The Role of School Meal Programs in the Food Environment Experienced by Children

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With the expansion of various school meal programs, children receive an increasing fraction of their meals at school. Many schools provide meals during the summer and some even provide dinner following afterschool programs. As such, a major part of the food environment that children face operates through what is served at school. In addition, due to the natural habit formation that can occur through food consumption, what children have access to and eat at school can influence the foods they are willing to eat at home. While data about the food environment of specific neighborhoods have dramatically improved, to better understand the influence of the food environment on children's food access and eating habits, it is important to also incorporate information about what schools choose to offer on their menus.

Despite the important role of schools in the food environment faced by children, most research examining access to healthy food has focused on the retail sector (Larson, Story and Nelson 2009). Some studies focus on supermarkets or grocery stores (Aggarwal et al 2014), others include a broader set of retail outlets (Powell et al. 2007; Kowaleski-Jones et al. 2009), and still others include restaurants (Binkley 2006; Guthrie, Lin, and Frazao 2002). Bitler and Haider (2011) highlight the potential role of school meal programs when they discuss that focusing on only one aspect of the food environment (like only grocery stores) may provide a mistaken notion of food access when other sources of food are available.

In this project, we will examine the roles that both the retail- and school-based food environments have on the nutritional choices made by children. We will also examine the degree to which the school food environment moderates the relationship between the retailed-based food environment and the food that children are actually eating. Furthermore, we will examine how these relationships differ based on whether children receive free or reduced-price meals and whether children are in school. As such, our project will bring together two important strands of research into one framework: (1) the impact of school meal programs on what children eat (Bhattacharya, Currie, and Haider 2006); and (2) the impact of the retail food environment on children (Lee 2012).

One important contribution of our project will be the creation of a database of school menus covering about 90% of the students in the US. This database of school menus will also include nutritional information about each of the items on the menu. Since the FoodAPS data includes a stratified sample of 50 counties of contiguous groups of counties, we will focus on ensuring that the database has nearly complete coverage of the school districts that correspond to the children in the FoodAPS sample. This new database will complement similar measures constructed for the retail-based food environment. We plan to make the complete school menu database available to other researchers so that it can be used to study a variety of other important questions.

The FoodAPS dataset is ideal for this analysis since it provides detailed measures of the food children eat both at home and at school, provides specific information about where the child lives, and has information about the retailed-based food environment of the immediate area. Based on the Census tract of the household residence, we will assign each household to a school district using the 2010 Census Block Assignment Files. We will use empirical approaches similar

those used by An and Sturm (2012) and, more recently, by Handbury et al. (2015) and Allcott et al. (2015), but incorporate measures of the school food environment.

This project will also contribute to the current literature in two additional ways. First, by combining information on the availability of healthful foods in both schools and the retail market, we will determine the degree to which the healthfulness of the retail and school food environments are correlated with each other. If they are positively correlated, then this will indicate that children in retail food deserts are doubly disadvantaged. Alternatively, it may be the case that schools play a key role in offsetting the lack of access in the retail market by providing access to healthful food at school (Sturm 2008). Preliminary analysis of the school menu data that we have already collected shows that there is significant variation across schools in the healthfulness of foods offered to students, which highlights the importance of incorporating information about the school food environment to understand the overall food environment for students.

Second, the school menu data that we collect for this project could be used to address a number of other questions about the factors that influence the nutritional quality of food served in schools. Several policy levers are available to influence these measures including federal reimbursement rates, nutritional guidelines for reimbursable meals, access to subsidized commodities, and many others. The data we will collect will open up opportunities to address these questions using a large national sample. Understanding the effect of these policies may also provide natural variation that could be exploited to answer the question in this project about the effect of what schools offer and what children actually eat.

Data

A key aspect of our project will be to provide a more complete picture of the overall food environment that children face that incorporates both the retail and school food environment. For this project, we will gather and standardize a nationally comprehensive dataset of what schools are serving at breakfast and lunch. We are already working with two companies (Nutrislice and Schoolmenu.com) that provide school menu content to school districts, and we will use their data for this project. We will also reach out to other companies that provide similar school menu services as well as companies (such as Aramark and Sodexo) that provide school meals across many school districts.

We have started to develop a web scraping program that will gather school menu data from information provided on school districts' websites. This program extracts information on the items being served and links them to information on the nutritional content of each item. Much of this information is posted as a PDF document, and we have developed programs to deal with this type of data as well. For many school districts, we can obtain the nutritional information for all of the items on their menus. In those districts where we cannot directly obtain that information, we will impute it from other school districts that serve very similar items.

The data that we have from schoolmenus.com includes 408 school districts covering about 17% of the students in the US. The data from Nutrislice provide an additional 370 school districts covering an additional 7% of students. Based on estimates from a random sample we examined, we will be able to obtain school menus online for 72% of remaining school districts. This results in a combined sample across the three sources of approximately 80% of the students in the US. For the remaining school districts, we will contact the Nutrition Directors of these districts directly to obtain copies of these past menus and nutritional information. Our final goal is to have a database that includes school menu data for 90% of the students in the US.

Since the FoodAPS data was collected between April 2012 and January 2013, we will be using the internet archive for our web-scraping program to obtain as many school menus as possible that match the time period of interest. Furthermore, the FoodAPS data used a stratified sample that involved 50 Primary Sampling Units (which are counties or groups of contiguous counties); thus, we will be able to narrowly focus our efforts by contacting these school districts to obtain past school menus. Where this is not possible, we will use school menus as close as possible to the time of the FoodAPS data period and estimate a series of sensitivity checks to see how our estimates depend on the temporal proximity of our school menu data. Thus, while we will create a database that provides the largest possible coverage of all school districts in the US, we will also focus our efforts so we have nearly complete coverage of the school districts that correspond to the respondents in the FoodAPS data.

