lack of academic and health effects from the program, but also how children's households play a large role in whether or not children participate and how consuming a school lunch affects them.

Hanson and Olson's 2013 study also took care to consider children's household environments in their analysis. Using 2003-2008 data on children 6-17 from the CDC's National Health and Nutritional Examination Survey (NHANES), they controlled for food preference to analyze children's nutritional intake. While they saw little difference in high-income students, they found that NSLP participation resulted in greater dietary quality for low-income students compared to those who did not eat a school lunch. Overall they saw higher vegetable consumption, but also more consumption of fat and sodium. Comparing groups of participants and nonparticipants, both had equal energy intake, suggesting that the difference in nutritional effects is more of a difference in quality versus caloric quantity. They suggest that the passing of the Healthy Hunger Free Kids of 2010, which calls for less fat and more produce and whole grains in the NSLP, may show new effects on program participants.

Ishdorj, Crepinsek, and Jensen looked at the NSLP's effects on nutritional consumption too, but also assessed how schools' meal policies affect participation. School meal policies not only regulate the lunches served, but also can restrict the sale of competitive foods which includes any food not sold by the NSLP like vending machine snacks and bake sales. Using data from the School Nutrition Dietary Assessment Study in 2005, they found that school nutritional improvements have not led to a decrease in participation. Controlling for participation endogeneity, the researchers found that NSLP participants consumed more fruits and vegetables at school, but less at home. Both participants and non-participants consumed more produce at home, but this is not surprising because children typically consume more meals and calories at home than at school.

In considering ways to extend the NSLP's positive effect on produce consumption at school, the researchers found that parent education programs on nutrition did increase fruit consumption in their children, though not vegetable consumption. Ishdorj, Crepinsek, and Jensen's 2013 study provides valuable support for how ongoing changes to the NSLP and parent education programs may be beneficial to ensuring more nutritionally rich diets in children. They also address and refute concerns that making NSLP lunches more nutritious will lead to children bringing a school lunch instead.

While results of Ishdorj, Crepinsek, and Jensen's study were positive with produce consumption, Campbell et al.'s 2011 study did not find the same results when they also looked at the NSLP's effect on overall nutritional consumption. They found that students who participated in the NSLP did not consume a higher quality diet at lunch, but instead consumed a higher quantity of calories. When comparing children at schools not participating in the NSLP, they found that the children did not have significantly different dietary outcomes than program participants. In comparison to previous studies linking NSLP consumption to obesity, they conclude that the reason for the obesity finding is not because of the potentially poor quality of NSLP provided lunched, but instead due to more calories present in them.

Of the studies examining the NSLP's potential connection to childhood obesity, Schazenbach's 2009 study was the most frequently mentioned study I came across during my research. Using data from the original Early Childhood Longitudinal Study with a 1998-1999 kindergarten cohort, she compares students who bring their lunch to those who participated in the NSLP. She identifies endogenous selection factors, finding that children who brought a lunch to school were more likely to have a higher household income and more educated parents. Students who were income-eligible for reduced price lunches were more likely to weigh more than those who were not.

Comparing both groups of students, her study saw no weight differences in kindergarten, but after two years, students who participated in the NSLP were 2% more likely to be overweight. Controlling for selection factors, this difference cannot be explained by background characteristics. She found that, on average, students who participate in the NSLP consume an additional forty calories a day. While these results were statistically significant, Schazenbach warns that the NSLP is only a small component to the US childhood obesity crisis.

Milliment, Tchernis, and Husain's 2010 study is very similar to Schazenbach's, using the same 1998-1999 kindergarten cohort data set to evaluate both the NSLP and related School Breakfast Program (SBP). They measure children's BMIs for an additional year up to third grade and also employ measurements for BMI growth rate, change in BMI percentile for time space, and indicators for overweight or obesity status based on age and gender specific percentiles. Controlling for parental and environmental factors, their study confirms Schazenbach's results that the NSLP exacerbates the childhood obesity problem. In contrast, they found that the SBP is not a contributing factor and may actually be a tool in combatting childhood obesity. More research should explore the SBP's potential relationship in maintaining or reducing children's weights.

