

About this report

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The Influence of the School Breakfast Program and National School Lunch Program on Child Weight and Academic Achievement

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Two types of childhood misnourishment, overweight/obesity and underweight, plague the United States with far-reaching consequences on children. In 2008, 13 million U.S. children and adolescents were obese, with those of low socio-economic status in rural areas more likely to be overweight. Furthermore, in 2006, 2.4 million children and adolescents were underweight.

In her RIDGE Center for Targeted Studies-supported doctoral dissertation research, "The Influence of the School Breakfast Program and National School Lunch Program on Child Weight and Academic Achievement," Kristen Capogrossi pays particular attention to low-income children, since 20 million program participants receive free- and reduced-price meals, as well as rural children, since National School Lunch Program participation rates are about 37 percent higher for rural children compared to non-rural children. Furthermore, low-income and rural children are more likely to be misnourished.

The study explores several questions:

1. What are key determinants of program participation?
2. What are the direct impacts of program participation on child BMI?
3. What are the direct and indirect impacts of program participation on academic performance?
4. What are other key determinants of child weight and academic performance?



U.S. Child Misnourishment

Two types of childhood misnourishment plague the United States and have far-reaching consequences on children: overweight and underweight. The term 'misonourishment' is used because it is usually a child's dietary and nutritional quality that causes problems of overweight and underweight in the United States as opposed to a lack of food. The one currently receiving the most attention is childhood overweight because of its dramatic growth over the past three decades. However, the prevalence of childhood underweight is also of concern in such a highly developed country.

In 2008, 19.6 percent of children aged 6 to 11 and 18.1 percent of adolescents aged 12 to 19 were obese – approximately 13 million (Ogden et al. 2010). In addition, about half of obese school-age children remain obese as adults (Serdula et al. 1993). Research has also shown that children of low socio-economic status and those residing in rural areas are more likely to

be overweight (e.g., Datar, Sturm and Magnabosco 2004; Wang and Beydoun 2007; Wang, Monteiro and Popkin 2002).

Even with all of the attention focused on the childhood obesity epidemic, the childhood underweight prevalence rate remains a concern. Although the percentage of underweight US children aged 6 to 11 decreased from 3.9 percent in 1994 to 2.7 percent in 2006, the percentage of US underweight adolescents aged 12 to 19 remained about the same at 3.9 percent (Fryar and Ogden 2009). These percentages translate to 2.4 million underweight children and teenagers, which are sizeable and should be of public concern given that the consequences of underweight can be serious. Both types of misnourishment are accompanied by health consequences: chronic diseases such as Type 2 diabetes for overweight and weakened immune systems for underweight. For instance, a study by Adams and Lammon (2007) found that factors other than family history may be more predictive for the development of Type 2 diabetes in rural school children with overweight status being one of the top modifiable risk factors.

Academic Achievement

Some research has linked childhood misnourishment to poor academic performance in school. For instance, the stigma of being overweight or underweight may negatively influence a child's self-esteem which may impact his/her performance (Falkner et al. 2001; Krukowski et al. 2009; Xie et al. 2006). Conditions associated with overweight and underweight may cause children to miss more school (Datar and Sturm 2006; Schwimmer, Burwinkle and Vami 2003) or have lower levels of concentration resulting in poorer performance (Luder et al. 1998). Furthermore, other unobserved factors such as certain home and school environment characteristics may be influencing both weight and performance and causing spurious correlations rather than an actual causal relationship between weight and performance (Averett and Stifel 2010; Crosnoe and Muller 2004; Datar, Sturm and Magnabosco 2004).

Some studies have found underweight elementary school students, including kindergartners, to have lower test scores than their healthy weight counterparts (Karp et al. 2003; Wendt and Kinsey 2009). In addition, numerous studies (both correlation and causal) find child weight to impact math and English assessments (Averett and Stifel 2010; Capogrossi and You 2012; Datar and Sturm 2006; Gable, Britt-Rankin, and Krull 2008; Shore et al. 2008). Other literature has specifically examined school program effects on academic performance which is crucial for policy analysis. For instance, most of the research in this area has focused on the impacts of after-school programs (Pierce, Bolt and Vandell 2010; Sheldon et

al. 2010; Shernoff 2010) and tutoring programs (Ritter et al. 2009; Zimmer, Hamilton and Christina 2010).

