

The Effect of NSLP Participation on Health Outcomes

Introduction

Today in the United States, more than one third of adults and one sixth of children are obese (Flegal, 2016). The obesity crisis is of critical concern from both a medical and economic standpoint, as obesity increases risk for myriad health issues and poses a substantial burden on the American economy through increased healthcare costs. Further, widespread obesity among children threatens the wellbeing of an entire generation. The largest food assistance program focusing solely on children is the National School Lunch Program (NSLP), which served 30.4 million children under a \$13.6 budget in 2016 (USDA, 2018). That year, over 100,000 public and non-profit private schools participated in the program, which provides free or subsidized lunch to eligible students based on their family's income. In its current form, the NSLP provides free lunch for all students in participating schools from families at or below 130% of the poverty line, and provides subsidized lunch for students from families between 130 and 185% of the poverty line (USDA, 2018). However, past research has indicated that NSLP participation may have increased obesity prevalence, which clearly is not the intent of the program (Schanzenbach, 2009). The poor nutritional quality of school lunches served under the NSLP was thought to be a primary factor spurring obesity in its participants; as

such, new nutritional guidelines were put into place for the 2012-13 school year (USDA, 2011). New regulation introduced by this mandate includes increased portions of fruits, vegetables, and whole grains, reduced sodium content, and elimination of trans fats (USDA, 2011). The efficacy of post-mandate NSLP in reducing childhood obesity has not been investigated, perhaps due to lack of relevant data. However, a recently published, nationally representative longitudinal dataset allows for evaluation of the new program. In this paper, I argue for the moral obligation of instituting a school lunch program with high nutritional standards using a bioethical framework, and I evaluate the new NSLP's effectiveness in achieving its goal of reducing childhood obesity. My analysis indicates that the new NSLP is no better than the old NSLP at generating positive health outcomes, and may in fact be worse. However, a more nuanced analysis is required to better answer this question.

Literature Review

I. Obesity's link to poverty

The single largest driver of Americans into poverty is medical out of pocket expenses, or MOOP (U.S. Census Bureau, 2016).

Change in Number of People in Poverty After Including Each Element: 2015
(In millions)