In an effort to control for selection factors, many studies do not examine the effect the NSLP may have on children who do receive a free or reduced-priced lunch, instead only comparing full price NSLP participants to those who do not participate. Gunderson, Kreider, and Pepper used advanced statistical methods in their 2012 study to attempt to see the effect the NSLP may have on low-income students. They initially found that after accounting for endogenous selection, the receipt of a free or reduced-price lunch improves the health outcomes of children by leading to reductions in food insecurity, poor health, and obesity. Under significance testing though, they conclude that their results were not significant enough to reject their hypothesis that the NSLP is ineffective in promoting healthy outcomes. Further research should be done employing their statistical models to see if their findings may be statistically significant with a larger sample size.

When evaluating previous research, Qian et al.'s 2015 study was one of the few that used recent data in their analysis. The study evaluates the United States Department of Agriculture's (USDA) Fresh Fruit and Vegetable Program (FFVP), which is a nutritional assistance program that provides funding for the distribution of fresh fruits and vegetables to students. Aimed at reaching students most vulnerable, the program was only available to schools that had free and reduced-price lunch participation rates higher than 50%.

To evaluate FFVP, they used a panel data set of Arkansas public school children from 2008-2010, the year the FFVP started in Arkansas. Comparing FFVP schools to control schools, they found the FFVP has a negative effect on weight gain, showing BMI percentile reductions of 4.2 percentile points on average. The results of this study show how small improvements to school lunches can be meaningful for creating change. More research should be done to further evaluate how the FFVP may help improve the NSLP, especially with more nationally representative samples.

Methods

Data

The data I will be using for my analysis comes from the Early Childhood Longitudinal Study (ECLS). The study consists of three different longitudinal studies aimed at examining child development, school readiness, and early school experience. The first study followed a 1998-1999 kindergarten class cohort through eighth grade and the second study followed a 2001 birth cohort up until the participants started kindergarten.

My secondary data analysis will use the third study, which follows a 2010-2011 kindergarten cohort. These children are still being followed until the study ends this Spring 2016 when the children finish their fifth grade year. Data is only publicly available until the Spring of their first grade year or Spring 2012. My analysis will include two years of school by analyzing data collected in the Fall of the children's kindergarten year through the Spring of first grade. The children in the study are defined by modal grade, but still included if they are not in the grade being measured. For example, if a student was included in the kindergarten class cohort, the student will still be included in the first grade year of data, regardless of whether or not he or she may have skipped or repeated a grade.

The Early Childhood Longitudinal Study is a government-funded study sponsored by the National Center for Educational Statistics (NCES) and the U.S. Department of Education. Children, their families, teachers, schools, and care providers provide information on the children's cognitive, social, emotional, and physical development. Background information is also collected on the children's home environments, home educational activities, school environments, classroom environments, classroom curriculums, teacher qualifications, and before and after school care.

The study includes a nationally representative sample of public and private school students in both full-day and half-day kindergarten classes throughout the United States. The majority of the participants began kindergarten at age five and were born during the years 2005 and 2006. Participants provide a socioeconomically and racially diverse sample that is largely representative of the population in the United States. All of the participation in the study is voluntary, with parents or guardians providing consent for their children to participate. Information collected is also private and unable to be linked to individual participants.

The primary data collection involved a variety of methods. Trained field staff assessed the children in their schools to collect information. Teachers and school administrators also provided information on the children by completing hard-copy questionnaires. Similarly, before and after school providers also completed hard-copy questionnaires, but they only completed these during the children's kindergarten years, not during the follow-up periods. Parents were interviewed by trained field staff primarily on the phone. Parents who did not have access to a telephone or preferred not to conduct an interview over the phone were interviewed in person by the staff.

I accessed the data set through the ECLS's publicly available website. Though the study measures many variables relating to children's academic experiences and well being, I am only using four. To ascertain a measure of children's health, I am using the child's BMI. While this is a very simple measure of health, it will help me draw conclusions as to whether or not the NSLP is making an impact on obesity. Researchers measured children's heights and weights and from that information, BMI scores for all participants were calculated and included as a variable in the study.

