Will Reducing the Calorie Content of School Lunches Affect Participation? Evidence from a Choice Experiment with Suburban Parents

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Abstract

Policymakers and school district officials hope to reduce childhood obesity by improving the nutrition of school lunches. The Healthy, Hungry-Free Kids Act of 2010 requires that the calorie content of lunches served as part of the National School Lunch Program (NSLP) must fall within ranges that are lower than previously required. This study explores whether the calorie reductions required as part of the new regulation will affect household's perception of or demand for NSLP lunches.

To answer this question, we implement a choice experiment via an online survey to parents of school-aged children from a suburban Ohio school district. In the choice experiment, parents are shown a weekly menu where each meal's content, calorie level, and price are randomly assigned. They are asked to rate the meal in terms of the meal's perceived healthfulness and in terms of the likelihood their child would eat the meal (palatability). Parents are then shown meal price and indicate whether their child would purchase the meal. We model the purchase decision as a function of the perceived health rating, perceived palatability rating, lunch price, total meal calorie content, and the household's current lunch purchase frequency using a random-effects probit model.

Meals that were perceived to be healthier and more palatable were more likely to be chosen for purchase from the menu. Total meal calorie content was not a direct factor behind lunch purchases. However, it was a driver of perceived health in the first-stage regression. Specifically, higher calories had a significant, negative effect on the health rating for two of the three income groups, suggesting that regulations that the lower calorie content of school lunches will have a small, positive effect on lunch sales for this sample.

Introduction

Children in the United States have consumed lunches subsidized through the National School Lunch Program (NSLP) since 1946. State governments and federal agencies have attempted to address rising rates of childhood obesity by enacting new regulations that target multiple factors that include the nutritional contents of breakfasts and lunches served under the NSLP. Specifically, one part of the Healthy, Hungry-Free Kids Act of 2010 regulates the average amount of calories that schools may serve as part of the NSLP. For elementary students in grades K-5, the acceptable calorie range is between 550 and 650 calories. Middle school students in grades 6-8 may consume between 600-700 calories and high school students in grades 9-12 may consume between 750-850 calories. Previous regulation mandated no upper limit on calories per meal, but rather required minimum calorie levels of 633 and 785 for grades K-3 and 4-12, respectively.

In order for regulated changes to NSLP meals to affect child nutrition, several barriers must be overcome: (1) children have to choose NSLP meals rather than available substitutes, (2) children have to choose the healthy items from NSLP offerings and (3) children must eat the healthy items they chose. We focus on how the proposed changes in lunch calorie limits affect barrier (1).

If the students do not like the foods served as part of the lunch program, or the child or parents do not view the meal as a good value, they may choose to consume competitive food items purchased from the school snack bar or vending machines. Several other regulations affect barrier (1), including regulations concerning vending machine content and competitive food sales from snack bars and other school stores. But, students can find ways around interventions that target the competitive food items that fall under state or federal reglations. One study found

students bought competitive food items from non-regulated vending machines after the school snack bar stopped selling chips, candy, sweet desserts, and sugar-sweetened beverages (Cullen et al. 2006). Furthermore, recent changes to the NSLP as dictated by the Healthy, Hungry-Free Kids Act of 2010 have restricted the types of foods and beverages one may purchase from a vending machine located within the school.

Finally, students can simply choose to leave campus to buy food from an outside vendor, go home for lunch if they do not like the on-campus food options or pack a lunch for at-school consumption. Several studies have explored closing these nutritional deficiency loopholes by prohibiting students from leaving the school campus during lunch (Ham, Hiemstra, and Yoon 2002) and banning packed lunches from home (Eng and Hood 2011; Probart et al. 2006). Although the number of students leaving campus for lunch is 6% for elementary school students, this number rises to 27% for high school students (O'Toole et al. 2007). Students and parents have derided the decision to ban packed lunches at one Chicago school since it takes the child's food choice away from the parents and the cost of a school lunch is prohibitive to many families. However, research suggests that packed lunches are often much less healthy than school lunches (Hur, Burgess-Champoux, and Reicks 2011).

While much of the recent literature has focused on barrier (2) (Reicks et al. 2012, French et al. 1997, Just, Mancino, and Wansink 2007; Just et al. 2008) or barrier (3) (Wardle et al. 2003, Birch 1980; Hendy, Williams, and Camise 2005), less work has focused on barrier (1).

The existing literature on NSLP participation has shown mixed results on whether serving healthier foods can negatively affect lunch sales and pressure school foodservice budgets. One notable example of negative lunch sales took place in the Los Angeles Unified School District. Although the district received 300,000 comments on the healthier lunch menu,

75% of them positive, the students rejected most of the new healthier menu items as school lunch participation declined by 13% (Watanabe 2011). However, two studies by Trevino et al. (2012) and Wojcicki and Heyman (2006) showed a modest increase in the number of students that purchased school lunches and minimal impact to foodservice budgets after the school lunch programs served healthier lunch items.