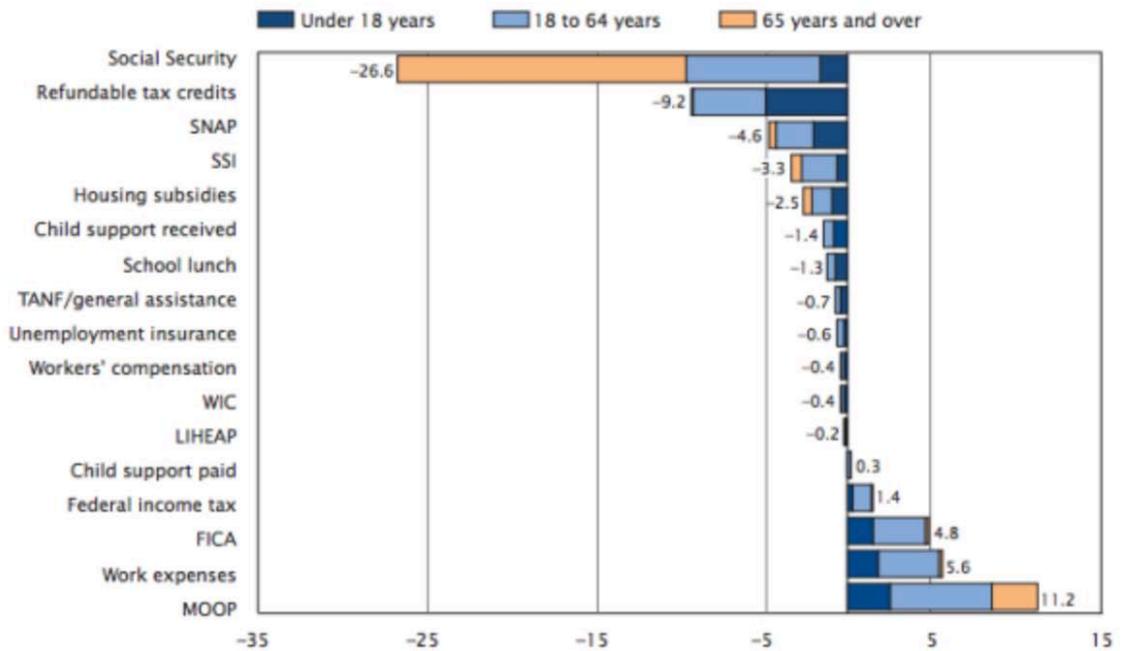


Figure 1: Shows largest programs/factors bringing people out and pushing people into poverty in 2015, in millions. A negative value on this x-axis indicates a reduction in poverty, and a positive value indicates an addition to poverty. Clearly, MOOP is the largest single contributor to poverty among all factors (U.S. Census Bureau, 2016).

In 2015, MOOP pushed over 11 million people into poverty (as an aside, health insurance clearly plays a large role in MOOP, but is not the focus of this paper). The largest preventable contributor to MOOP is obesity and its related diseases, which account for roughly 70% of total health costs in the United States (Levine, 2011). Obesity is a risk factor for an extensive collection of diseases, including type 2 diabetes, cardiovascular disease, certain cancers, stroke, and mental health problems. (Delisle, 2005). Moreover, these conditions increase the risk of one

another, only exacerbating the danger posed by obesity. In addition, obesity is an incredible burden on the American economy, contributing about \$150 in direct healthcare costs per year. This number jumps up to roughly \$215 billion per year when the indirect cost of human capital decreases due to obesity are included (Hammond, 2010). These are entirely avoidable encumbrances on the American economy, and, with intelligent policy decisions, the negative impact of obesity could be significantly reduced.

Obesity disproportionately affects minorities and those in poverty (Levine, 2011).

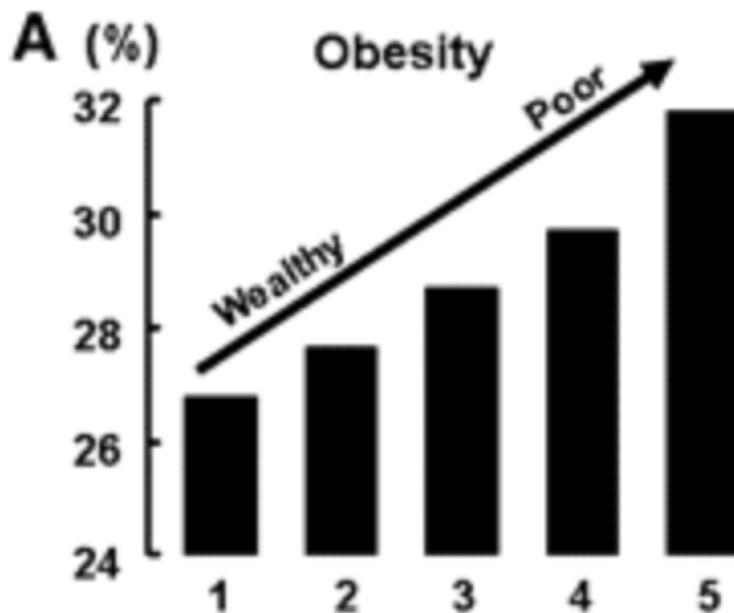


Figure 2: Shows that increasing obesity prevalence (y-axis) is associated with lower income quintile (x-axis). The richest quintile is represented by Quintile 1, while the poorest quintile is represented by Quintile 5. There is a roughly 19% increase in obesity incidence between Quintile 1 and Quintile 5 (Levine, 2011).

Those living in poverty are significantly more likely to be obese than their wealthier counterparts. Further, 48.4% and 42.6% of Blacks and Latinos are obese, while 36.4% of Whites are obese (Flegal, 2016). It is difficult to disentangle the degree to which obesity causes people to be poor and the degree to which poverty causes people to be obese, but it is likely that both mechanisms are at play in a devastating cycle. Clearly, the issue of obesity among poor Americans is one of critical concern.