In order to measure academic achievement, I used three different variables. I used the three cognitive test scores available in the subjects of reading, math, and science. I chose to use all three subject test scores in case there was any variation in how NSLP participation affected one subject area more or less than the other. While a child's learning experience certainly extends beyond test scores, evaluating the participants' potential academic effects with test scores allowed me as a researcher to compare students from different schools and classroom environments. Uncontrolled-for individual and school factors like learning styles and classroom sizes may certainly be playing a role in children's test scores. To keep this study manageable and to have the ability to use a standardized measure of comparison across many different schools, evaluating test scores proved to be the best option to study the potential academic effects from the NSLP.

I took special care to control for potential lurking variables that could skew the results of my analysis. Because the NSLP participants have a very different demographic profile than non-participants I controlled for race, household income, parent one (maternal) education level, and sex. This was an attempt to try to understand the effect the NSLP may be having on weight and academic achievement, not the effect program selection factors are having. Sex is less a variable concerned with program selection, but more a factor that could potentially effect BMI and test scores.

In choosing to conduct a secondary data analysis, I specifically chose the ECLS for its wide availability of different variables to measure both dependent variables and control for a variety of background factors. I also chose it because it offered a longitudinal study that would allow me to see the progression of change the NSLP has on participants, something one cannot ascertain from a retrospective cohort study. The original ECLS has been used in published studies on the NSLP in the past (Millimet, Tchernis, and Husain 2010; Schanzenbach 2009), demonstrating its utility as a respected data set.

Variables

My independent variable, child NSLP participation, was available in the data set as "Child Receives Complete School Lunch," deriving from the Spring 2012 parent interview in which parents were asked whether or not their child receives a complete school lunch. I recoded the variable in SPSS to have yes equal 0 and no equal 1. This means that positive correlations would be associated with children not receiving a school lunch. For parents who did not know the answer or for whom the question was not applicable, I coded the answer as missing.

For my academic dependent variables, I used reading, math, and science test scores. The study had the unique distinction of scoring tests specifically for the use of the longitudinal study. Reading and math testing occurred twice per a year, or four times in total in the data set. Instead of using separate scores, the data set provides a composite score of all the child's test scores at the end of each of the testing periods. My analysis will be evaluating Spring 2012 math and reading test scores, taken from four tests. I will also be evaluating children's science test scores, though this is only taken from three different tests, as children were not tested in science in the Fall of their kindergarten year. No recoding was necessary for academic test scores.

My other dependent variable, BMI, was derived directly from the researchers who calculated BMI after measuring children's heights and weights. Children's BMI is only available for the Spring of first grade for most participants. Data on BMI is not available at the kindergarten level at all and only 1/3 of the participants had their BMIs measured in the Fall of first grade. Because of this, I chose to only use the Spring of first grade data. For BMI, I recoded the answer "not ascertained" as missing.

My control variables included child sex, child race, household income, and parent one education level. Child sex was ascertained by both school reports and parent interviews. I recoded male as 0 and female as 1, as well as coded "not ascertained" as missing. Child race was also derived from parent interviews and school reports. I recoded race to look at the effects on minority children. White was recoded as 0 and all other race options were coded as 1. Like the dependent and independent variables, I coded the answer, "not ascertained," as missing.

Parent one education and household income were both derived from parent interviews in which the parents chose one answer from ordinal variables which answer best fit. Household income had categories every $5,000 from 0 up to $75,000. After $75,000, parents could only select $75,000-$100,000, $100,001-$200,000, and $200,000 and up. Similarly, parents selected their education level from categories for degrees and partial school completion. Only parent one education was used in my analysis, which represents maternal education. If a child had two father figures, then one father would be included in the parent one data. Because this case applied to so few participants, parent one education primarily refers to maternal education. No recoding was needed for either control variables. All of the variables used in my study were renamed to make my statistics in this section more reader-friendly. A table on the next page summarizes all of the renaming I conducted.