In general, reduced lunch sales pressure foodservice profit margins since healthier food costs more money to purchase and the NSLP reimbursement rate limits the ability of school lunch programs to serve high-cost food items after accounting for overhead expenses. The current NSLP reimbursement rate for a lunch served during the 2011-2012 school year is 26 cents per meal for a fully paid lunch, $2.37 for a reduced price lunch, and $2.77 for a free lunch (Food and Nutrition Service, United States Department of Agriculture 2011).

In addition to lunch's palatability, several others factors can affect school lunch purchases. These factors include price, NSLP subsidies, child age, whether the campus is closed, food preparation, income, portion size, time waiting in line, availability of competitive foods, and total lunch time (Akin et al. 1983; Braley and Nelson Jr 1975; Ham, Hiemstra, and Yoon 2002; James, Rienzo, and Frazee 1996; Marples and Spillman 1995; Mirtcheva and Powell 2009; Neumark-Sztainer et al. 2005; Snelling, Korba, and Burkey 2007; Wharton et al. 2008; Zucchino and Ranney 1990). These studies have not explored the effects of changing school lunch menus on overall foodservice profitability. In addition, many of them are out of date since they were conducted over ten years ago when different nutritional guidelines were in place.

Currently, the literature has not documented the effects of new federal guidelines, such as the calorie content guidelines specified in Healthy, Hungry-Free Kids Act of 2010, on the total number of school lunch sales. This study uses information about parental perceptions of school

lunch palatability, healthiness, and demographics to examine how the inclusion of calorie information directly or indirectly, via perceived healthfulness of a meal, affects a household's intended school lunch purchase frequency.

Methodology

An online survey was used to elicit responses from parents in the Upper Arlington School District, an affluent suburb of Columbus, Ohio. We chose an online survey over other methods, such as mail or telephone, because of its low cost of administration, ease of data entry and analysis, and controlled sampling (Evans and Mathur 2005). This study and survey was approved by the Institutional Review Board at The Ohio State University. The survey was open to respondents from September 11, 2012 to October 31, 2012 and recruited participants 18 years of age or older with at least one child in the Upper Arlington school district. Respondents were recruited by e-mail using the school district's monthly newsletter, word of mouth from parents, social networking websites, and links to the survey from each school website's homepage. A group consisting of the authors and Upper Arlington school administrators and foodservice staff convened and revised drafts of the survey based on staff feedback prior to administering the online survey.

The survey asked respondents to state their health and palatability perceptions for five school lunch meals and whether or not they would allow their children to purchase the lunches (see Table 1 for a sample menu). If the respondent had more than one school-age child, he or she was asked to focus on the youngest child while answering the survey questions. Overall, it took about 15 minutes for a respondent to complete the entire survey.

A choice experiment was used to determine the role of calorie content information on the household's school lunch purchasing decision. Following the methods described by Lancsar and

Louviere (2008) and Street and Burgess (2007), we construct a weekly lunch menu based on a D-optimal design. The attributes considered included meal content, calorie levels and price. The survey displayed the modifiable school lunch attributes all at once, using a non-metric scale for the dependent variable, the lunch purchase decision, and using a probit model for relating household decision to choice probability. A unique aspect of this study is that the number of school lunches one may choose to purchase is not limited, i.e., parents could choose to buy every day or not at all.

There were 50 experimental menu combinations utilized across all version of the survey. Each conjoint combination presented the respondent with a weekly lunch menu for 5 school days. A menu for a school day consisted of 1 of each of the following: main entrée, vegetable, fruit, and other/dessert, and milk. There were 10 possible choices for the main entrée and 5 choices for the vegetable, fruit, and other/dessert items. Fluid milk was included in each day's menu as stipulated by the NSLP guidelines, and was assumed to be skim milk for study purposes. Each conjoint menu combination received one of 5 prices from $2.75 to $3.75 incremented in $0.25 intervals. Although the study hypothetically altered the price of a school lunch for a given school day from $2.75 to $3.75 in 25 cent increments, participants were reminded that the current cost of a school lunch was $2.75, and that there were no immediate plans to change that price. Portion sizes and calorie amounts included in the survey were 1.7 to 2.3 oz. and 550 to 650 calories, respectively, and were incremented in 0.15 oz and 25 calorie intervals. The portion size was linearly correlated with calorie size to ensure respondents interpreted differences in calories in a nutritionally consistent manner (e.g., this rules out one person thinking lower calories are achieved by fewer vegetables and another perceiving fewer calories from smaller main entrees). The numbers for calorie content were selected to be in

compliance with the regulations specified in the Healthy, Hungry-Free Kids Act of 2010. Table 2 lists the values utilized to create the weekly lunch menus.