II. Obesity trends among children

This problem is of special concern among children. The percentage of American children with obesity has tripled since the 1970s. Further, nearly one in every six children aged 6-19 are currently obese (CDC Obesity Facts, 2018). Again, this trend disproportionately affects the poor; boys aged 2-19 under 130% of the poverty line are about ten percentile points more likely to be obese than are their peers over 350% of the poverty line (Ogden, 2010).

Significant evidence indicates the long-term dangers of childhood obesity. A 14-year longitudinal study of 6,000 German children found a statistically significant association between obesity and death rate. Indeed, mortality risk increased as age of obesity onset decreased (Delisle, 2005). This evidence is further supported by a longitudinal study performed in the UK investigating childhood obesity and decreased health outcomes. It was found that subjects who were obese at age 12 were 4x more likely to be obese upon adulthood than their non-obese counterparts (Delisle, 2005).

The adverse effect of poor nutrition on academic performance has also been well characterized. Interestingly, there is extensive research indicating that specific nutritional deficiencies are associated with specific academic inadequacies. For example, one study interviewing 5,367 students aged 6-16 about their diets found that students with high fat intake scored lower on reading exams and displayed more social anxiety than those with healthy fat intake, while students with high cholesterol intake scored lower on math exams than those with healthy cholesterol intake (Zhang, 2005). Further, a review examining the relationship between fruit and vegetable intake and academic performance found that students with inadequate amounts of fruit and vegetables in their diets consistently performed worse than those with healthy diets (Neumark-Sztainer, 1998). In a different study conducted on a nationally representative sample of 2,519 students, obesity was found to be correlated with decreased standardized test scores, spatial reasoning, and memory (Li, 2008). Indeed, there is strong evidence indicating that poor nutrition and obesity are correlated with a variety of decreased academic outcomes.

III. History of the NSLP before the new mandate

The NSLP was founded in 1946 after congressional approval of the National School Lunch Act, creating the first permanent federal program of its kind in the United States (USDA, 2018). Since its inception the NSLP has recognized the importance of, what was considered at the time, good nutrition with respect to health outcomes, especially for low-income students. Various amendments have

been passed in the program's history specifying what can and cannot be served at school cafeterias participating in the NSLP. Unfortunately, not until relatively recently have these provisions moved away from the carbohydrate-heavy meals that dominated nutritional theory for the better part of the 20th century. This means that, for decades, students participating in the NSLP were served food that may actually have *decreased* their health outcomes. While providing free or subsidized lunch to low-income students is certainly a worthy cause in theory, there is evidence that, in practice, lack of nutritional quality generated significant negative externalities (Schanzenbach, 2009).

Summary of Previous NSLP Research

The literature regarding the short-term effect of NSLP participation on health effects is largely mixed, with some studies finding a positive relationship between NSLP participation and health outcomes and some studies finding a negative relationship between the same parameters. The lack of consensus does not bode well for a strong trend in either direction, but I will attempt to review the key differences in methods among some important papers in order to account for these differences in results.

I. Previous short-term research finding that NSLP participation is associated with *worse* health outcomes

A 2009 study (Schanzenbach) took advantage of the sharp eligibility cutoff of 185% of the poverty rate in order to get at the question of whether NSLP participation is associated with increase incidence of obesity. The author used data from the data from the Early Childhood Longitudinal Study- Kindergarten Class of 1998-99 (ECLS-K). This dataset followed a nationally representative group of 17,565 kindergarteners from 994 schools for four years, providing reasonable time for NSLP participation to result in measurable health outcomes. However, for whatever reason, the author used the end of first grade in the analysis, providing only a year for NSLP participation to have an effect. The author controlled for many potentially confounding variables, including race, gender, birth weight, born premature status, teen mother status, mother over 30 status, mother's education, mother's work status, father at home status, father's education, nonparental care status, number of siblings, household income, and number of children's books in the house. The author found that students who receive school-provided lunches are about 2 percentile points more likely to be obese than those who bring their lunch from home. Further, students just eligible for the NSLP are more likely to eat school lunches, to be obese, and to weigh more than students just ineligible for the program. Lastly, school lunch contains 40-120 more calories than lunch from home, which is associated with an increase of overweight of 2-4 percentile points