In order to quantify the nutritional content of the items being served in schools, we will construct measures based on the standards adopted by the Healthier U.S. School Challenge, which requires that school meals emphasize fruits, vegetables, and whole grains; include lean meats, poultry, fish, beans, eggs, and nuts; and are low in saturated fats, trans fats, cholesterol, salt, and sugars. These guidelines also emphasize that items should be routinely selected by students and not just token foods on the menu. Since schools offer 2-3 entrees at each meal (along with a choice of side dishes), we will construct nutritional measures based either on the least healthy option available or a weighted average across the different items. We will use point-of-sale data from a large school district in Florida to examine the degree to which each of these measures based on menus reflect the actual food choices that children make. We will use the insights from this analysis to refine the school menu measures used in this project.

While the school menu data we will collect is a unique innovation of our project, the key data that makes the project possible is FoodAPS. FoodAPS is a cross-sectional, nationally representative survey of more than 4,800 households that contains detailed information on individual-level food consumption at home and away from home. In particular, youths in the household completed detailed records of all foods that were purchased or acquired at school, including the price, size or weight, and brand. Additional information is available in the data about how often a student eats breakfast or lunch at school and whether they receive free or reduced-price meals. Further, the FoodAPS Geography Component files include measures of the retail food environment at the block group, tract, and county level that include the number of different types of retailers near a student's residence and measures of prices and the availability of different food and beverage categories available from retailers.

The FoodAPS data is ideal for this project since it provides traditional measures by which food access is related to children's food intake. This allows us to compare estimates from a traditional model to one in which we include information about the child's school food environment. Although FoodAPS includes measures of the laws related to school nutrition, including school meals and competitive foods, the detailed data that we will gather and combine with the FoodAPS data will provide a more complete understanding of the foods available to students within schools. This will allow us to examine the degree to which the school meal programs can either moderate or reinforce the impact that local sources of food have on what children eat.

Methodology

In this project, we will integrate school-level measures of access to healthy foods into the FoodAPS data and estimate previously-established empirical models to examine the impact of

food environment on children's eating decisions. First, we will estimate the correlation between measures of the retail food environment and the school food environment. Next, we will estimate regression models similar to An and Sturm (2012), which estimate the relationship between students' food consumption and measures of the retail food environment using measures that are also included in the FoodAPS data. We will build upon their framework by adding measures of the school food environment as additional explanatory variables and by estimating the regressions separately for children who qualify for free and reduced-price meals. Then, we will estimate regression models similar to the cross-sectional regressions using the Nieslen Consumer Panel data of Allcott et al. (2015) and Handbury et al. (2015). These regressions examine whether household income is associated with the healthfulness of food purchases and whether the healthfulness of retail food environment differs based on the income of the neighborhood. Further, following Handbury et al. (2015), we will estimate within-school and within-neighborhood regressions to determine the potential influence of equating the school food environment and the neighborhood retail food environment on the income-based differences in the healthfulness of children's consumption patterns. Since school district boundaries can differ from the area included in distance-based neighborhood measures, we will be able to separately identify the influence of the school food environment and the neighborhood retail food environment.

Incorporating the role of schools will also allow us to address the issue of whether differences in the availability of healthy foods are driven by supply or demand (Bitler and Haider 2011). School meal programs face a different set of market forces and supply factors than those faced by the retail sector. The USDA reimburses schools based on the number of meals that they serve to students eligible for free or reduced-price meals, thus potentially providing even more resources in areas with lower incomes. Because school meals are subsidized and have specific nutritional requirements, their supply is less subject to the individual demands of students.

In addition, since each respondent in the household completed a food diary for seven consecutive days, we will be able to examine the degree to which the school food environment differentially impacts children on days they are in school compared to days they are not. Moreover, data collection included both observations during the school year and the summer. For those observations that occur during the school year, we will be able to do a within-person comparison across school days and non-school days and, for the whole sample, we will be able to do a between-person comparison that includes the summer months.

Logisitics

The project investigators are David Frisvold and Joseph Price. Frisvold is an Assistant Professor of Economics at the University of Iowa and a Faculty Research Fellow of the NBER. Price is an Associate Professor of Economics at Brigham Young University and a Faculty Research Fellow of the NBER. Price has also been the Director of the BYU Veggie Project for the last 7 years and has employed over 200 undergraduate research assistants during this time. Both investigators have significant experience with school-level experiments that study eating behaviors of students and the analysis of food assistance programs.

The funding from this grant will allow us to hire a team of undergraduate research assistants to gather, clean, and standardize the school menu data and assign nutritional content information to each of the items on the menu. The research assistants that we will employ will be paid $9-10 an hour, which will allow us to use the funding from this project to devote over 1,500 hours of research assistant time to creating the school menu dataset. We have previous

experience employing a team of research assistants in this type of large data work, and they were integral to our project using Nielsen National Consumer Panel data to examine the habit formation effects of the WIC program (Frisvold, Leslie, and Price 2015).

We will make the school menu dataset that we create publically available so that it can be used to answer other important questions related to the impact of various federal policies designed to improve the healthfulness of school meals. Additionally, our collection of school menu data and nutritional information could help identify a set of districts that are engaging in best practices, making it easier for other districts to adopt components of their menus and to select menus that have been effective in improving the food environment for schoolchildren in districts that are similar to their own.

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