Table 1: Example Weekly Lunch Menu for Choice Experiment

Day	Lunch Menu Content
Monday	Baked Chicken Breast, Tossed Salad, Diced Peaches, Milk, and Chocolate Chip Cookie. Main Entrée Portion Size: 1.7 oz. Total meal calorie content: 550. Meal Price: $3.50.
Tuesday	Ravioli with Sauce, Steamed Broccoli, Cinnamon Applesauce, Milk, and Dinner Roll. Main Entrée Portion Size: 2.15 oz. Total meal calorie content: 625. Meal Price: $2.75.
Wednesday	Macaroni & Cheese, Baby Carrots, Fresh Orange Sections, Milk, and Pretzel Snack. Main Entrée Portion Size: 2.3 oz. Total meal calorie content: 650. Meal Price: $3.25.
Thursday	Mini Corn Dog Bites, Baked French Fries, Banana, Milk, and Fruit Flavored Yogurt. Main Entrée Portion Size: 1.85 oz. Total meal calorie content: 575. Meal Price: $3.00.
Friday	Bosco Cheese Sticks, Green Bell Pepper Strips, Fresh Grapes, Milk, and Graham Cracker Snack. Main Entrée Portion Size: 2 oz. Total meal calorie content: 600. Meal Price: $3.75.

Table 2: Menu Items and Prices Used in Design

Main entrée (10 choices)	Baked Chicken Breast, Oven Roasted Sliced Turkey on Whole Grain Bread, Cheeseburger on Whole Grain Bun, Macaroni & Cheese, Bosco Cheese Sticks, Chicken Nuggets, Taco Turkey, Ravioli with Sauce, Mini Corn Dog Bites, Cheese Quesadilla
Vegetable (5 choices)	Baby Carrots, Baked French Fries, Green Bell Pepper Strips, Steamed Broccoli, Tossed Salad
Fruit (5 choices)	Cinnamon Applesauce, Banana, Diced Peaches, Fresh Grapes, Fresh Orange Sections
Other/Dessert (5 choices)	Chocolate Chip Cookie, Dinner Roll, Fruit Flavored Yogurt, Graham Cracker Snack, Pretzel Snack
Price (5 choices)	$2.75, $3.00, $3.25, $3.50, and $3.75
Main Entrée Portion Sizes (5 choices)	1.7 oz., 1.85 oz. , 2 oz., 2.15 oz., 2.3 oz.
Calorie Content (5 choices)	550, 575, 600, 625, 650

The random effects probit regression conducted using STATA version 11 modeled the influences of the respondent's ratings of health and palatability estimates, the conjoint menu price, the caloric level, the square of the caloric level on the buy/no-buy decision for the day's lunch menu, and the current frequency of school lunch purchases. Households were separated into three groups depending on their responses to the annual income question. Households that did not respond to this question were assigned to the lowest income category of "Less than $75,000" based on a series of likelihood ratio tests that found that estimated model parameters were most similar to those from the low income category. A full description of the variables used in the random effects probit model is listed in Table 3.

Results

A total of 247 respondents completed the survey. All respondents provided a health and palatability rating for each individual daily menu for the school week and then marked the days they would normally decide to have their child purchase the school lunch. Therefore, each completed response has the ability to generate up to 5 observations if the respondent answered all 5 buy/no buy decision questions for the lunch week. Multiplying by 5 to account for the total number of observations gave a total of 1,235 maximum possible observations.

Table 3: Variables Used in the Buy/No-Buy Ordered Probit Regression

Variable	Description
Price	The hypothetical price for the lunch on a given day
Health	The school lunch's perceived healthiness. Possible values: scale of 1 (very unhealthy) to 4 (very healthy)
Palatability	Likelihood that the child would eat the majority of the lunch. Possible values: scale of 1 (very unlikely) to 4 (very likely)
Calorie	Total calorie content for a meal
Quadratic Calories	Squared value of the meal calorie content
Current Lunch Purchase Frequency	Number of school lunches a household purchases in a typical school month

Table 4 shows key income and demographic information about the sample of respondents and the city of Upper Arlington. Approximately 60.3% of the residents earned an annual income of $75,000 or greater and 26.6% have attained a Bachelor's degree or higher. The survey data indicated that 85% of the respondents in the sample earn an annual income of $75,000 or greater and 88% have attained a Bachelor's degree or greater. Furthermore, the survey sample was heavily biased towards females as 87% of respondents were female compared to the city-wide average of 50.5% with the percentage of white respondents being nearly equal between the sample, 94%, and Census data, 92.2%. These figures suggest two important and limiting issues of this study. First, the chosen school district is relatively affluent and well-educated compared to other schools in Ohio, making the chosen district non-representative of the rest of Ohio. Second, those who responded to the survey revealed higher incomes and more formal education than the average Upper Arlington resident, suggesting there may be sample selection issues even within this non-representative community.

The Upper Arlington school district consists of five elementary schools, two middle schools, and one high school. For the 2011 – 2012 school year, a total of nearly 5,700 students were enrolled in the school district. A majority of the students represented in this study are enrolled in elementary schools with the remainder enrolled in the middle and high schools.

Table 5 lists the random-effects probit regression results for each income category. A likelihood ratio test ($\chi^2(df=6) = 53.2$, $p = 1.06 \times 10^{-9}$) supports modeling each income group separately. The ratings of the lunch's healthiness and palatability were based on the entire lunch meal as presented in the choice experiment. Each rating was measured on a 4-point Likert scale. For the health rating, a score of 1 denotes a rating of very unhealthy to 4 for very healthy. A similar interpretation follows for the palatability rating of 1 for very unlikely that the child will

consumer a majority of the meal to 4 for very likely. Positive coefficients suggest an increase in this variable is associated with an increase in the probability that the household will purchase the lunch.

