



# Food choice behavior of adolescents under parent-child interaction in the context of US school lunch programs

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## ABSTRACT

A relatively new trend in school feeding programs around the world is procuring food from local producers. However, little is known about student preferences for locally sourced food in school meals and how the interaction between parent and student preferences for locally sourced items influence joint school lunch decisions. We conducted a nationwide survey in the U.S. that embeds a school lunch discrete choice experiment. Results indicate that students and parents would prefer that locally produced items be added to school lunch menus. However, while parent and student preferences align on some aspects of locally sourced meal elements, their preferences are not identical, with parents displaying a higher willingness to pay for locally sourced vegetables and students displaying a higher willingness to pay for locally sourced fruit. Joint choices are influenced by both parties. Parents dominate the joint outcomes when the household income is lower, when students eat school lunch more frequently and in dyads featuring a female parent and female student compared to male parent-male student dyads. Our findings emphasize why analyzing joint parent-student food choice behavior, rather than individual choices, is vital to understand participation in school feeding programs and hold implications for efforts to promote locally sourced food elements in school meals and the role of parent engagement in that process.

## 1. Introduction

Across the world, school feeding programs play important roles as social safety nets by providing safe nourishment to children, reducing hunger and malnutrition, and improving student enrollment and learning outcomes (Bundy et al. 2009; Kristjansson et al. 2007; Sumberg and Sabates-Wheeler 2011). A relatively new trend in school feeding programs is procuring food from local producers (Bundy et al. 2009; Smith et al. 2016; Triches 2018). For example, the home-grown school feeding (HGSF) programs initiated by the World Food Program operate in 46 countries linking school feeding programs with local smallholder farmers (Drake et al. 2016; Espejo, Burbano and Galliano 2009). These programs benefit local farmers by increasing their access to institutional markets while providing fresh and quality food for children.

In the U.S., meals obtained via the National School Lunch and School Breakfast Programs are an important potential source of nutrition for children, accounting for more than half of student's recommended daily caloric intake during nearly half the days each year (Cullen and Chen

2017). However, participation in these programs has been declining on both the extensive (i.e., the total number of meals served) and intensive (i.e., the number of meals served per student) margins especially among student segment who obtain full priced lunches (U.S. Department of Agriculture, Food and Nutrition Service, 2020) with interventions to increase student participation yielding modest impacts (Thompson et al. 2020) (Fig. 1).

Similar to the global trend, adding local foods to school meals is hypothesized to attract more students to school meals instead of alternative food sources (National Farm to School Network 2017), which often are less nutritious (Hur, Burgess-Champoux and Reicks 2011). In 2010, U.S. Department of Agriculture's Farm-to-School (FTS) programs were formally established to improve access to local foods in schools. However, adding local foods to school meals creates additional logistical (O'Hara and Benson 2019) and budgetary burdens (Watson, Treadwell and Bucklin 2018). Therefore, understanding student preferences is important to decision makers weighing whether the benefits of increased student participation via inclusion of locally sourced foods in

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school meals justify the additional costs. Deciding whether a child will eat school lunch on any particular day may involve input from both parent and child; hence, understanding how parent and child interact during such decisions is important.<sup>2</sup> In this study, we investigate how the interaction of parent and child preferences for locally sourced items influences school lunch decisions.

Our specific objectives are to investigate: 1) adolescent preferences for locally sourced elements in school meals and willingness-to-pay; 2) how parent-student influence for locally sourced food varies across socio-economic dimensions and informs when assessing the preferences of one party is sufficient for predicting choice versus assessing both parent and student preferences.

This work connects to three strands of literature. The first concerns preferences for local foods. Much of this literature concludes that consumers are willing to pay a significant premium for local variants of foods (Adams and Adams 2008; Bean and Sharp 2011; Carpio and Isengildina-Massa 2009; Connolly and Klaiber 2014; Costanigro et al. 2014; Darby et al. 2008; Giraud, Bond and Bond 2005; Hu et al. 2013; Meas et al. 2015; Pelletier et al. 2013; Thilmany, Bond and Bond 2008), but less is known about how inclusion of local foods as part of a meal

affects demand.

