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Nutrition and cognitive achievement: An evaluation of the School Breakfast Program ☆

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ABSTRACT

This paper investigates the impact of the School Breakfast Program (SBP) on cognitive achievement. The SBP is a federal entitlement program that offers breakfast to any student, including free breakfast for any low-income student, who attends a school that participates in the program. To increase the availability of the SBP, many states mandate that schools participate in the program if the percent of free or reduced-price eligible students in a school exceeds a specific threshold. Using the details of these mandates as a source of identifying variation, I find that the availability of the program increases student achievement.

1. Introduction

A large body of research provides evidence that better nourished children perform better in school (e.g., Glewwe et al., 2001; Winicki and Jemison, 2003; Alderman et al., 2006; Victora et al., 2008). Because food insecurity, food insufficiency, and nutrition deficiencies are more prevalent for poor children than non-poor children, low-income children are less likely to acquire the educational benefits from better nutrition (Alaimo et al., 2001; Currie, 2005; Federal Interagency Forum on Child and Family Statistics, 2007). In the United States, food assistance programs have been established to improve the well-being of poor and low-income children. Although there is ample evidence that nutrition interventions for young children in developing countries have led to increases in cognitive achievement and greater educational attainment (Pollitt et al., 1995; Maluccio et al., 2006), there is limited evidence regarding whether food assistance programs in the U.S. achieve similar results.

The School Breakfast Program (SBP) was established with the Child Nutrition Act of 1966 to improve the nutritional needs of children "in recognition of the demonstrated relationship between food and good nutrition and the capacity of children to develop and learn" (42 U.S.C. 1771). Upon signing the bill, President Johnson stated that "good nutrition is essential to good learning" (School Nutrition Association, 2011). Consistent with the goal of the program, Bhattacharya et al. (2006) conclude that the availability of the SBP enhances nutrition. However, there is very little evidence on the relationship between the SBP and educational outcomes (Fox et al., 2004). This paper fills this gap in the literature and investigates the impact of the availability of the SBP on cognitive achievement.

The SBP is a federal entitlement program that offers breakfast to any student who attends a school that participates in the program. Children from households with income equal to or below 130% of the poverty guidelines are eligible for free meals. Children from households with

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income equal to or below 185% of the poverty guidelines are eligible for reduced-price meals. The SBP provided subsidized breakfast to over 11 million children in 2009 at a cost of nearly $3 billion (United States Department of Agriculture (USDA), 2010). Although the SBP is similar to the National School Lunch Program (NSLP), the SBP serves a lower income population; approximately half of NSLP participants received a free lunch in 2009, while approximately three quarters of SBP participants received a free breakfast.

In this paper, I focus on the influence of the availability of the SBP in schools, since this has been an important policy lever throughout the history of the program. To increase the availability of the SBP, the federal government provided funding to states for schools serving low-income children to offset the start-up costs of implementing the SBP in the Child Nutrition Act of 1989. In order to receive these funds, many states mandate that schools must provide breakfast through the SBP if the percent of free and reduced-price eligible (FRP) students exceeds a set threshold. These thresholds range in value primarily from 10 to 40%, and I use these mandates as an identifying source of variation. Thus, this paper introduces a new approach for determining the impact of the availability of the SBP.

I first estimate a difference-in-differences specification that compares the achievement among students in schools above to those below the threshold values across states with differing levels of SBP thresholds using data from the National Assessment of Educational Progress (NAEP). Second, I use a regression discontinuity design to compare the cognitive achievement of students in schools where the percent of FRP students is just below the mandated threshold to students in schools where the percent of FRP students is just above the threshold. The results suggest that state mandates that schools offer breakfast through the SBP increase math and reading achievement.

The benefits of using NAEP data are the sample size, since NAEP is one of the largest data sets with student achievement measures, and the ability to merge the percent of FRP students in the school from the Common Core of Data. However, NAEP does not include information about the availability of the SBP in the school. Thus, I also utilize data from the Early Childhood Longitudinal Study, Kindergarten Cohort of 1998–99 (ECLS-K), which includes the availability of the SBP in the school and information about consumption and attendance that is used to determine the mechanism through which the availability of the SBP influences achievement. The results using the ECLS-K data support the conclusions from the NAEP data and suggest that state mandates that schools offer breakfast through the SBP increase the availability of the SBP in schools, which increases achievement scores. Further, the results provide suggestive evidence that the availability of the SBP improves the nutritional content of what is consumed for breakfast.