Table 4: Sample and Upper Arlington City Demographic Summary Statistics

	Total Sample (N=247 people)	Upper Arlington city-wide average[1]
Household Income		
Less than $75,000	8.9%	41.9%
$75,000 to $150,000	38.1%	32.3%
More than $150,000	44.9%	25.8%
No Response	8.1%	N/A
% White	90.3%	91%
% Female	90.6%	52.2%
Employment[2]		
3 full time workers	0.4%	N/A
2 full time workers	34.9%	15.6%
1 full time worker[3]	63.9%	81.9%
1 full time worker, 2 part time	2.1%	N/A
1 full time worker, 1 part time	53.8%	N/A
1 full time worker, 0 part time	44.1%	N/A
2 part time workers	N/A	0.82%
No full time worker/Unemployed (Census)	0.8%	2.5%
Respondent Education		
Less than four-year college degree	7.8%	32.5%
Four-year college degree	44.5%	37.7%
Greater than four-year college degree	47.7%	29.8%
Spouse/Partner Education		
Less than four-year college degree	7.4%	N/A
Four-year college degree	40.7%	N/A
Greater than four-year college degree	48.2%	N/A
Not Applicable	3.7%	N/A
Most Common Grade Level of Youngest Child	3	N/A

[1]Source: American Community Survey 5-year estimates 2006-2010 (US Census Bureau 2012)
[2]Unemployment figure represents married couples.
[3]No specific information was available on the breakdown in these sub-categories

Price is a significant driver of purchase for the lowest income group only. Middle and upper income respondents did not respond to price variation in a statistically significant fashion, which is consistent with the widespread off-campus meal options available in this school district,

where the median per meal price for off-campus lunch options from this sample were double the price of school lunches. Table 6 provides predictions of the percent change in the probability of purchase for each price level used in the choice experiment. These calculations use $3.00 for the current cost of the school lunch as currently charged by the Upper Arlington School District. Table 6 shows that the price significance was at the 5 percent level for all prices levels for the lowest income group.

Perceived health is modeled with a separate dummy variable for each possible rating level, where the lowest rating category is omitted, and it is the second biggest driving factor for lunch purchases across all income groups. Rating categories of 3 and 4 are significantly different from the lowest (base) category at the 1 percent level for all income groups. Table 7 illustrates that the changes in the probability of purchasing a school lunch. For the lowest income category, there is a large increase in this probability going from a health rating of 1 to 2. However, the increase going from a health rating of 1 to 3 and 1 to 4 has a diminishing effect on increasing the probability of the lunch purchase. For the middle and upper income categories, moving from the perceived health rating 1 to 3 and from 1 to 4 increases this probability by a larger magnitude. For instance, the probability of purchase going from a health rating of 1 to 2 for the income group between $75,000 and $150,000 is only 3.1%. Moves of ratings of 1 to 3 and 1 to 4 increase the probability of purchases by 10.6% and 11.7%, respectively. Pairwise tests of significance between perceived health rating levels for all income categories indicate that the perceived health rating levels are statistically distinct from one another at the 1% level.

The perceived palatability of a meal is the dominant direct driver of purchase. The effect of an increase in the perceived likelihood that the child will eat most of the lunch on the probability of purchasing the lunch is inconclusive across income groups moving from a rating

of 1 to 2. However, moving from ratings of 1 to 3 and 1 to 4 will increase the likelihood of lunch purchase at the 1 percent significance level. For example, among households with income between $75,000 and $150,000 a one rating scale point change in perceived palatability as shown in Table 8 from a rating of 2, or 'somewhat unlikely my child will eat the meal', to a rating of 3, or 'somewhat likely', is associated with a 12.1% increase in purchase probability. Pairwise tests of significance between perceived palatability rating levels for all income categories indicate that the perceived palatability levels are statistically distinct from one another at the 1% level. The lone exception to this finding is the significance level of 5% between rating levels 2 and 3 for the lowest income group.

In contrast to the palatability and health ratings, calorie content had no direct influence on the purchase decision for the lowest and highest income categories. Table 5 shows that calorie content has no statistically significant effect on the probability of purchasing a lunch. Calories remain an insignificant driver of results if they are modeled linearly or if each level used in the choice experiment is assigned its own dummy variable. Therefore, the changes in lunch purchase probabilities listed in Table 9 are not statistically significant. Hence, the effect of calorie content information on the lunch purchase decision is inconclusive. However, a random effects probit regression modeling the health rating as a function of item-specific dummies and the total number of calories in a meal shows that total meal calories have a negative effect that is significant at the 10% level for the lowest and highest income groups. This result is shown in Table 10.

The final driver of the purchase decision in the hypothetical choice experiment is the reported frequency of actual school lunch purchases. Hypothetical approaches can face difficulties because the non-binding nature of the choice decision can lead to noisier decision-

making than decisions made when money exchanges hands (Harrison 2006), though a meta-analysis of studies featuring parallel hypothetical and non-hypothetical valuation exercises finds no bias for items with a value of $10 or less (Murphy et al., 2005, p. 321). Indeed, our results reveal that the likelihood of purchase in the hypothetical choice experiment increases significantly with the respondent's actual purchase frequency, which provides some support for the validity of the chosen methodology.