The second strand of literature includes evaluation of the FTS programs. Previous work investigates the benefits and impacts of FTS programs (Becot et al. 2017; Joshi, Azuma and Feenstra 2008; Schwartz et al. 2015; Avuwadah and Kropp 2022); examines how local food purchases are affected by local agricultural conditions (O'Hara and Benson 2019; Botkins and Roe 2018), and the definition of local (Plakias et al. 2020); explores the impact of local food expenditures on school food service revenues and earnings (Motta 2019); analyzes the determinants of program continuation (Bonanno and Mendis 2021); determines the relationship between the per student local food expenditures and the local food supply chain structure (Christensen et al. 2017); and qualitatively assess student food preferences (Prescott et al. 2019). Related to this, the broader literature on HGSF programs documents program details and evaluate the impact on HGSF on nutrition, education, agriculture, and other social outcomes (Gelli et al. 2016; Singh and Fernandes 2018; Sumberg and Sabates-Wheeler 2011). Bonanno and Mendis (2021) find that the percentage of racial/ethnic minority students in a school district positively associate with participation, but negatively associate with continuation in FTS activities.

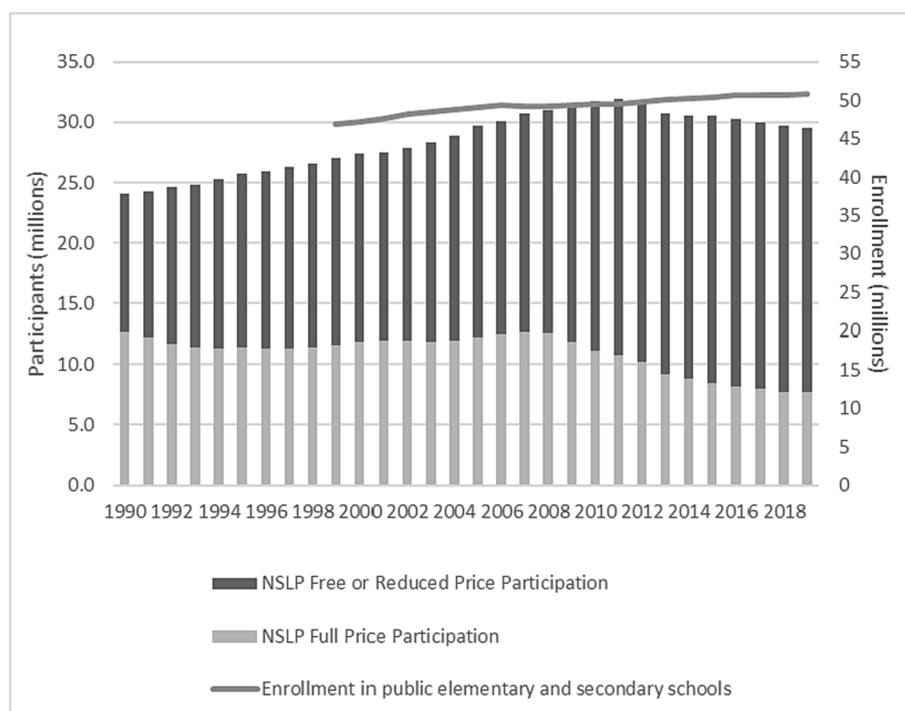


Fig. 1. National school lunch program (NSLP) participation and enrollment in public and secondary schools from 1990 to 2019.

<sup>2</sup> Under NSLP, meals are chosen on the spot, but schools publish the menus in advance, and they are accessible to parents and students. Depending on the household, parents, students or both (via negotiation) decide whether to obtain a school lunch on a given day even though some students from economically struggling families may have no choice but to eat school lunch. Decisions about what food items to serve are made by local School Food Authorities (SFAs). The U.S. Department of Agriculture (USDA) sets the nutritional standards (i.e., basic meal patterns) which lists the meal components that must be offered at lunch, minimum amounts of each component, and requirements or limits for calories, sodium, and saturated fat in a weekly menu (U.S. Department of Agriculture, Food, and Nutrition Service, 2019). Further, to get federal reimbursement for the meals served, schools need to make sure that each student selects a fruit or vegetable with their lunch and have a minimum of three meal components on their tray. SFAs can involve parents and students in setting menus, building recipes, and taste testing.

Similarly, Botkins and Roe (2018) find schools in rural areas are less likely to participate in FTS activities. Both studies find that the percentage of students receiving free or reduced price meals is negatively associated with participation in FTS activities.