Table 1: Renamed Variables and Descriptions

Variable Name in ECLS Data Set	Variable Name in Present Study	Description
P4 WP6160 CHILD RECVS COMPLETE SCH LUNCH	Child Receives a School Lunch	Whether or not a child receives a complete lunch at school
X4 READING THETA-K1 DATA FILE	Child Reading Score	Child's Spring 2011 composite reading score
X4 MATH THETA-K1 DATA FILE	Child Math Score	Child's Spring 2011 composite math score
X4 SCIENCE THETA-K1 DATA FILE	Child Science Score	Child's Spring 2011 composite science score
X4 CHILD COMPOSITE BMI	Child BMI	Child's calculated BMI score
CHILD COMPOSITE SEX-REVISED	Child Sex	Child's reported sex
CHILD RACE PARENT AND SCHL REPORT-REV	Child Race	Child's reported race
X4 INCOME CATEGORY (IMPUTED)	Household Income	Child's reported total household income
X4 PARENT 1 EDUCATIONAL LEVEL (IMPUTED)	Parent 1 Education Level	Reported level of child's mother's (possibly father's) education level

Bivariate Correlation

Using the statistical software program, SPSS, I ran a series of tests to measure the pattern, strength, and significance of the relationship of my independent variable on all four of the dependent variables. My first test is a simple bivariate correlation. This looks at the relationship one variable has on another. My correlation output compares my independent variable with all of the dependent variables. It also compares all of my control variables to see the effect they have on my dependent variables. The output also shows how the control variables relate to each other and my independent variable, giving valuable insight into how important the control variables may be in NSLP program participation.

I employed pair-wise deletion for my test, which means that it includes every sample subject possible for each bivariate correlation and does not exclude a participant from being included in the correlation table if she or he has a missing value for one of the variables. This is why the sample size (indicated in the table as "N") varies for each bivariate relationship. Two-tailed p-values are reported in the correlation table. The alpha level is set to .01, thus any p-value less than or equal to .01 will be considered statistically significant.

As shown in table two on the following page, my independent variable, Child Receives a School Lunch, correlates with all of my dependent variables. It shows a statistically significant and positive relationship with all test scores. Reading and math scores both had a Pearson Correlation of .215 and science scores had a Pearson Correlation of .247. While these are all statistically significant values, they demonstrate a relatively weak relationship. Because the values are positive, this means that children who do not receive a school lunch have higher test scores, on average.

The Pearson Correlation for the relationship between my independent variable and child BMI is -.140. While this is statistically significant, the value indicates a weak relationship. The negative direction indicates that children who do not receive a school lunch have lower BMI scores, on average.

Table 2: Correlations Among the Variables

Correlations Among the Variables

		Child Receives a School Lunch	Child Reading Score	Child Math Score	Child Science Score	Child BMI	Child Sex	Child Race	Parent 1 Education Level	Household Income
Child Receives a School Lunch (No=1)	Pearson Correlation	1	.215**	.215**	.247**	-.140**	.012	-.218**	.328**	.396**
	Sig. (2-tailed)		.000	.000	.000	.000	.173	.000	.000	.000
	N	12060	11608	11600	11574	11580	12060	12057	12060	12060
Child Reading Score	Pearson Correlation	.215**	1	.748**	.636**	-.089**	.110**	-.184**	.362**	.356**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000	.000
	N	11608	15115	15101	15070	15044	15092	15094	12445	12445
Child Math Score	Pearson Correlation	.215**	.748**	1	.682**	-.093**	-.038**	-.245**	.360**	.373**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000	.000
	N	11600	15101	15103	15070	15036	15080	15082	12437	12437
Child Science Score	Pearson Correlation	.247**	.636**	.682**	1	-.066**	-.027**	-.345**	.412**	.405**
	Sig. (2-tailed)	.000	.000	.000		.000	.001	.000	.000	.000
	N	11574	15070	15070	15072	15007	15049	15051	12408	12408
Child BMI	Pearson Correlation	-.140**	-.089**	-.093**	-.066**	1	-.014	.102**	-.142**	-.152**
	Sig. (2-tailed)	.000	.000	.000	.000		.078	.000	.000	.000
	N	11580	15044	15036	15007	15061	15038	15040	12409	12409
Child Sex (Female=1)	Pearson Correlation	.012	.110**	-.038**	-.027**	-.014	1	.014	.007	-.002
	Sig. (2-tailed)	.173	.000	.000	.001	.078		.056	.438	.856
	N	12060	15092	15080	15049	15038	18132	18084	12952	12952
Child Race (Minority=1)	Pearson Correlation	-.218**	-.184**	-.245**	-.345**	.102**	.014	1	-.290**	-.373**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.056		.000	.000
	N	12057	15094	15082	15051	15040	18084	18124	12949	12949
Parent 1 Education Level	Pearson Correlation	.328**	.362**	.360**	.412**	-.142**	.007	-.290**	1	.593**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.438	.000		.000
	N	12060	12445	12437	12408	12409	12952	12949	12952	12952
Household Income	Pearson Correlation	.396**	.356**	.373**	.405**	-.152**	-.002	-.373**	.593**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.856	.000	.000	
	N	12060	12445	12437	12408	12409	12952	12949	12952	12952