School Meal Programs

Congress has played an integral role in school meal programs which are now being targeted as potential policy instruments to combat child overweight. In 2010, more than 31.7 million students participated in the National School Lunch Program (NSLP) each day, costing the government \$10.8 billion, while the School Breakfast Program (SBP) currently serves more than 11.6 million children daily at a cost of \$1.9 billion.

While both programs were intended to provide children with nutritionally adequate meals, they have garnered recent media attention for the unhealthy and energy dense content of their meals (Alderman 2010; Pear 2011). Research has found that much of the food served through the programs has been of low nutritional quality (Briefel, Wilson and Gleason 2009; Cole and Fox 2008; Gordon et al. 2007) with a few studies finding that the meals have contributed to child overweight (Millimet, Tchernis and Husain 2010; Schanzenbach 2009). While additional research is still needed to confirm results, these findings have spurred the USDA to release higher school meal standards in January 2012, the first changes in nutrition requirements for these programs since the 1995 School Meals Initiative. The negative media attention on the programs has also led to healthier school meal campaigns such as the Healthy, Hunger-Free Kids Act of 2010, *Chefs Move to Schools* and the Small Farms/School Meals Initiative, all of which support SBP and NSLP. While these changes to the programs are being made,

only a handful of studies have gone beyond correlation research in examining program impacts on child weight (Millimet, Tchernis and Husain 2010; Schanzenbach 2009), and even less research has examined impacts on academic performance.

Due to the links found between child weight and academic performance and between school meal program participation and child weight, further research on the relationship among all three is crucial not only for alleviating childhood misnourishment but also for improving U.S. children's academic performance.

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Determinants of Program Participation

First, in examining key determinants of program participation in both elementary and middle school by only participation status, our results support those of the literature: we find race/ethnicity (particularly Hispanic), household income, father's education, urbanity (rural/urban/suburb), and past program participation to be the most significant indicators of current participation across programs in both elementary and middle school. For example, there is a negative relationship between participation and income as well as with father's education (see Dunifon and Kowaleski-Jones 2001). Similar to Datar and Nicosia (2009b), elementary students who have mothers working full-time are more likely to participate in the programs; however, this impact does not carry over to 8th grade. In addition, children attending elementary schools with a higher proportion of its students eligible for free lunch (i.e., lower socioeconomic status) are more likely to participate (Mirtcheva and Powell 2009), although the magnitude of this effect was small. We also find that household income has a different impact on the propensity to participate across programs – a certain household income level may influence parents to enroll their child in NSLP, but it would take a different income (likely lower) to enroll in SBP. For elementary school students receiving free- and reduced-price (FRP) meals, household participation in the SNAP program is a determining factor of SBP and NSLP participation (Dunifon and Kowaleski-Jones 2001; Mirtcheva and Powell 2009). Additionally, mainly for elementary school students, age and the length of time allotted for school breakfast is a significant predictor of SBP participation as in Gordon et al. (2007) and Reddan et al. (2002); however, the magnitude of the coefficient estimates are extremely small. Urbanity is a significant predictor of participation. More specifically, students in rural areas are more likely to participate in both SBP and NSLP than students in urban areas in both elementary and middle schools, and full-price students living in urban areas are less likely to participate in SBP in elementary school.

However, once we compare children by FRP eligibility status, there is a different story to tell. Income, SNAP participation and the percentage of FRP eligible students at the school are not nearly as crucial in determining participation. Race (particularly Hispanic) is only a significant determinant for 8th grade NSLP participation, and whether a child's mother works full-time is only significant for non-eligible students. Past program participation is now the most important determining factor once children are compared to others of similar income.

Do SBP and NSLP Impact Child Weight?