The third strand of literature involves joint stated preference elicitation. This literature shows why understanding the preferences of a group, a couple or a household as a whole, matters instead of just the preferences of an individual (Bateman and Munro 2009; Beck and Hess 2016; Beharry-Borg, Hensher and Scarpa 2009; Mariel, Scarpa and Vega-Bayo 2018; Rao and Steckel 1991; Rungie, Scarpa and Thiene 2014; Scarpa et al., 2012; Marcucci et al. 2011; Zhang et al. 2009). A few studies analyze parent-child preference differences in non-recurring choices such as school choice (Giustinelli 2016; Huntington-Klein 2018) or electronics purchases (Aribarg, Arora and Bodur 2002; Aribarg, Arora and Kang 2010). Papoutsis et al. (2015) use parent-child pairs to examine how food fiscal policies and child pestering influence

parental choice of food for their child. However, parents alone made the decisions while their children were allowed to sit next to them during the experiment. Even though there is not much literature on how parent-student interaction affects school meal choices, there are several studies examining parents' perception of school meals in the U.S. [Spruance et al. \(2018\)](#) find that awareness of the existence and nutrition value of school meal programs, and students' grade level to be significantly related to eating breakfast at school. In contrast [Meier et al.'s \(2020\)](#) findings suggest that parents had mixed perceptions about school meals based on whether or not the student participated in free and/or reduced-price meal programs. [Martinelli et al. \(2020\)](#) investigate the changes in parental perceptions of school meals before and after the implementation of Healthy Hunger Free Kid Act of 2010 and find no significant changes.

We make three contributions to the literature. First, we study a recurring choice situation by modeling both joint and separate local food preferences of parents and students using a school lunch choice experiment which is novel in the literature of stated preference elicitation. We use the results to further understand how parent-student influence differs across different locally sourced meal elements and with household socio-economic characteristics. Second, we extend the existing literature on FTS programs in the context of U.S., as well as the literature on preferences for local food. Third, we contribute to the discrete choice experiment literature by developing novel scenarios that create relevant choices for families of all economic strata by embedding lunch credits within choice scenarios to make the price relevant to students who receive free or reduced-price lunches.

Modeling both parent and student choices is important for several reasons. For many families, participation in school meal programs is a decision that involves input from both parent and child.<sup>3</sup> In the survey we conducted for this study, 39% of the parents said that they sent cash with their student to pay for lunch which suggests regular interaction between parent and child concerning participation. Secondly, the food purchasing behaviors and eating habits of children are influenced by the food environment created by parents ([Barlow and Dietz 1998](#)). Parents communicate healthy behavior, exercise control over children's eating patterns, and provide feedback on children's health choices ([Andrews, Silk and Eneli 2010](#)). On the other hand, child pestering strongly affects food purchasing behavior of parents, mainly when parents shop for food with children present ([Nicholls and Cullen 2004](#); [Søndergaard and Edelenbos 2007](#)), often choosing less nutritious alternatives due to such pestering ([Papoutsis et al. 2015](#)).

We conduct a nationwide survey of parents with children enrolled in schools with midday meal programs in the U.S. In the embedded discrete choice experiment, respondents were shown school lunch options and asked to choose one or opt-out. The lunch options included an entrée, a fruit, and a vegetable that differed in terms of which elements were locally sourced. Parent-student dyads faced choice exercises first *individually* and then *jointly*. Results show that joint choices are influenced by both parties, with the relative importance of each party varying by the meal element. Parents' influence is higher in households with lower household income, in dyads featuring a female parent and female student compared to male-male dyads, and if students eat school lunch more frequently.<sup>4</sup> While our findings are consistent with the limited evidence suggesting that consumers place higher value on local food,

<sup>3</sup> In the U.S., [Pham and Roe \(2013\)](#) document that more than two-thirds of parents had at least some input into which days of the week their child eats lunch from school. [Botkins \(2017\)](#) documents that parents and children often disagree on whether particular school meals are desirable, with only a 62% agreement rate within 90 parent-child dyads evaluating whether students would prefer a described school lunch over non-school meal alternatives.

<sup>4</sup> Dyads featuring a female parent and male student, or a male parent and female student are not statistically different from the baseline which is a male-male dyad.

they accentuate why analyzing joint parent-student food choice behavior, rather than individual choices, is vital to understanding decision making in this area.