A 2010 study (Millimet) attempting to make a causal assessment of NSLP participation and childhood obesity also using data from the ECLS-K, but used data through the children's third grade data in its analysis. In order to avoid confounding

variables that may contribute to obesity, especially among lower income families, the authors controlled for child's starting height and weight, race, gender, birth weight, household income, mother's employment status, mother's education, number of children's books at home, mother's age at first birth, a WIC participation indicator, region, city type, and amount of food in the household. Further, the authors included multiple interaction terms among these variables. On average, NSLP participants were found to most likely be nonwhite, from the south, live in a poor household, have a less educated mother, have fewer children's books at home, and have a mother who more likely gave birth as a teenager. As an aside, this is why is so vital to control for potentially confounding variables; most, if not all, of these factors can be reasonably assumed to increase a child's likelihood of living in poverty, and in turn, of being obese. If not taken into account, the causal relationship between NSLP participation and health outcomes would be muddied. Controlling for all of these factors, the authors found that NSLP participation increases obesity incidence (as measured by BMI percentile) to a statistically significant level.

A 2009 study (Gleason) investigated the relationship between NSLP participation and health outcomes using SNDA-III data of 2,314 nationally representative 1st-12th graders, 70% of whom were NSLP participants. This dataset was unique in that it relied on self-reported dietary recalls from the past 24 hours, combined with height and weight data used for BMI determination. Additionally, the dataset had an extraordinary number of control number, too many to list here, but key differences to previous control variables include more detailed controls for

student eating habits and student physical activity habits, in addition to fixed effects at the school level. The authors found that 24.3% of NSLP participants were obese, whereas only 18.0% of non-participants were obese. However, this relationship is purely associative, saying nothing of causation. When control variables and fixed effects are taken into effect, there is a small, but statistically insignificant decrease in BMI due to NSLP participation. However, I am skeptical of the self-reporting aspect of this dataset. It seems reasonable that there could be a systematic under-reporting of calories. This would result in a systematic skew in the results, thus making any conclusions potentially even murkier.

II. Previous short-term research finding that NSLP participation is associated with *better* health outcomes

A 2012 study (Gunderson) attempted to answer the NSLP-obesity question using a subset of the 2001-2004 NHANES, looking at 2,693 children ages 6 to 17 from households with greater than 185% of the poverty line. Unfortunately, the authors have a much less robust set of control variables than other studies, controlling only for age, gender, household income and NSLP participation. The authors found a strong, statistically significant decrease in food insecurity, poor health, and obesity incidence among NSLP participants as compared to similar non-participants. My concern with this research is the lack of a robust set of control variables, especially compared to other literature in the field.

III. Previous longitudinal research

While there is a relatively significant amount of research examining the short-term effects of NSLP participation on health outcomes, the research on long-term effects is much less robust. In fact, is only one paper to my knowledge examining this question: a 2010 project undertaken by Peter Hinrichs.

Interestingly, Hinrichs examined both health and educational outcomes, which are rarely investigated in the same work. However, the data used are fairly outdated, examining the NSLP during the 1960s. Still, considering this is the only longitudinal work in the field, I feel it still warrants discussion.

Hinrichs took advantage of a 1965 change to the federal funding formula allocated to states for NSLP usage, which implies that different birth cohorts from the same states were exposed to different degrees of NSLP availability. This is an instrumental variable approach that admittedly seems like a bit of a stretch, but it is the only way longitudinal analysis can be performed, as no single dataset contains both NSLP and obesity data (at least until very recently). Hinrichs compared information on NSLP funding, NSLP participation, and per capita income information from 1947-1973 to National Health Interview Surveys from 1976-1980 to estimate NSLP participation's effect on health outcomes, and he compared the same NSLP data to data from the 1980 Census to estimate NSLP participation's effect on educational outcomes. The health outcomes of interest were height, BMI, weight, a self-reported measure of overall health (poor, fair, good, excellent), and a self-reported measure of disabilities. The data indicated no strong relationship

among NSLP participation and any of these variables, indicating that there either are were no differential health effects relative to non-participants, or the effects dissipated over time. The only educational outcome of interest investigated was educational attainment, but the results were large and significant. For example, a 10% estimated increase in NSLP exposure is associated with a full year increase in educational attainment among men. A possible explanation offered by Henrichs is that the quality of food provided by the school was comparable with what would be provided outside of school, and thus would not provide a differential health effect, but the reduced price incentivized school attendance and therefore educational attainment (Henrichs, 2010).