**. Correlation is significant at the 0.01 level (2-tailed).

With the exception of child sex, all of the control variables were statistically significant at correlating with whether a child receives a school lunch. The strongest relationships were parent one education level and household income, which demonstrated a positive relationship with not receiving a school lunch. All of the control variables showed statistically significant relationships with children's test scores in all subject areas, with parent one education showing the strongest relationship. Minorities and females had lower test scores, on average, with the exception of child reading score in which being female was weakly correlated with receiving a higher score.

Students' test scores and all of the controls, except sex, were all statistically significant at correlating with child BMI. The lack of relationship between child sex and a child receiving a school lunch or child BMI is not surprising, as this control variable is more so in place to accommodate potential sex differences in test scores. While the correlation table shows how each variable relates to another variable, it does not take into account control measures. For example, the relationship of a child receiving a school lunch with the dependent variables may, in fact, not be related to the NSLP, but instead background variables relating to whether or not a child participates in the NSLP. The correlation table is still helpful to seeing how variables correlate to other variables alone, but control measures are necessary to fully investigate the relationships. To do this, I must conduct multi-linear regression models for each dependent variable.

Child BMI

The mean child BMI score for all participants was 17, a normal BMI score. This means that, on average, the children in the study were not overweight or obese. Unsurprising, as while the childhood obesity rates are higher than before, they are in no way the norm. In my multi-linear regression model I conduct two models to compare the means of BMI scores between participants in the NSLP and non-participants. The first examines the relationship of my independent variable on child BMI alone and the second includes my background control variables in the test.

In order to be able to see the effect of all of the control variables together on the relationship, I used list-wise deletions for all of my linear regression models. This means that if a participant was missing a value for one of the variables, he or she was not included in the analysis. Because of the large number of participants in the study, my linear regression tests also yielded large sample sizes, making it less susceptible to sampling error. Table three below presents my results of my first regression model that examines the effect on my dependent variable, child BMI.

Table 3: Regression Predicting BMI Scores

Independent Variable	**Model 1**	**Model 2**
Child Receives School Lunch (No=1)	-.931*** -.140	-.542*** -.082
Background Variables		
Child Sex (Female=1)		-.058 -.010
Child Race (Minority=1)		.262*** .045
Parent 1 Education Level		-.091*** -.061
Household Income		-.038*** -.072
Model R-Squared (Adj.)	.020	.036
Sample Size	11,580	11,577

*p-value ≤.05, **p-value≤.01, ***p-value≤.001
Note: The table shows unstandardized slopes with standardized slopes underneath.

The first model yielded an unstandardized slope of -.931, which is statistically significant. This value means that children who do not receive a school lunch have BMI scores that are .931 values lower, on average, than children's who do receive a school lunch. An adjusted r-square value of .020 means that 20% of the variability in the dependent variable, child BMI, can be explained by the independent variable, whether a child receives school lunch.

The second model employs the control variables along with the independent variable. Unsurprisingly, the adjusted r-squared value increases to .036, indicating that the control variables do play a role into explaining the variability in child BMI. The standardized slopes shown in Model 2, allow one to compare the relative strength of predictor variables on the dependent variable, child BMI. Predictor variables in this study include whether a child receives a school lunch, as well as the control variables.

The standardized slope for the relationship between a child receiving a school lunch and BMI is -.082. This value is statistically significant and shows strong mean differences in BMI scores between school lunch participants and nonparticipants. Even when employing the control variables, the results indicate that school lunches may be contributing to obesity because of the higher BMI scores in participants. When considering the standardized slopes of the controls variables, none of them are as high as the independent variable. All were significantly significant except for child sex, which is to be expected. The second strongest predictor of child BMI was household income (-.072), followed by parent one education level (-.061), and child race (.045).