## 2. Methods

### 2.1. Study design

We implement a discrete choice experiment (DCE) involving hypothetical school lunch choice scenarios to simulate parental, student, and the parent-student dyad decisions about choosing what the student would eat from school lunch program, for lunch on a typical day. The DCE is a part of a national online survey of parents with children enrolled in schools with midday meal programs in the U.S. The survey also elicited socioeconomic characteristics of the respondents, characteristics of school attended by the child, child's recent school lunch participation, awareness about local food served in school meals, child's and parent's perceptions and expectations of school lunch, and general food preferences of children.

### 2.2. Study sample

A total of 3988 parent-student dyads were recruited via Qualtrics to participate in the survey in 2017. The completed survey provided 1201 usable responses for the choice model. In order to be deemed a usable response, the participating parent had to make decisions about the child's school day lunch more often than any other parent or guardian, the child had to be between age 13 to 18 and had to attend a public or private/charter school, and the survey must have been completed successfully (including correct answers to questions designed to measure attentiveness). We limit the study sample to children between the ages of 13 and 18 for the following reasons. First, a pilot study by [Pham and Roe \(2013\)](#) suggested that children have more autonomy in determining school lunches as they age. Due to this reason, we decided to exclude younger children to ensure that students had adequate autonomy when they make the lunch related decisions jointly with their parents. Second, we restrict the focus on adolescents who are defined as children between the ages 13 and 18 in similar studies ([Ayala et al. 2007](#); [Kassem et al. 2003](#)). Third, DCEs are complex and younger children may not understand them sufficiently ([Rogers et al. 2021](#)).

The recruits who are not included feature 340 who started but did not complete the survey, 202 who completed the survey but did not pass questions designed to ensure respondents were paying attention, 1147 where either the parent or child did not consent or assent to participate, 601 where the child was either too young or too old for the study (ineligible), and 497 where the child did not attend a U.S. school serving a midday meal (ineligible). This translates to 41.6% completion rate among eligible recruits.<sup>5</sup>

### 2.3. Discrete choice experiment

In the choice experiment each choice alternative was a lunch option defined by four attributes: the entrée, the vegetable, and the fruit, and the price charged for the lunch ([Table 1](#)). The first three attributes had two levels: (locally produced or not) and the price had four levels which were based on the average school lunch prices in the U.S. For each

<sup>5</sup> Among those who consented (2890 – 1147 = 1743), our percent of incompletes is 19.5% (340/1743) and our inattentiveness rate is 11.5% (202/1743). In comparison, [Gummer et al. \(2021\)](#) report the results from three studies and report incomplete rates (a.k.a., break-off or drop-out rates) of 5%, 15%, and 17% while [Peer et al. \(2022\)](#) report drop-out rates ranging from 0 to 21%. [Gummer et al. \(2021\)](#) report inattentiveness rates ranging from 5% to 24%. Given these studies features only adult respondents rather than parent-child dyads, our break-off and inattention rates appear reasonable.

**Table 1**  
Attributes and levels.

Attributes	Levels
Entrée	Local or not (2 levels)
Fruit	Local or not (2 levels)
Vegetable	Local or not (2 levels)
Price per lunch	\$2.80, \$3.20, \$3.60 or \$4.00 (4 levels)

Note: This table shows the four attributes and levels of a lunch option.

choice situation, respondents were shown three alternatives. The first two lunch options varied in terms of which of the three attributes were locally produced or not and prices, while the third option always had no local content and was the lowest price (i.e., \$2.80).

Respondents could choose any of the three options or select “I would not choose any of the options.” A full factorial design of all possible combinations of all attributes and levels would yield 32 ( $2^3 \times 4$ ) possible alternative menu profiles. The choice experiment adopted a full factorial design. However, since each dyad was unable to evaluate all 32 permutations, a randomly selected subset of menu profiles was presented to each dyad. A block design with four blocks of four choices was created using the %mktblock macro available in Statistical Analysis System software (Kuhfeld 2003). While each dyad did not see the whole design, every permutation was included across all the blocks.

The parent and child each separately answered the first two choices of the block. At the end of the survey, dyad members came together and jointly answered the same first two choice scenarios and jointly made two additional choices for a total of eight decisions for each dyad. Joint decisions were always made last, so individual choices were made without confounding those choices with influence of preferences by other members.