Overall, we find long-term program impacts to be more significant for obese, overweight and healthy weight children, as shown in Figure 1. Long-term participation looks at those students who consistently participated in meal programs from 1st to 8th grades. We find that while participating only in NSLP decreases the probability of children being overweight, participating in both SBP and NSLP

simultaneously increases the likelihood of being overweight and decreases the likelihood of being underweight, particularly for FRP recipients. For FRP eligible students, participating in NSLP decreases BMI z-scores (standardized results of multiple data sets) by approximately 14 percent. However, there are no significant impacts on students paying full-price. We also find that participating in SBP increases a child's BMI z-score by approximately 0.34 to 0.49 points when examining all participants, which is equivalent to about a 5.4 percent to 7.8 percent change in BMI z-score. For FRP participants, SBP participation increases BMI z-scores by 0.77 points.

We also examine results at the end of elementary school (5th grade) since children often have more food choices in middle school. For instance, 32.7 percent of elementary schools had vending machines, a school store, canteen or snack bar where students could purchase foods or beverages. However, 71.3 percent of middle school students had access to these competitive foods (CDC 2006). In examining elementary school students, we find minimal impacts of program participation on 5th grade child weight outcomes: students paying full-price for only NSLP decreases a child's BMI z-score as well as decreases the probability of being overweight, findings that are consistent with the 8th grade results.