Table 5: Random-Effect Probit Results by Income Group

	Less than $75000		$75,000 to $150,000		More than $150,000	
Variable	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
Calorie	0.027	0.032	-0.025	0.020	0.010	0.018
Quadratic Calories	-0.00002	0.00003	0.00002	0.00002	-0.00001	0.00002
Palatability						
1 (base case)	---	---	---	---	---	---
2[a]	-0.060	0.095	0.130**	0.063	0.040	0.060
3[b]	0.420***	0.089	0.436***	0.056	0.405***	0.054
4[c]	0.605***	0.103	0.741***	0.061	0.636***	0.057
Health						
1 (base case)	---	---	---	---	---	---
2[d]	0.437**	0.215	0.081	0.071	0.144*	0.082
3[e]	0.568***	0.213	0.273***	0.066	0.341***	0.077
4[f]	0.594***	0.220	0.301***	0.077	0.386***	0.081
Price	-0.177**	0.078	-0.039	0.049	-0.002	0.045
Current Lunch Purchase Frequency	0.011**	0.005	0.017***	0.004	0.016***	0.004
1	-0.152	0.134	0.141	0.088	-0.038	0.079
3	-0.265	0.255	-0.030	0.087	0.040	0.098
4	0.007	0.143	0.055	0.076	0.110	0.073
12	0.003	0.134	0.176**	0.078	0.185**	0.080
20	0.113	0.150	0.398***	0.106	0.313***	0.089
Constant Term	-7.492	9.568	7.403	5.853	-3.221	5.422
R^2	0.4037		0.4566		0.4037	
N	200		418		514	

***, **, *: Parameter estimate significant at 1%, 5%, and 10% significance levels, respectively

[a,b,c,d,e,f]: Superscript letters indicate that the given level differed from the other levels at the 5% significance level.

Table 6: Price Sensitivity Analysis by Income Group

	Change in Probability of Purchase		
Price	**Income less than $75,000**	**Income between $75,000 and $150,000**	**Income greater than $150,000**
$2.75	1.2%**	0.4%	0.016%
$3.00 (base price)	--	--	--
$3.25	-1.3%**	-0.4%	-0.016%
$3.50	-2.6%**	-0.7%	-0.031%
$3.75	-4.0%**	-1.1%	-0.047%

Table 7: Health Rating Sensitivity Analysis by Income Group

	Change in Probability of Purchase		
Health Rating	**Income less than $75,000**	**Income between $75,000 and $150,000**	**Income greater than $150,000**
1 (base: very unhealthy)	--	--	--
2	10.2%**	3.1%	4.7%*
3	12.3%***	10.6%***	11.9%***
4 (very healthy)	12.7%***	11.7%***	13.6%***

Table 8: Palatability Rating Sensitivity Analysis by Income Group

	Change in Probability of Purchase		
Palatability Rating	**Income less than $75,000**	**Income between $75,000 and $150,000**	**Income greater than $150,000**
1 (base: very unpalatable)	--	--	--
2	-1.8%	5.0%**	1.3%
3	9.9%***	17.1%***	14.3%***
4 (very palatable)	12.9%***	28.9%***	23.4%***

Table 9: Total Meal Calorie Content Sensitivity Analysis by Income Group

	Change in Probability of Purchase		
Calorie Count	**Income less than $75,000**	**Income between $75,000 and $150,000**	**Income greater than $150,000**
550 (base)	--	--	--
575	3.1%	-2.3%	-1.0%
600	5.2%	-3.7%	-2.3%
625	6.7%	-4.1%	-3.9%
650	7.5%	-3.7%	-5.8%

Table 10: Random-Effect Probit Results by Income Group (Dependent Variable: Perceived Health)