One challenge posed in this experiment is that many students receive free or reduced-price school meals, potentially making prices attached to different meals unimportant or unfamiliar. To overcome this challenge, we developed a choice scenario in which the student has a particular amount of lunch credit available. Any unspent balance generated by choosing less expensive options or a non-school lunch option can be carried over to buy future lunches or healthy snacks from the school cafeteria. Referencing future lunches and healthy snack alternatives creates a more uniform expectation among respondents concerning the opportunity cost of spending less on the lunch options in the choice set.

Another challenge is that some students may have strong pre-existing preferences for certain foods (e.g., love school lunch pizza but dislike school lunch hamburgers). Choosing foods for the choice experiment that individuals may never consider purchasing due to pre-existing preferences would render the incremental value of “local” to be meaningless (i.e., if a child hates beets, making them local is unlikely to make them more desirable). To overcome this challenge, earlier in the survey respondents indicated their first and second choices of entrée, fruit, and vegetable from a fixed list (appendix table A1). Each element of the lunch options in the choice experiment was then populated with these favorite elements.<sup>6</sup> We asked the favorite items from students’ perspective and used their favorite for all choice scenarios, but the parents could help the student decide their favorites. While food types vary between choice sets, each choice set had three variations of the same entrée, fruit, and vegetable with the only distinction being which elements were local and the total price. Fig. 2 provides a sample choice set provided in a choice situation.

A key question in choice experiments is whether decisions made in the proposed hypothetical choice experiments can track real purchases

<sup>6</sup> For example, let’s assume that the first choice of entrée, fruit, and vegetable were named e1, f1, and v1, respectively, and the second choices were e2, f2, and v2. the first choice set was made of dyad-specific e1, f2, v2 and the second choice set was made of dyad-specific e2, f1, and v1.

(Chang, Lusk and Norwood 2009; Penn and Hu 2018). However, a pilot study showed that the percent of hypothetical school meals purchased in the choice experiment is monotonic in respondents’ revealed purchase frequency, and price sensitivity is associated with household income (Pham and Roe, 2013).

### 3. Econometric model

#### 3.1. Parent, student, and dyad preferences for locally sourced elements in school meals

Following Lancaster (1966) and McFadden (1974), we specify an indirect utility function where the utility of individual  $i$  who chooses  $j$  lunch alternative at choice occasion  $t$  is given by,

$$U_{ijt} = \alpha Price_{ijt} + \beta_{11} Entree + \beta_{12} Fruit + \beta_{13} Vegetable + ASC_{no-buy} + \varepsilon_{ijt} \quad (1)$$

where  $Price_{ijt}$  is a continuous variable with the four price levels in the design;  $Entree_{ijt}$ ,  $Fruit_{ijt}$  and  $Vegetable_{ijt}$  are dummy variables for locally sourced entrée, fruit, and vegetable, respectively. They take a value of 1 when the specific meal element is locally sourced, and 0 otherwise.  $ASC_{no-buy}$  is the alternative specific constant of the no-buy option and invariant in the population;  $\beta$  is the vector of parameters for local attributes;  $\alpha$  is the price parameter; and  $\varepsilon_{ijt}$  is the unobservable random portion of the utility.

We use a random parameter logit (RPL) model to represent the repeated choices of each parent, student, and dyad. The random error term, therefore, follow an iid type I extreme value distribution. We specify the price and no-buy option coefficients as fixed in the population, while all the local attribute coefficients are specified as normally distributed allowing for the possibility of both positive and negative preferences for local sourcing of meal elements. The fixed price specification allows average marginal WTP estimates to have the same distribution as the coefficient of the attribute (Colombo, Hanley and Louviere 2009). Following Hess and Train (2017), we allow all random parameters to have correlated distributions accounting for the possibilities where an individual favors locally sourced vegetable also favors locally sourced fruit.

Assuming a utility function that is linear in a vector of random parameters  $\beta$ , with a density function  $f(\beta|\theta, \alpha, ASC_{no-buy})$ , where  $\theta$  refers to parameters of the density function (i.e., mean and variance of the random parameters), the probability of a sequence of choices is given by

$$S_n = \int \prod_{t=1}^T \prod_{j=1}^J \left[ \frac{\exp(x'_{ijt}\beta_i)}{\sum_{j=1}^J \exp(x'_{ijt}\beta_i)} \right]^{y_{ijt}} f(\beta|\theta, \alpha, ASC_{no-buy}) d\beta \quad (2)$$

where  $y_{ijt} = 1$  if the choice of individual  $i$  is  $j$  in choice situation  $t$  and 0 otherwise (Hole 2007a; Hole 2013; Train 2009). All models are estimated using the simulated maximum likelihood estimation in Stata 15 with 1000 Halton draws (Hole 2007b).