2. Why might the School Breakfast Program influence cognitive achievement?

There are at least three reasons why the availability of the SBP could improve cognitive achievement. First, improved nutrition could enhance cognition (Pollitt and Mathews, 1998).[1,2] Deficiencies in various specific vitamins and minerals, including thiamine, vitamin E, and iron, can lead to a decrease in mental concentration and cognition (Chenoweth, 2007; Greenbaum, 2007a,b).[3] Bryan et al. (2004) notes that brain development occurs through childhood and poor nutrition can influence brain development; in particular, the authors' review of the research on the relationships between nutrients and cognitive development among school-aged children highlights the importance of iodine, iron, and folate and the contribution of zinc, vitamin B12, and omega-3 polyunsaturated fatty acids to long-term cognitive development. The very early stages of iron deficiency can alter dopamine transmission, which influences cognition (Pollitt, 1993). Choline and lecithin, which are found in many foods including eggs, influence the synthesis of the neurotransmitter acetylcholine and may improve memory (Fernstrom, 2000). Additionally, Lieberman (2003) concludes that amino acids, such as tyrosine, and carbohydrate supplementation can improve cognition. Finally, short-term increases in glucose improve short-term memory and cognitive ability (e.g., Bellisle, 2004); thus, high-fiber foods that provide a more sustained increase in blood glucose could be more effective in boosting cognition (Mahoney et al., 2005).[4]

A considerable body of research has examined the impact of eating breakfast through the SBP or universal free breakfast programs on nutrition outcomes.[5] For example, Bhattacharya et al. (2006) compare nutrient intakes during the school year and the summer for students in schools that offer the SBP and in schools that do not. They conclude that the availability of the SBP does not increase breakfast consumption but it improves the overall nutrition quality of children's diets; increases the likelihood of meeting the Recommended Daily Allowance of fiber, potassium, and iron; decreases the likelihood of having low serum levels of vitamin C, vitamin E, and folate; and reduces the number of calories from fat. Thus, based on the conclusions of the nutrition literature and the findings of Bhattacharya et al. (2006), the availability of the SBP is likely to improve memory and cognition.

Second, the availability of the SBP could reduce absenteeism or tardiness at school, either because students arrive earlier at school to eat breakfast prior to the beginning of the school day or, indirectly, because improvements in nutrition could reduce illness-related absences. For example, Hinrichs (2010) utilizes a change in the funding formula to demonstrate an increase in educational attainment from the expansion of the NSLP, which he suggests could be due to an increase in attendance.

Third, the availability of the SBP is similar to an increase in household income for households with children receiving subsidized meals (Bhattacharya et al., 2006). The reimbursement rate for free breakfasts in 2004 was $1.20 per meal, so the value of the monthly transfer to households below 130% of the poverty threshold was approximately $26 per child who consumes breakfast daily, which is approximately 30% of the average monthly SNAP benefits per person and 70% of the average monthly food costs per person of the WIC program in 2004 (USDA, 2014).[6] Dahl and Lochner (2012) demonstrate that an increase in family income, based on changes in the Earned Income Tax Credit, increases math and reading scores, with larger increases for children from disadvantaged backgrounds, younger children, and boys.

Although there are many reasons to expect that the availability of the SBP will increase achievement, such a result is not obvious a priori. To be able to consume breakfast as part of the SBP students must arrive to school earlier, which could have a negative impact on achievement if this reduces the amount of time students sleep. Additionally, the availability of breakfast could induce low-performing or disruptive students to attend school, which might change the composition of peers in the

[1] Related to this mechanism, Pollitt and Mathews (1998) also note that breakfast, in particular, could influence cognition by reducing the length of the overnight fast and the associated metabolic changes of fasting.

[2] There could also be an indirect impact of nutrition through non-cognitive skills, which are important determinants of cognitive achievement (Heckman et al., 2006). This area of research is less developed than the relationship between nutrition and cognitive skills, but Bryan et al. (2004) suggest that the micronutrients zinc and omega-3 polyunsaturated fatty acids may be related to attention and Kleinman et al. (1998) find that malnutrition is correlated with behavior problems.

[3] For a summary of the literature on the relationships between macronutrients and cognition and a discussion of the neurological and biological mechanisms underlying these relationships, see Gibson and Green (2002).

[4] Figlio and Winicki (2005) find that, in response to accountability pressures, some schools increase glucose loads through school lunches to improve test scores.

[5] Related research suggests that participation in the SBP reduces childhood obesity, although the National School Lunch Program (NSLP) increases obesity (Schanzenbach, 2009; Millimet et al., 2010).

[6] The SBP occurs prior to the beginning of school. Thus, there is also an implied income transfer for families with children who would have attended before-school care in the absence of the SBP.