Child Reading Score

Table 4- Regression Predicting Reading Test Scores

Independent Variable	**Model 1**	**Model 2**
Child Receives School Lunch (No=1)	.371*** .215	.095*** .055
Background Variables		
Child Sex (Female=1)		.156*** .102
Child Race (Minority=1)		-.048*** -.032
Parent 1 Education Level		.087*** .223
Household Income		.027*** .197
Model R-Squared (Adj.)	.046	.182
Sample Size	11,608	11,605

*p-value ≤.05, **p-value≤.01, ***p-value≤.001
Note: The table shows unstandardized slopes with standardized slopes underneath.

Table 4 above examines students' test scores in reading. The mean reading score for all participants was 1.636. When comparing school lunch participants to non-participants, their reading scores differed by .371, on average. This means that those who do not receive a school lunch have higher test scores, on average. While this value is statistically significant, an adjusted r-square value shows that a child receiving a school lunch only accounts for 4.6% of the variability in reading test scores.

The second model employs the control variables and yielded at standardized slope of .055. While this value is lower, it is still statistically significant. All of the control variables yielded statistically significant standardized slope values. The largest value was parent one educational level (.223), followed by household income (.197), child sex (.102), and child race (-.032). With the exception of child race, all of the control variables were stronger predictors of reading test scores than receiving a school lunch.

Child Math Score

Table 5- Regression Predicting Math Test Scores

Independent Variable	**Model 1**	**Model 2**
Child Receives School Lunch (No=1)	.416*** .215	.092*** .048
Background Variables		
Child Sex (Female=1)		-.086*** -.050
Child Race (Minority=1)		-.168*** -.098
Parent 1 Education Level		.088*** .202
Household Income		.031*** .203
Model R-Squared (Adj.)	.046	.188
Sample Size	11,600	11,597

*p-value ≤.05, **p-value≤.01, ***p-value≤.001
Note: The table shows unstandardized slopes with standardized slopes underneath.

The mean math test score for all participants was 1.704, slightly higher than the mean reading test score. When comparing school lunch participants to non-participants, the mean test score difference was .416. Interestingly, the adjusted r-squared value was exactly the same as that of the reading test score, at .046. Very little of the variability (4.6%) in children's math scores can be explained by whether or not a child receives a school lunch.

The second model's results were also very similar to the second model for reading test scores. Once again, not receiving a school lunch has a positive effect on test scores, yielding a standardized slope of .048. All of the control variables had the same relationship they did on reading test scores, with the exception of sex. Model two shows a negative standardized slope for child sex, indicating that female children receive math test scores lower than male children, on average. These results indicate potential sex differences in learning styles or crude subject aptitude. With a standardized slope of .203, household income is a slightly largest predictor of math test scores than parent one education level (.202). This difference in very small, but shows how predictor variables may have differing influence on specific subject tests.

Child Science Score

Table 6- Regression Predicting Science Test Scores

Independent Variable	**Model 1**	**Model 2**
Child Receives School Lunch (No=1)	.551*** .247	.130*** .058
Background Variables		
Child Sex (Female=1)		-.058*** -.030
Child Race (Minority=1)		-.381*** -.193
Parent 1 Education Level		.123*** .243
Household Income		.030*** .170
Model R-Squared (Adj.)	.061	.253
Sample Size	11,574	11,571

*p-value ≤.05, **p-value≤.01, ***p-value≤.001
Note: The table shows unstandardized slopes with standardized slopes underneath.

The mean child science score was .927. Note that the test scores are composite scores of all the tests a child has taken. Because the science tests were only administered three times and reading and math tests were administered four times, it is expected that the mean science score would be much lower. The mean difference between participants and non-participants was higher than the other test scores at .551. Once again, there is a positive relationship on test scores for children who do not receive a school lunch. The r-squared value is also highest for the science test scores, though still fairly small at .061.