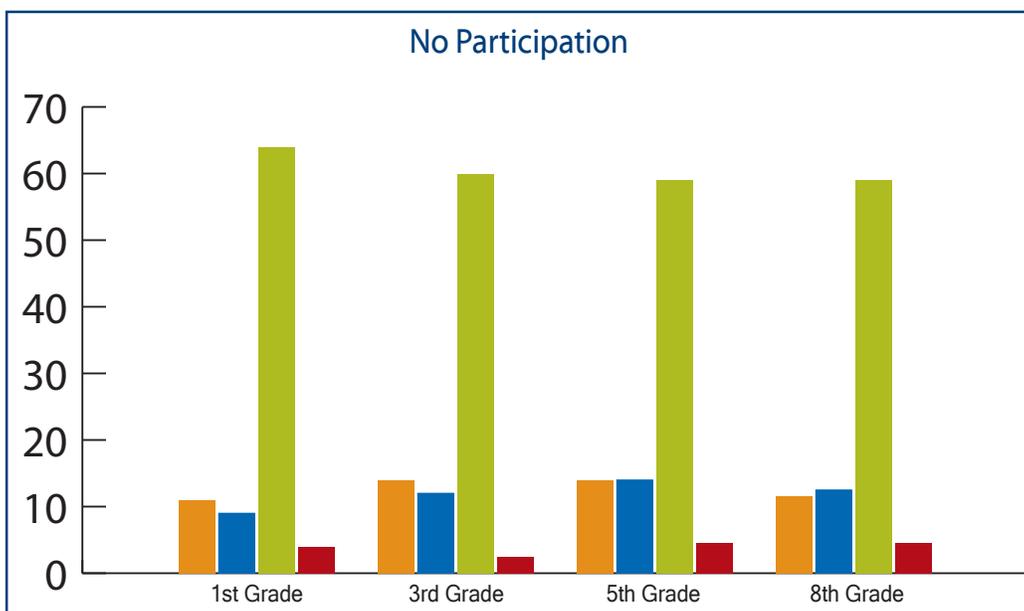
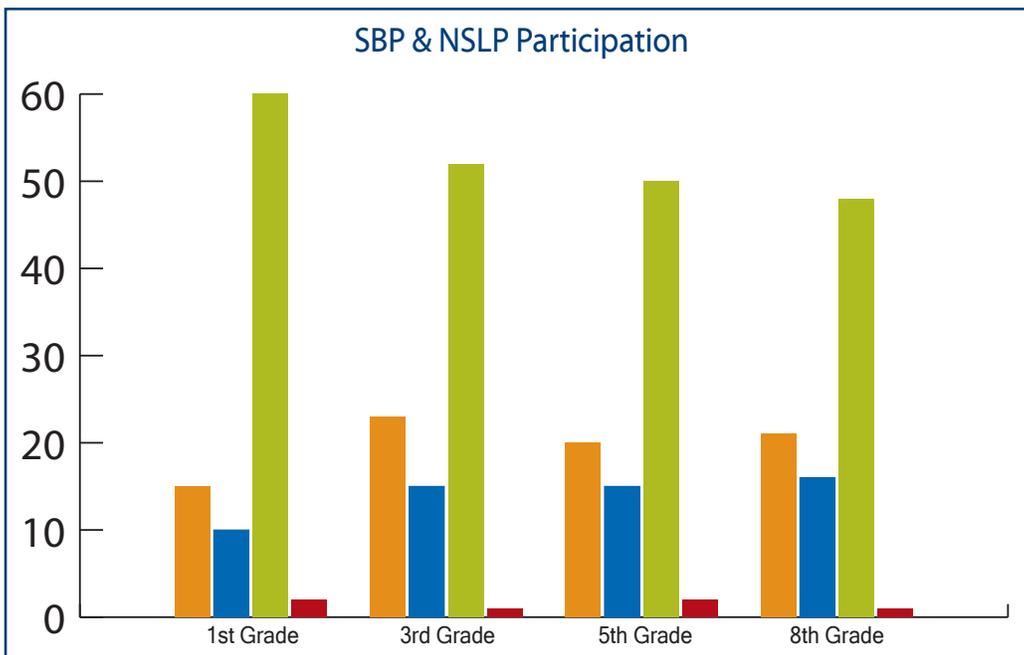
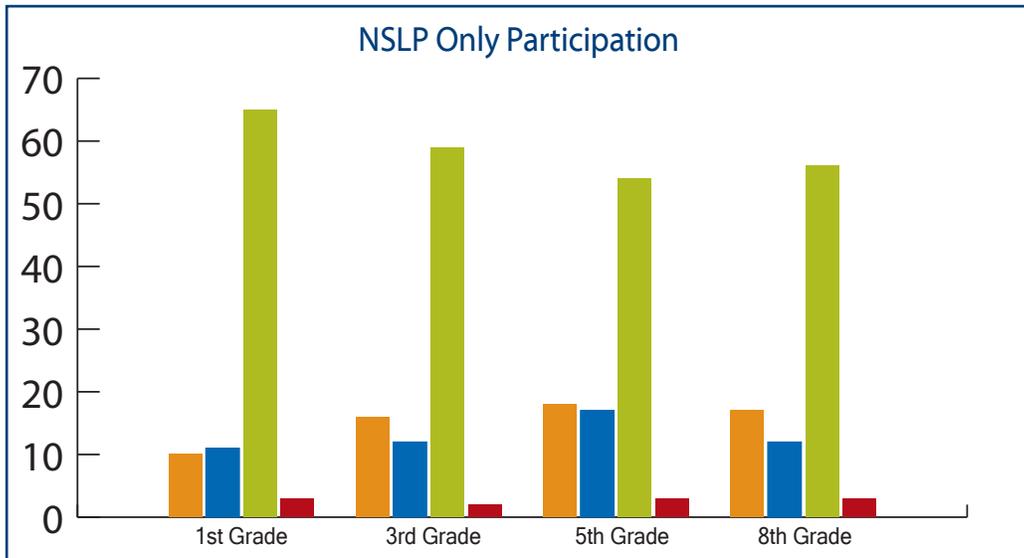
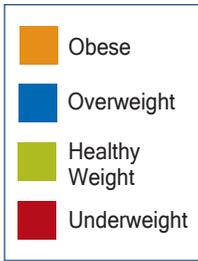
We also find that participating in SBP tends to increase child weight, although the magnitude is not large, and the impact is particularly seen on students paying full-price for breakfast. These results are similar to Millimet, Tchernis and Husain (2010) who find SBP participation to be associated with higher BMI. We find no direct or indirect impacts of SBP participation on child BMI when we separate by whether the child is eligible for FRP. Past BMI, urbanity, TV viewing and physical activity levels are the most significant predictors of a child's BMI in these models.

Previous research has found correlations between children living in rural areas, being overweight and participating in school meal programs. However, we find that living in a rural area (or a city) has different influences on the child's participation in school meal programs than it does on the child's BMI. That is, living in a rural area results in different impacts on the probability of a child being overweight than it does on a child's participation in school-based meal programs.