We estimate three separate RPL models to model the food choice behavior of parent-only, student-only, and joint parent-student choices (Table 2). The survey contained four different choice sets, denoted A-D. Choice sets A and B were each presented multiple times (parent only, student only, and joint), while choice sets C and D were presented only in a joint decision. The dependent variable in all 3 models is whether or not a particular meal was selected (coded as 1 and 0) and the independent variables are meal specific attributes, such as whether or not each item in the meal is locally sourced (coded as 1 and 0), and meal price which enters in dollar. The identification strategy comes from observing sequence of choices of the same parent/student/dyad which allows to keep the within parent/student/dyad variations constant. Using the data on repeated choices over several parent/student/dyads we model the probability of observing a sequence of choice as a function of the attributes of the choices made while keeping the individual level

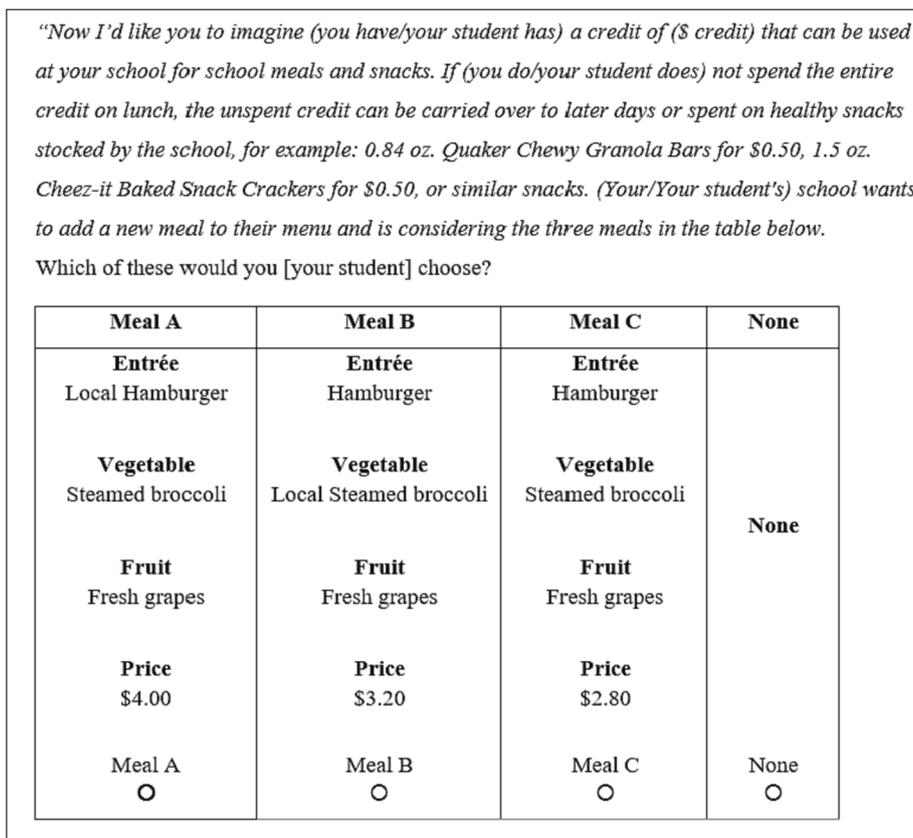


Fig. 2. A sample choice situation.

Table 2  
Design and models.

Order of the choice experiment in the Survey	Choice sets used	Who is choosing	Parent-only model	Student-only model	Joint model
1st & 2nd	A & B	Parent only	X		
3rd & 4th	A & B	Student only		X	
5th & 6th	A & B	Joint decision			X
7th & 8th	C & D	Joint decision			X

variation in control. Any observation in our data can either be classified as related to a choice made by the student on their own, by the parent on their own, or by the student and parent collectively (joint choices). Thus, the distinction between parent only, student only, and joint models is one of which observations in our data set are being included when applying the model to our data.