	Less than $75000		$75,000 to $150,000		More than $150,000	
Variable	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
Calories	-0.002*	0.001	-0.0003	0.001	-0.002**	0.001
Main Entrée						
Baked Chicken Breast (base)	---	---	---	---	---	---
Oven Roasted Sliced Turkey on Whole Grain Bread	-0.293	0.240	0.047	0.158	-0.119	0.129
Cheese Quesadilla	-0.617***	0.186	-0.538***	0.139	-0.549***	0.117
Cheeseburger on Wheat Bun	-0.675***	0.212	-0.623***	0.152	-0.518***	0.138
Macaroni & Cheese	-0.995***	0.186	-0.622***	0.142	-0.775***	0.120
Chicken Nuggets	-0.996***	0.192	-0.830***	0.149	-0.785***	0.125
Taco Turkey	-0.401**	0.162	-0.263**	0.131	-0.214**	0.109
Bosco Cheese Sticks	-1.126***	0.186	-1.007***	0.144	-0.822***	0.116
Ravioli with Sauce	-0.368**	0.173	-0.542***	0.137	-0.414***	0.106
Mini Corn Dog Bites	-1.417***	0.183	-1.229***	0.143	-0.969***	0.111
Vegetable						
Baby Carrots (base)	---	---	---	---	---	---
Baked French Fries	-0.380***	0.126	-0.283***	0.087	-0.407***	0.078
Green Bell Pepper Strips	-0.070	0.116	0.051	0.088	0.009	0.077
Steamed Broccoli	-0.050	0.125	0.214**	0.091	0.116	0.079
Tossed Salad	-0.116	0.128	0.024	0.097	0.051	0.080
Fruit						
Cinnamon Applesauce (base)	---	---	---	---	---	---
Banana	-0.003	0.122	0.089	0.092	0.171**	0.082
Diced Peaches	-0.348***	0.125	-0.061	0.098	-0.001	0.081
Fresh Grapes	-0.106	0.123	0.063	0.090	0.093	0.078
Fresh Orange Sections	-0.187	0.124	0.113	0.089	0.224***	0.079
Other						
Chocolate Chip Cookie (base)						
Dinner Roll	-0.014	0.119	0.224**	0.089	0.097	0.077
Fruit Flavored Yogurt	0.203	0.118	0.226**	0.090	0.166**	0.078
Graham Cracker Snack	0.002	0.125	0.186**	0.090	0.116	0.078
Pretzel Snack	0.041	0.119	0.081	0.090	0.234***	0.078
Constant Term	5.013***	0.696	3.311***	0.524	4.315***	0.454
R^2	0.7040		0.7008		0.6704	
N	208		444		535	

***, **, *: Parameter estimate significant at 1%, 5%, and 10% significance levels, respectively

Discussion

This study has shown that a meal's calorie content has no direct effect on purchase decisions. However, there is an alternative pathway though which calorie content may affect the purchase decision. Calorie content also has a modest indirect influence via health perceptions of the meal. To our knowledge, this is the first study to explore the relationship between calorie content and lunch demand. This contributes to a small literature exploring the implications of nutritional changes to school lunches for the profitability of school foodservice divisions.

In this study, calorie reduction has indirect affect on the perceived health of the school lunch. In turn, this perceived health has a statistically significant effect on the probability of lunch purchases. For the lowest income category, decreasing the amount of calories from 650 to 550 in a school lunch will increase the perceived health rating for a typical respondent in each income category by 0.2 ratings points, or by about 6.78%. This increase in the perceived health rating will increase the probability of school lunch purchases by approximately 0.08% using the average health rating of 2.95. For the highest income categories, decreasing the amount of calories from 650 to 550 in a school lunch will increase the perceived health rating for a typical respondent in each income category by 0.2 ratings points, or by about 6.8%. This increase in the perceived health rating will increase the probability of school lunch purchases by approximately 0.34% using the average health rating of 2.94. So, for each 300 meals normally sold, reducing calorie content from the highest level allowed by regulation to the lowest allowable level would result in one additional meal being sold on average. It is clear the effect of reducing calories has a small impact on lunch participation based on the decision model estimated from the choice experiment with this sample of parents.

Most respondents in the survey chose not buy the school lunch. The lack of school lunch purchasers agreed with the results from the (Condon, Crepinsek, and Fox 2009) study where only 38% of public school students consumed school lunch. One possible explanation for the low number of students that consume school lunches is that the households already know their subjective assessments of the school lunch items since the conjoint menu combinations utilize existing items on the lunch menu. In this case, changing the hypothetical price from $3.75 to $3.50 is not likely to convince someone that an item is any healthier or more palatable.

One must also consider the socioeconomic characteristics of the student body and the respondents before any changes are made to other school lunch programs. In this study, Table 4 shows that the Upper Arlington community and the survey respondents consist mostly of Caucasian students from relatively high-income families. Furthermore, the survey respondents are even wealthier than the community-wide averages. As a result, it would be difficult to extrapolate this study's findings to school districts with different student body and community demographics, such as a student body composed mostly of low-income households or those composed mostly of an underrepresented racial minority group. One possible reason for the extrapolation difficulty is that peoples' food consumption choices are influenced by their socioeconomic backgrounds. People from one socioeconomic background, for instance highly affluent, may exhibit different food consumption habits than those from a poor socioeconomic background. Future research is needed with a more representative sample, including different respondent and student body racial background and income levels, to verify this study's results.

In addition to demographic disparity, there is the potential for a mismatch in what the parent believes the child will eat and in what the child will actually eat. For instance, the parents and guardian indicate whether or not the child likes to eat certain foods at home. Using this

observed child palatability along with the parents' subjective assessment of the school lunch's healthiness, the household then makes the decision to buy or to not buy a school lunch. This decision is recursive since the parents must know their perceived healthiness and child palatability before deciding to buy or not to buy the school lunch. However, there is the possibility for asymmetrical information between the child and the parents. One possible underlying factor is in the food preparation. For example, the child might not like the way parents prepare and cook a vegetable egg roll at home, but might find the school's version to be more appealing. Furthermore, the parents usually do not observe the children eating the school lunch itself, and this contributes to the potential difference between what the child likes and what the parents think the child likes.