While Henrichs' paper is certainly helpful for my purposes, I think that there is room for some new directions to be explored. First, there is much more recent data available from the ECLS that can provide a clearer picture of the current status of post-mandate NSLP participation. Therefore, I would like to quantify the effects of post-mandate NSLP participation on obesity, which I will discuss after providing an ethical framework arguing for the moral obligation of providing nutritious school lunch programs.

Normative Argument: What should an ethical school lunch program entail?

Because, at its heart, childhood obesity is a biological issue, I will frame this discussion using a bioethical model: Beauchamp and Childress' Four Foundational

Principles. This theory is a hallmark of bioethical thinking, and it has been applied to numerous bioethical dilemmas over the past few decades. First, I will describe the theory in general terms, and I will then apply it more directly to school lunch programs. Lastly, I will evaluate the pre-mandate NSLP using this framework, arguing that it is not an ethically permissible program, and that policy makers had a moral obligation to invoke the changes seen in the post-mandate NSLP.

I. A brief overview of Beauchamp and Childress' Four Foundational Principles

Beauchamp and Childress' Four Foundational Principles provide a general framework to assess the ethics of an action, or in this case, a program. In short, all four principles must be met to constitute an ethical action. If any are violated, the actor is under a moral obligation to change said action. The foundational principles are as follows: autonomy, beneficence, nonmaleficence, and justice (Beauchamp, 2003). These principles are not simply a checklist that one is required to fulfill, but should be thought of as a guiding force that reflects common morality and responsible practices. The condition of autonomy requires that an individual's right to make an informed personal choice is not infringed upon. The "informed" aspect of this principle is not always clear when dealing with policies aimed at children. However, common practice does not treat children as autonomous actors in most situations. It is therefore often in the policymakers' hands to make the best decision on behalf of the children. The second principle, beneficence, is fairly simple; actions should be undertaken with the intent of doing good for the recipient. In most cases

of policy, this is the case. The third principle, nonmaleficence, requires that the action do no harm to the recipient. Again, from a policy perspective, this is often taken for granted. However, the lack of intent to do harm does not preclude harm from being done. For example, hidden negative externalities may outweigh the benefits provided by a service, which may in turn end up doing more harm than good. Lastly, the principle of justice, as understood in the context of the four foundational principles, is essentially Rawlsian. It requires that inequities should be fairly distributed such that they are to the benefit of the least advantaged. In practice, this could take the form of reduced-price meals for the poor. While there is an inequity in price between the poorer and richer students, the inequity benefits the least advantaged group, so it is indeed just. Again, these principles should reflect what intuition would tell us is an ethical action. None of these principles are especially radical, and taken together, they provide an effective framework for evaluating the morality of biologically relevant actions and/or programs.

II. Beauchamp and Childress' Four Foundational Principles applied to school lunch programs

In this section, I will create a hypothetical school lunch program that would be in accordance with the foundational principles. First, I would argue that deciding what a child can and cannot eat is not a violation of the child's autonomy, assuming that this decision is made in the best interest of the child and with no malintent (i.e. is in accordance with the principles of beneficence and nonmaleficence). Children

lack the knowledge and experience to choose foods based on their nutritional quality, so it would be permissible to create a program where nutritious foods are provided even at the expense of what the children may consider palatable (Crawford, 2011). Further, choosing to provide nutritious food is certainly in accordance with the principle of beneficence, while choosing to restrict access to unhealthy food is in accordance with the principle of nonmaleficence. Lastly, schools provide an opportunity to address social and economic inequalities so that the “gap” between children from disadvantaged families and their more fortunate counterparts may be, at least in part, rectified (Crawford, 2011). Providing more nutritious food at a school meal than would otherwise be financially possible for children from low-income families is an excellent way of addressing one such inequality. Additionally, providing free or subsidized meals for low-income children is an inequality that is of greatest benefit to those with the fewest resources, so this would be required as well.