### 3.2. Preference comparisons

#### 3.2.1. Within individual, between-meal preference comparisons using Willingness-to-Pay (WTP)

We use bootstrap with 1000 replications to estimate the average marginal willingness-to-pay (WTP) values for local content, their standard errors, and confidence intervals. The average marginal WTP of a local attribute is defined as the negative of the ratio between the coefficients of local attribute and price ( $WTP = \beta_{local} / \beta_{price}$ ), which measures the additional dollar amount that the respondent is willing to pay for a locally sourced meal element compared to the same non-locally

sourced meal element. Further, we use bootstrap with 500 replications to test the pairwise between meal element differences of WTP (e.g., WTP of locally produced entrée Vs. WTP of locally produced fruit). Bootstrapping does not impose a symmetric WTP distribution as in other methods, and does not require the coefficients to be joint-normally distributed (Hole 2007a).

#### 3.2.2. Between individual preference comparisons: Whose individual preferences dominated the joint choices

We estimate individual-specific parameters following the estimation of parent and student RPL models and dyad-specific parameters following the joint RPL models. The superscripts *p*, *s*, and *j* indicate parent, student, and joint parameter estimates, respectively. Subscript *i* indicates the dyad, and *k* indicates the random attribute. Adapting the classification scheme from Beharry-Borg, Hensher and Scarpa (2009), we compare the individual specific and joint coefficients to categorize them into two groups representing parent or student dominated outcomes, respectively.

If all within-dyad coefficients for an attribute share the same sign and  $\hat{\beta}_{ik}^j > \hat{\beta}_{ik}^p > \hat{\beta}_{ik}^s$ , then the joint choice is consistent with the parent’s preferences (Table 3). This implies that the joint preference parameter is stronger than the parent’s preference and closer to the parent’s

**Table 3**  
Classification of parent and student dominated outcomes in joint decisions.

Scenario 1: Within dyad attribute specific coefficients share the same sign and the joint coefficient has the greatest absolute value	
$ \hat{\beta}_{ik}^j  >  \hat{\beta}_{ik}^p  >  \hat{\beta}_{ik}^s $	Parent's preference dominates the joint choice
$ \hat{\beta}_{ik}^j  <  \hat{\beta}_{ik}^p  <  \hat{\beta}_{ik}^s $	Parent's preference dominates the joint choice
$ \hat{\beta}_{ik}^j  >  \hat{\beta}_{ik}^s  >  \hat{\beta}_{ik}^p $	Student's preference dominates the joint choice
$ \hat{\beta}_{ik}^j  <  \hat{\beta}_{ik}^s  <  \hat{\beta}_{ik}^p $	Student's preference dominates the joint choice
Scenario 2: Within dyad attribute specific coefficients do NOT share the same sign and/or the absolute value of the joint coefficient is between the individual specific coefficients	
$ \hat{\beta}_{ik}^j - \hat{\beta}_{ik}^s  <  \hat{\beta}_{ik}^j - \hat{\beta}_{ik}^p $	Student's preference dominates the joint choice
$ \hat{\beta}_{ik}^j - \hat{\beta}_{ik}^p  <  \hat{\beta}_{ik}^j - \hat{\beta}_{ik}^s $	Parent's preference dominates the joint choice

Note:  $\hat{\beta}_{ik}^j$ ,  $\hat{\beta}_{ik}^p$ , and  $\hat{\beta}_{ik}^s$  are respectively the parent, student, and joint preference parameters for attributes obtained from RPL models. Subscript *i* indicates the dyad, and *k* indicates the random attribute. For each parent-child pair this classification is done 10,000 times using the 10,000 randomly generated betas from individual-specific mean and standard deviations.

preference than that of student's preference for attribute *k*.<sup>7</sup> However, the coefficients could be a mix of positive and negative values within the same dyad and/or the joint coefficients could lie between the individual coefficients. In these cases, the absolute distance between the individual and joint preference coefficient will determine whose preferences dominate the joint decision. Since the parents and students can have overlapping preference distributions, we compare the 95% confidence intervals of the individual-specific coefficients to further break each category into groups for whether the confidence intervals overlap or not.