In the second model, the standardized slope between school lunch participants and non-participants is .058 when control variables are taken into account. The other control variables had similar relationships on science test scores as they did with the other subject test. Like the math test scores, female children received lower science test scores, on average, in comparison to male children. Because of the similar quantitative nature of science and math subjects, it is not surprising that this relationship pattern occurred.

In this model, the strongest predictor of science test scores is parent one education level (.243), followed by child race (-.193), and household income (.170). The only predictor variable with a standardized slope lower than the school lunch variable (.058) is child sex (-.030). Surprisingly, child race yielded a much larger standardized slope for science test scores than it did for the two other subject tests. Perhaps there are ethnic and cultural factors present in minority races that affect children's exposure to science at home. There also could be potential classroom differences minority children experience in school that affect their science aptitude.

Discussion

After a series of statistical tests, my findings can conclude that NSLP program participation has a negative effect on standardized test scores and a positive effect on BMI. The effects on standardized test scores in the subjects of reading, math, and science were much less substantial. It is unlikely that receiving a school lunch is directly to blame for these results. While my analysis took care to control for children's sex, race, parent education level, and household income, there are probably other lurking variables causing the mean differences in test scores between participants and nonparticipants. Perhaps parents that choose to pack a lunch at home for their children are also more involved in their children's education. They may spend more time encouraging academic growth in their homes with activities like reading, helping with homework, or playing educational games than parents who may choose to have their child eat a school lunch because they have less time to devote to their children. Potential lurking variables are often very hard to identify and even harder to control for.

The most prominent effects of the NSLP were shown in my results for child BMI. Even when I included my control variables, NSLP participation was shown to have the most significant effect on child BMI. Consistent with previous studies (Schazenbach; Milliment, Tchernis, and Husain), NSLP participation was linked to children having higher BMIs. Of the control variables, household income had the most prominent effect followed by parent education level and race. This suggests that the higher obesity rates in minority children ("Childhood Obesity Facts" 2015) may not only be due to socioeconomic status. Perhaps cultural factors, especially those relating to food and exercise, present in minority groups may be playing a role in the childhood obesity epidemic. More research should examine food and exercise habits within different racial groups, especially outside of socioeconomic factors.

While the results found were significant, the NSLP may not be solely to blame. The overall differences in mean BMI scores were partially reduced when employing the control variables in the second model. This accounts for the socioeconomic differences that strongly predict BMI. Nonetheless, the NSLP participants still had higher BMIs on average than nonparticipants. Still, the NSLP is a very small part of children's overall diet. Children who receive the NSLP may also participate in the SBP, but nonetheless eat dinners, snacks, and all meals on the weekends and school breaks at home.

More research should be done to further explore the differences in family lifestyles between NSLP participants and nonparticipants. Perhaps parents that enroll their children in the NSLP do so because they have demanding work schedules and less time to pack their children a lunch. These same households may also be less likely to cook for their children, instead opting for take-out or restaurant meals.

It could be that parents who enroll their children in the NSLP have less awareness and care for healthy eating than those who may be more health conscious and choose to pack their children a lunch because of this. Parents opting out of the program may serve healthier food to their children, encourage physical activity, limit television time, or even have genetic dispositions making them and their children less likely to be overweight. Future studies should ask parents more questions about their personal exercise and eating habits, as well as the practices they encourage in their children. It also could be helpful to measure parents' BMIs to consider children's potential dispositions for BMI scores, both genetically and from the food and exercise habits practiced in the household.

The Early Childhood Longitudinal Study used for my analysis had many advantages for use, specifically a large sample size, nationally representative sample, wide variety of variables, and multiple reporting sources for the variables. Nonetheless, there are always limitations in research. The study could potentially have some reporting bias if parents did not always give accurate answers. There also are problems with using test scores as the only evaluation for children's academic success.

Another limitation is using BMI to measure children's health. While BMI is one of the best ways to measure children's weight categories, it has many flaws. Children's weights often are not consistent in the way that adults' are, making it hard to evaluate whether or not they are overweight. Children's BMIs also do not always stick with them into adulthood. Many children who are overweight will be as adults too, but some have higher weights or "baby fat" that they grow out of as they age. This is especially true with younger children, the age group in my study.