The program I just described sounds very similar to the pre-mandate NSLP, but as stated above, there is evidence indicating that the principle of nonmaleficence was not followed in practice. Even if it was not the intent of the program, the lack of stringent nutritional standards quite possibly increased obesity among its participants. This would constitute a violation of the principle of nonmaleficence, and therefore, policy-makers would be morally obligated to rectify the issues in the program. With the introduction of the new mandate, it would seem that this concern is addressed. Whether or not the results of the new mandate are in accordance with its intent remains to be seen.

Methodology

In order to empirically investigate this question, I make use of the ECLS-K:2011 dataset. This is a nationally representative sample of about 18,000 children who attended kindergarten in the 2010-11 school year. The dataset follows the same cohort of children over their elementary school years, making longitudinal analysis possible. It contains hundreds of variables for each student through direct observation, like in BMI determination, and through parent and child interviews. Further, this is the first longitudinal dataset to include observations from the same cohort of children before and after the new NSLP mandate was put into effect, allowing for unprecedented analysis. The most recent publically available data is from the 2014-15 school year (the children's 4th grade), a full two years after the new mandate's institution (the children's 2nd grade).

Controlling for relevant variables, I quantified the effect of pre-mandate and post-mandate NSLP participation on 4th grade obesity prevalence. I performed my analysis with and without controlling for explanatory variables that have been previously implicated in increasing obesity rates. My control variables were dummies for whether the child was white or non-white, the activity level of the child as reported by the primary caregiver, the gender of the child, and the dropout status of the primary caregiver. The dropout variable was very highly correlated with the poverty status of the family, so I used it as a proxy for both poverty incidence and for lack of parental knowledge about the importance of good nutrition.

A drawback of using self-reported data is that it is not always entirely accurate. In this case, participants were given the opportunity to not answer any question if they did not want to. Unfortunately, a large proportion of the participants did not answer questions about their highest educational attainment (i.e. their dropout status) and whether or not their child participated in the NSLP. Further, those who did not answer the educational attainment question were very highly correlated with those who did not answer the NSLP participation question. Therefore, I made the assumption that those who did not answer either question were dropouts whose children were NSLP participants. Admittedly, this is a major assumption, but I believe it was warranted. More statistical analysis is required to substantiate this claim, however.

I use two models for my analysis: one comparing children who participated in pre-mandate NSLP to children who participated in post-mandate NSLP (using a dummy for each) relative to children who never participated, and one comparing children who participated in only post-mandate NSLP to those who participated in both pre- and post-mandate NSLP (again, using a dummy for each) relative to children who never participated. I perform OLS regressions using Stata for each model with and without controls with a dummy for 4th grade obesity incidence as my dependent variable. The general equations for the first model are:

(i) Without controls:

$$Obese = \beta_1 PrevNSLP + \beta_2 PostNSLP + \varepsilon$$

(ii) With controls

$$Obese = \beta_1 PrevNSLP + \beta_2 PostNSLP + \beta_3 White + \beta_4 Dropout + \beta_5 Active + \beta_6 Male + \varepsilon$$

The general equations for the second model are:

(i) Without controls:

$$Obese = \beta_1 PostOnly + \beta_2 Prev\&Post + \varepsilon$$

(ii) With controls:

$$Obese = \beta_1 PostOnly + \beta_2 Prev\&Post + \beta_3 White + \beta_4 Dropout + \beta_5 Active + \beta_6 Male + \varepsilon$$

Results

Model 1:

	(1)	(2)
	CURRENTOBESE	CURRENTOBESE
PREVNSLP	0.00360 (0.37)	-0.00145 (-0.14)
POSTNSLP	0.0752*** (7.91)	0.0818*** (8.21)
WHITE		-0.000624 (-0.07)
DROPOUT		0.00287 (0.35)
ACTIVE		-0.0853*** (-11.39)
MALE		0.0111 (1.51)
_cons	0.0680*** (11.82)	0.102*** (9.43)
N	8674	7199