Another reason to believe that there is asymmetrical information between the parents and child is that peer effects play a significant role in a child's decisions, including those to eat certain foods during lunch. Several studies (Asirvatham, Nayga Jr, and Thomsen 2012; Birch 1980; Fulkerson et al. 2004; Perry, Mullis, and Maile 1985; Story et al. 2002) have shown that peer effects have a major influence on a child's food decision. In most cases, parents do not directly observe how their children react to their friends' influences at school. Not accounting for peer effects leaves out a key component in a child's food decision, especially if the child is enrolled in the lower primary grades, including kindergarten to third grade.

Conclusion

Childhood obesity has become a public health crisis. Although school district officials want to serve healthier foods for NSLP lunches, there is a limitation to what they can serve due to their students' limited palates. Households have their own preferences regarding lunch item healthiness and child palatability.

This study shows that meal palatability and healthfulness ratings were statistically significant factors that affected the probability of purchasing a school lunch. However, the calorie information only had a small, indirect effect on lunch purchases through a meal's perceived healthiness. This paper provided the evidence that the school district foodservice program considered in this study can maintain overall lunch sales regardless of the calorie level served within the range of allowable calories. If improving nutrition requires a price increase, the school foodservice must improve the perceived healthiness of the new food items by serving high quality, nutritious items in order to offset the customers lost from raising the lunch prices.

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References

Akin, J. S., D. K. Guilkey, B. M. Popkin, and J. H. Wyckoff. "The Demand for School Lunches: An Analysis of Individual Participation in the School Lunch Program." *Journal of Human Resources* (1983): 213-30.

Asirvatham, J., R. M. Nayga Jr, and M. R. Thomsen. "Peer-Effects in Obesity among Public School Children: A Grade-Level Analysis." Boston, MA, 2012.

Birch, Leann Lipps. "Effects of Peer Models' Food Choices and Eating Behaviors on Preschoolers' Food Preferences." *Child Development* 51, no. 2 (Jun., 1980): pp. 489-496

Braley, G. A. and P. E. Nelson Jr. "Effect of a Controlled Price Increase on School Lunch Participation: Pittsburgh 1973." *American Journal of Agricultural Economics* (1975): 90-6.

Condon, Elizabeth M., Mary Kay Crepinsek, and Mary Kay Fox. "School Meals: Types of Foods Offered to and Consumed by Children at Lunch and Breakfast." *Journal of the American Dietetic Association* 109, no. 2, Supplement (2, 2009): S67-78.

Cullen, K. W., K. Watson, I. Zakeri, and K. Ralston. "Exploring Changes in Middle-School Student Lunch Consumption After Local School Food Service Policy Modifications." *Public Health Nutrition* 9, no. 06 (2006): 814-20.

Eng, M. and J. Hood. "Chicago School Bans some Lunches Brought from Home." *Chicago Tribune*, April 11, 2011.

Evans, Joel R. and Anil Mathur. "The Value of Online Surveys." *Internet Research: Electronic Networking Applications and Policy* 15, no. 2 (2005): 195-219,

Food and Nutrition Service, United States Department of Agriculture. *Nutrition Standards in the National School Lunch and School Breakfast Programs*. Vol. 76 2011.

French, S. A., M. Story, R. W. Jeffery, P. Snyder, M. Eisenberg, A. Sidebottom, and D. Murray. "Pricing Strategy to Promote Fruit and Vegetable Purchase in High School Cafeterias." *Journal of the American Dietetic Association* 97, no. 9 (9, 1997): 1008-10.

Fulkerson, Jayne A., Simone A. French, Mary Story, Helen Nelson, and Peter J. Hannan. "Promotions to Increase Lower-Fat Food Choices among Students in Secondary Schools: Description and Outcomes of TACOS (Trying Alternative Cafeteria Options in Schools)." *Public Health Nutrition* 7, no. 05 (2004): 665

Ham, Sunny, Stephen J. Hiemstra, and Barbara J. Yoon. "Factors Affecting School Lunch Participation in Indiana Schools." *Foodservice Research International* 13, no. 3 (2002): 133-46.

Harrison, Glenn W. "Experimental Evidence on Alternative Environmental Valuation Methods." *Environmental and Resource Economics* 34, no. 1 (2006): 125-62.

Hendy, Helen M., Keith E. Williams, and Thomas S. Camise. "“Kids Choice” School Lunch Program Increases Children's Fruit and Vegetable Acceptance." *Appetite* 45, no. 3 (12, 2005): 250-63.

Hur, Inyoung, Teri Burgess-Champoux, and Marla Reicks. "Higher Quality Intake from School Lunch Meals Compared with Bagged Lunches." *ICAN: Infant, Child, & Adolescent Nutrition* 3, no. 2 (April 01, 2011): 70-5.

James, Delores C. S., Barbara A. Rienzo, and Carol Frazee. "Using Focus Group Interviews to Understand School Meal Choices." *Journal of School Health* 66, no. 4 (1996): 128-31.