Because the meal programs are directed by state agencies and are operated by local education agencies (LEAs), heterogeneous impacts could exist due to unobserved food quality differences of school meals. Therefore, we examine the potential for unobserved food quality differences in three different ways:

1. Analyzing impacts on child weight controlling for food expenditures by LEA;
2. Examining impacts on child weight by separating the sample based on the percentage of students eligible for free lunches;
3. Examining impacts on child weight by dividing the sample based on urbanity and region.

Figure 1. Percent of Students by Weight and Participation Status



When we include per pupil food expenditures as an indicator of food quality, results mimic estimates of the original model in significance and magnitude indicating that per pupil food expenditures do not account for program impacts on child weight. When examining impacts based on the percentage of a school's students eligible for free lunches (the higher the proportion of free-lunch eligible children indicates a greater likelihood of a lower income school that may devote fewer resources to food services or have more demands for free meals which causes less attention paid to food quality), results do not differ from the original specification. This indicates that the programs have similar impacts on weight whether or not the school is considered "poor".

When we examine impacts by urbanity, we find that participation in only NSLP increases BMI z-scores in rural areas, and participation decreases the probability of overweight and increases the probability of underweight in the suburbs. For students participating in both programs, participation increases the probability of overweight and decreases the probability of underweight in urban areas as well as decreases the probability of obesity and underweight in the suburbs.

Finally, in examining impacts by region (i.e., Northeast, Midwest, South and West), we find that participating in both SBP and NSLP increases child weight for those students in the Midwest, and participation in only NSLP increases child weight for 8th grade students in the South and West indicating that cuisine may play a factor in the nutritional quality of food served. Furthermore, participation rates of rural households are higher in the South with more than 25 percent of all rural households with children in the South participating in NSLP and 23 percent in SBP.

Do SBP and NSLP Impact Academic Achievement?

We find that effects of program participation on achievement do exist, particularly when examining children by FRP eligibility status. These results further encourage participation in the meal programs. Results indicate that there are both direct and indirect effects from program participation on 8th grade student achievement. When we look at all school meal program participants, we find that there is a large positive direct impact of NSLP participation on math scores while there are very small indirect impacts of SBP and NSLP participation on math and English scores. While there are no direct impacts of program participation on FRP recipients or students paying full-price, there are larger positive indirect impacts from SBP participation on math scores of FRP recipients and small negative

indirect impacts on both math and reading scores of students paying full-price. When we examine students by FRP eligibility, NSLP participation has a large positive direct impact and a small negative indirect impact on math and English scores of participants who are non-eligible for FRP (i.e., with household incomes 185 percent of the poverty line).

Additionally, attending a Title 1 school has a large negative impact on both math and English scores which may contribute to the increasing disparities between high- and low-income schools. This could also be evidence of a lack of resources available to students in Title 1 schools. Furthermore, living in a rural area has a positive direct impact on 8th grade English scores for both FRP recipients and students paying full-price.

“ This report found that SBP and NSLP do impact child weight: participating in only NSLP decreases the probability of child overweight, while participating in both SBP and NSLP increases the probability of overweight; SBP increases child weight. ”

Policy Implications of Program Participation

Because children consume one-third to one-half of their daily calories while in school each day, school level programs are natural policy instruments to tackle misnourishment. This report found that SBP and NSLP do impact child weight: participating in only NSLP decreases the probability of child overweight, while participating in both SBP and NSLP increases the probability of overweight; SBP increases child weight. Furthermore, NSLP has larger positive direct impacts on achievement particularly for FRP eligible students. These findings result in two main policy implications: first, the quality of school breakfasts needs to be improved particularly since lower-income children are more likely to eat school breakfasts; and second, the programs have a larger impact on FRP eligible students who are often the most in need of both nutritional and academic assistance.

Overall, we find the programs to have an integral impact on the weight and achievement of school meal program participants especially those in 8th grade. Our findings provide further motivation for campaigns and initiatives to continue their calls for healthier school meals particularly school breakfasts. Healthier meals may also entice more parents to have their children participate in the programs. The USDA's higher nutrition requirements for school meals, unveiled in January 2012, are a start, and Michelle Obama's 'Let's Move' campaign is also in support of healthier foods served via meal programs. While higher nutrition standards are necessary, particularly for SBP, one key facet that needs to be considered is how children will respond to healthier meals and whether they will consume the food. This problem may be overcome by gradually making changes to school menus as well as expanding initiatives such as *Chefs Move to Schools* and the

Small Farms/School Meals Initiative. These programs support SBP and NSLP while encouraging students to eat healthier by having them take more of an interest in where food comes from and how it is prepared through cooking demonstrations with chefs and visits to local farms.