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001

According to this model, pre-mandate NSLP participation is not a statistically significant predictor of 4th grade obesity, while post-mandate NSLP participation is a strong predictor of 4th grade obesity. These results indicate that, when controlling for other explanatory variables, post-mandate NSLP participants are about 8% more likely to be obese than children who never participated in the program, indicating that post-mandate NSLP participation is a contributor to obesity. The only other variable that was statistically significant was the activity status of the child. High activity was associated with a nearly 9% decrease in obesity incidence. Clearly, regular exercise plays a vital role in protecting against childhood obesity

Model 2:

	(1) CURRENTOBESE	(2) CURRENTOBESE
PREVNPOSTY	0.0730*** (3.81)	0.0851*** (4.04)
PPREYPOSTY	0.0704*** (5.22)	0.0762*** (5.43)
WHITE		-0.00121 (-0.10)
DROPOUT		0.0000286 (0.00)
ACTIVE		-0.0981*** (-9.22)
MALE		0.0143 (1.38)
_cons	0.0757*** (6.05)	0.110*** (6.09)
N	5937	4466

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001

According to Model 2, both children who only participated in post-mandate NSLP and children who participated in pre- and post-mandate NSLP were at statistically significant higher risk of being obese than children who were never in the program. With and without controls, the children who were NSLP participants from kindergarten through 4th grade were at less risk than children who participated in the NSLP only after the new mandate. This indicates that post-mandate NSLP participation is a large contributor to obesity prevalence. Admittedly, a simple comparison of the coefficients of the two groups is not necessarily enough to differentiate between the effects of the two groups, and it certainly is not enough to

make any causal claims. That being said, these results do not bode well for the effect of post-mandate NSLP participation on obesity.

Due to the nuanced interplay between poverty, obesity, and other poor health outcomes, it is extremely difficult to isolate one's effect from another. A simple OLS regression is likely not sophisticated enough to truly investigate this interplay, and I am hesitant to make too many claims regarding my results. At their best, I would argue that my results show correlations, but not causations. More sophisticated analysis is required to better investigate the question of post-mandate NSLP's efficacy.

Conclusions

These results indicate that the post-mandate NSLP is no better at improving health outcomes (and may in fact be worse) than the pre-mandate NSLP. There are several alternative explanations, however. First, more students are bringing lunch from home than ever, perhaps in response to the new mandate (Murphy, 2015). Children likely prefer the taste of food from home to the fruits, vegetables, and whole grains now part of every school lunch. Therefore, it is possible that a significant portion of the children that are still part of the program are financially unable to bring lunch from home, which would lead to a selection bias in the program towards the poorest of the poor. This would bias the post-NSLP participant group to be more obese than expected. Second, many schools report that children are simply throwing away the fruits and vegetables from their meals

(Murphy, 2015). While the NSLP can ensure that children receive healthy food, they cannot ensure that the children actually eat it. This too would complicate analysis based only on NSLP participation.

As previously stated, more analysis is required to better understand the relationship between NSLP participation and childhood obesity, but if my results are accurate, diverting at least part of the massive \$13.6 billion NSLP budget to other methods of obesity prevention should be considered. I suggest increasing health education at a young age as a possible alternative. Preventing the problem of childhood obesity before it ever occurs would be the ideal scenario. Educating children from their first days in school about the benefits of exercise and good nutrition and the dangers of eating poorly would likely pay dividends in the future. Additionally, children's reluctance to eat the nutritious food provided in the post-mandate NSLP lunches is in large part due to the high-fat, high-sugar diets that they consume outside of school. Their taste preferences for unhealthy food make it difficult to incentivize trying the new NSLP lunches. Research indicates that palates are generally formed within the first two years of life, and it is much harder to change a palate than it is to form one (Mennella, 2014). Therefore, earlier introduction of nutritious food is another possible alternative.

While providing free or subsidized food for disadvantaged children is certainly done with good intent, it may be doing more harm than good. Considering the size and scope of the NSLP and the state of childhood obesity in America, the lack of empirical review of its efficacy in achieving its stated goals is surprising at

best and irresponsible at worst. More research is certainly warranted on this subject in the future.

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