Just, D. R., L. Mancino, and B. Wansink. *Could Behavioral Economics Help Improve Diet Quality for Nutrition Assistance Program Participants?*. Washington, D.C.: United States Department of Agriculture Economic Research Service, 2007.

Just, D. R., B. Wansink, L. Mancino, and J. Guthrie. *Behavioral Economic Concepts to Encourage Healthy Eating in School Cafeterias*. Washington, D.C.: United States Department of Agriculture Economic Research Service, 2008.

Lancsar, Emily and Jordan Louviere. "Conducting Discrete Choice Experiments to Inform Healthcare Decision Making." *Pharmacoeconomics* 26, no. 8 (2008): 661-77.

Marples, C. A. and D. M. Spillman. "Factors Affecting Students' Participation in the Cincinnati Public Schools Lunch Program." *Adolescence* 30, no. 119 (1995, 1995): 745-54.

Mirtcheva, Donka M. and Lisa M. Powell. "Participation in the National School Lunch Program: Importance of School-Level and Neighborhood Contextual Factors." *Journal of School Health* 79, no. 10 (2009): 485-94.

Murphy, James J., P. Geoffrey Allen, Thomas H. Stevens, and Darryl Weatherhead. "A Meta-Analysis of Hypothetical Bias in Stated Preference Valuation." *Environmental and Resource Economics* 30, no. 3 (2005): 313-25.

Neumark-Sztainer, Dianne, Simone French, Peter Hannan, Mary Story, and Jayne Fulkerson. "School Lunch and Snacking Patterns among High School Students: Associations with School Food Environment and Policies." *International Journal of Behavioral Nutrition and Physical Activity* 2, no. 1 (2005): 14

O'Toole, Terrence P., Susan Anderson, Clare Miller, and Joanne Guthrie. "Nutrition Services and Foods and Beverages Available at School: Results from the School Health Policies and Programs Study 2006." *Journal of School Health* 77, no. 8 (2007): 500-21.

Perry, Cheryl L., Rebecca M. Mullis, and Marla C. Maile. "Modifying the Eating Behavior of Young Children." *Journal of School Health* 55, no. 10 (1985): 399-402.

Probart, Claudia, Elaine McDonnell, Lisa Bailey-Davis, and J. Elaine Weirich. "Existence and Predictors of Soft Drink Advertisements in Pennsylvania High Schools." *Journal of the American Dietetic Association* 106, no. 12 (12, 2006): 2052-6.

Reicks, M., J. P. Redden, T. Mann, E. Mykerezi, and Z. Vickers. "Photographs in Lunch Tray Compartments and Vegetable Consumption among Children in Elementary School Cafeterias." *JAMA: The Journal of the American Medical Association* 307, no. 8 (2012): 784-5 (accessed 3/9/2012 8:19:32 PM).

Snelling, A. M., C. Korba, and A. Burkey. "The National School Lunch and Competitive Food Offerings and Purchasing Behaviors of High School Students." *Journal of School Health* 77, no. 10 (2007): 701-5 (accessed 3/9/2012 8:16:03 PM).

Story, Mary, Leslie A. Lytle, Amanda S. Birnbaum, and Cheryl L. Perry. "Peer-Led, School-Based Nutrition Education for Young Adolescents: Feasibility and Process Evaluation of the TEENS Study." *Journal of School Health* 72, no. 3 (2002): 121-7.

Street, Deborah J., Leonie Burgess, and Jordan J. Louviere. "Quick and Easy Choice Sets: Constructing Optimal and nearly Optimal Stated Choice Experiments." *International Journal of Research in Marketing* 22, no. 4 (2005): 459-70.

Treviño, R. P., T. Pham, C. Mobley, J. Hartstein, L. E. Ghormli, and T. Songer. "HEALTHY Study School Food Service Revenue and Expense Report." *Journal of School Health* 82, no. 9 (2012): 417-23.

US Census Bureau. "American Community Survey 5 Year Estimates 2006-2010." http://www.census.gov/acs/www/ (accessed June 1, 2012).

Wardle, Jane, Lucy J. Cooke, E. Leigh Gibson, Manuela Sapochnik, Aubrey Sheiham, and Margaret Lawson. "Increasing Children's Acceptance of Vegetables; a Randomized Trial of Parent-Led Exposure." *Appetite* 40, no. 2 (2, 2003): 155-62.

Watanabe, Teresa. "L.A. Schools' Healthful Lunch Menu Panned by Students." *Los Angeles Times*, December 17, 2011.

Wharton, C. M., M. Long, and M. B. Schwartz. "Changing Nutrition Standards in Schools: The Emerging Impact on School Revenue." *Journal of School Health* 78, no. 5 (2008): 245-51.

Wojcicki, J. M. and M. B. Heyman. "Healthier Choices and Increased Participation in a Middle School Lunch Program: Effects of Nutrition Policy Changes in San Francisco." *American Journal of Public Health* (2006): AJPH. 2005.070946 v1 (accessed 3/6/2012 9:52:50 PM).

Zucchino, L. and C. K. Ranney. "School Lunch Program Participation." *Journal of Consumer Affairs* 24, no. 2 (1990): 245-67.