As more data rounds become publicly available through the Early Childhood Study, research should utilize this to evaluate children over a longer period of time. While my study did evaluate children over two years, test scores were the only variable that included data for all two years. BMI scores were not measured until the children were in first grade, so I was not able to see the rate of or how BMIs changed during the children's years in school. Future studies would benefit from analyzing BMIs over more years as the data becomes available. It also may be more meaningful to study children's test scores as they age through school, especially as their learning and test taking ability may improve in later grades.

Studies like mine are important for evaluating the NSLP's effectiveness, especially as changes are continually being made to the program. Research should continuously be done to evaluate the program, especially using longitudinal methods to see changes over time. Improvements should continue to be made to the NSLP, especially ones that involved produce. Like the results Qian et al.'s study suggested, expanding fresh fruit and vegetable availability in schools can have meaningful results. Continual small changes to the NSLP can lead to gradual improvements in results.

When considering the NSLP, it is important to remember that the program is not solely to blame for childhood obesity and consequently should not be the only thing policy should concentrate on changing. It is a relatively small component in children's diets as they only consume one meal a day through the NSLP. Children's meals are primarily provided at home and solely provided at home during the weekends and school breaks.

Attempts to reduce childhood obesity should concentrate on all aspects of children's lives. Family meal practices, frequency of snacks, and physical activity are all important components to consider when investigating why children may be more likely to be overweight and how to solve it. There also is a strong need for individual attention to food preferences and intolerances, genetic dispositions, family lifestyles, socioeconomic capability, and cultural considerations. The NSLP is only one piece of the puzzle when it comes to combatting childhood obesity. Policy should focus on trying to identify and solve problems relating to childhood obesity from all angles.

Bibliography

"About Let's Move." 2016. *Let's Move*. Accessed February 10. http://www.letsmove.gov/about.

"Childhood Obesity Facts." 2015. *Centers for Disease Control*. June 19. http://www.cdc.gov/obesity/data/childhood.html.

Dunifon, Rachel, and Lori Kowaleski-Jones. 2003. "The Influences of Participation in the National School Lunch Program and Food Insecurity on Child Well-Being." *Social Service Review* 77 (1): 72–92. doi:10.1086/345705.

Hinrichs, Peter. 2010. "The Effects of the National School Lunch Program on Education and Health." *Journal of Policy Analysis & Management* 29 (3): 479–505. doi:10.1002/pam.20506.

Millimet, Daniel L., Rusty Tchernis, and Muna Husain. 2010. "School Nutrition Programs and the Incidence of Childhood Obesity." *Journal of Human Resources* 45 (3): 640–54. doi:10.3368/jhr.45.3.640.

National School Lunch Act. 1946.

"National School Lunch Program." 2015. Economic Research Service. *USDA*. April 15. http://www.ers.usda.gov/topics/food-nutrition-assistance/child-nutrition-programs/national-school-lunch-program.aspx.

"National School Lunch Program (NSLP)." 2013. Food and Nutrition Service. *USDA*. September. http://www.fns.usda.gov/nslp/national-school-lunch-program-nslp.

Parsons, Amanda. 2010. "From Middle America to the Inner City: How the National School Lunch Program Became Black in the 1960s and 1970s." Undergraduate Thesis, Columbia University. http://academiccommons.columbia.edu/catalog/ac:125997.

"Policy Conference 2015 Infographic." 2015. Infographic. Organic Trade Association. http://ota.com/sites/default/files/indexed_files/PolicyConference2015_Infographic_8.5x11_1a_0.pdf.

Schanzenbach, Diane Whitmore. 2009. "Do School Lunches Contribute to Childhood Obesity?" *Journal of Human Resources* 44 (3): 684–709.

Singh, Alisha Coleman-Jensen, Matthew Rabbitt, Christian Gregory, Anita, Matthew Rabbitt, Christian Gregory, and Anita Singh. 2015. "Household Food Security in the United States Is 2014." Economic Research Service. *USDA*. September. http://www.ers.usda.gov/publications/err-economic-research-report/err194.aspx.

"White House Task Force on Childhood Obesity Report to the President." 2016. *Let's Move*. Accessed February 10. http://www.letsmove.gov/white-house-task-force-childhood-obesity-report-president.