Although SBP and NSLP participation rates are highest among elementary school students, we find minimal evidence that school meal program participation has impacts on academic performance in elementary school; results do show direct and indirect program effects on 8th grade math and English scores. In terms of policy, this indicates that school meal programs have far-reaching impacts on participants, particularly on FRP eligible students who are often the most in need of both nutritional and academic assistance. There are direct impacts of participation on child weight and achievement. There are also indirect impacts of participation on achievement through program effects on weight and exercise. Therefore, the positive overall impacts SBP and NSLP have on these children are noteworthy.

A report to Congress entitled *Foods Sold in Competition with USDA School Meal Programs* (2001) found that children may perceive school meals to be primarily for poor children which may reduce

the willingness of low-income children to accept FRP meals. For example, while rates of participation in NSLP are about 37 percent higher for rural children compared to non-rural children, approximately 1.5 million of the 2.8 million (53.6 percent) income-eligible rural households with children do not participate. Because FRP eligible children are the ones most impacted, more creative advertising that focuses on making participation trendy and enticing should increase participation and decrease negative associations with the programs. This would then increase the benefits of the programs particularly for the FRP eligible. For instance, states with the most restrictive competitive food policies (e.g., Georgia, West Virginia, Louisiana, Mississippi) have school meal program participation rates higher than the national average making SBP and NSLP seem more inclusive. Policies such as those could have large benefits for the programs and participants, especially income-eligible students who are currently choosing not to participate.

In conclusion, it is evident that SBP and NSLP impact the weight and achievement of participants. Therefore, changes to these programs are likely to have tremendous effects on a large number of children. While many of the impacts are positive, it is crucial that policy makers continue to work to remedy the negative effects of these programs so that the well-being of our children can be fully realized.

Study Methodology

This study was drawn from the Early Childhood Longitudinal Study - Kindergarten Class (ECLS-K) which is a longitudinal study of a nationally representative cohort of 21,260 kindergartners beginning in the 1998-1999 school year and who are followed through 8th grade (2006-2007 school year). The study collected data on children in over 1,000 different schools, as well as on their families, teachers and school facilities to examine early childhood experiences, early childhood development and early school performance. Details of the data collection and instruments can be found in the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 User's Manual (Tourangeau et al. 2009).

The study used a unique theoretical framework (Capogrossi and You 2012) and employed a variety of estimation methods innovative in this area of research to aid in identifying non-spurious relationships. Using the Early

Childhood Longitudinal Study – Kindergarten Class and the Common Core of Data, we examined the impacts of SBP and NSLP on child misnourishment status (overweight and underweight) accounting for self-selection into programs and allowing for multiple simultaneous treatments since students have the option to participate in none, one or both programs. A multiple overlapping treatment investigation of school meal programs is necessary since students have the option of participating in SBP and NSLP simultaneously: 25 percent of the students in our sample participated in both programs simultaneously at some point in elementary and/or middle school. We specifically utilize Average Treatment Effect on the Treated and Difference-in-Difference methodologies in this essay.

Furthermore, we also identify direct and indirect effects of SBP and NSLP on academic performance. Direct effects are the impacts that

go directly from one variable to another variable. Indirect effects are often called mediators where the effects between two variables are influenced by additional intervening variables. Total effects, obtained by combining direct and indirect effects, provide the results of a simultaneous change in all inputs from a change in a single exogenous variable (Raykov and Marcoulides 2006). The ability to identify both partial (i.e., direct and indirect effects) and total effects is significant because it allows us to answer different research or policy questions. This is important since policymakers often have several targets of interest (You and Davis 2010) such as program participation's influence on child weight and its consequential influence on academic performance. We use structural equation modeling to estimate selection equations, child choice equations as well as weight and cognitive production functions simultaneously employing data from the Early Childhood Longitudinal Study – Kindergarten Class.

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