**3.3. Explaining within-dyad influence**

Based on the influence of individual preferences within dyads, we generate a dichotomous variable at the dyad level indicating if preferences for at least two of three meal elements are influenced by parents (i. e., based on the classification in Table 3). We estimate a logistic regression of the dichotomous variables on socioeconomic variables and school lunch participation related characteristics (Aribarg, Arora and Bodur 2002; Beharry-Borg, Hensher and Scarpa 2009). School lunch related variables include whether the student is a picky eater, was exposed to local food or activities related to local food at school and eats school lunch at least once a week. Socioeconomic variables of interest include the absolute age difference between the parent and the student<sup>8</sup>, gender mix of the parent and the student, indicators for household income, responding parent's education, whether the student received free or reduced-price meal, and if more than one adult in the household works full or part time.

<sup>7</sup> Preference parameters have both sign (positive or negative) and magnitude. The larger the magnitude, the stronger the preference and it can be either positive or negative. When  $\beta^j > \beta^p > \beta^s$  and all are positive, for e.g.,  $0.8 > 0.5 > 0.1$ , respectively, then 0.8 is closer to 0.5 than it is to 0.1. Hence, the joint positive preference parameter (0.8) is stronger than either individual preference parameter but is closer in magnitude to the parent parameter than the student parameter. In this example, joint preference is closer to parent preference than student preference, and thus parent preferences are a more accurate and predictively useful proxy for joint preference than student preference.

<sup>8</sup> The absolute difference in ages between parent and child proxies for the age when the adult became a parent, which has been shown to correlate to parenting style (Kendler, Sham and MacLean 1997) and which we hypothesize to affect joint decision making.

**4. Results**

**4.1. Descriptive statistics of the sample**

Descriptive statistics are shown in Table 4. >90% of the students purchased school lunch at least once a week. The final sample had more female parents (73.2%) than male parents but similar proportions of female and male students. The higher share of female parents is likely due to more female parents making decisions about whether or not child eats school lunch on any given day. Students paying full price for lunch reported paying an average of \$3.39 per lunch.<sup>9</sup> The average including free and reduced-price meals is \$2.40 per lunch. About 25% of sample households reported receiving free school meals, and 10% received reduced-price school meals. Nationally, about 68% (6%) of all school lunches are free (reduced price) (School Nutrition Association 2019). A comparison of key demographic averages of the final sample (N = 1,201) against the groups who dropped out of the final sample for reasons other than not meeting the criteria is provided in appendix table A2. Compared to the final sample, those who failed the attention test and were removed from the final sample were more likely to feature male parents, but featured a similar distribution of student age, and

**Table 4**  
Descriptive statistics (% are reported unless specified otherwise).

Variable	Description or Categories	Sample (N = 1,201)	National statistics
Parent's gender	Percentage of female	73.2	51.4
	Prefer not to answer	0.1	
Student's gender	Percentage of female	51.7	
Parent's age	Years (mean and s. d.)	42.4 (8.1)	
	Student's age	Years (mean and s. d.)	15.2 (1.4)
Age difference between parent and student	Years (mean and s. d.)	29.9 (6.9)	
Parent's race/ethnicity	Non-Hispanic White	69.8	56.6
	Non-Hispanic Black	12.4	11.3
	Hispanic	12.7	22.0
	Other non-Hispanic Minority	5.1	10.1
Household income	\$50,000 or higher	59.9	54.6
Parent's education	Bachelor's degree or higher	39.4	31.2
	More than one adult work full or part time	Yes	40.4
Urban/Rural status of the place of residence	Rural	25.0	14.0
	Urban	24.9	31.0
	Sub-urban	50.1	55.0
Frequency of eating school lunch	At least once a week	91.4	
Student is a picky eater	Yes	15.7	
Student has awareness of local food in school cafeteria	Yes	15.7	
	Average cost per lunch	All lunches	\$2.41
Receive free or reduced-price meals	Received free school meals	25.2	
	Received reduced price school meals	9.7	

Notes: The minimum and maximum ages are 34 and 76 for the parents and 13 and 18 for the students, respectively. All national statistics are derived from the U.S. census data 2017/18 except for the urban/rural status which was obtained from Pew research data, and lunch cost which was derived from Fedrerel Register (2017).

<sup>9</sup> For comparison, the 2017–18 federal reimbursement rate for school lunch was \$3.23 (Federal Fedrerel Register, 2017) while the average price reported by 1,550 member-schools of the School Nutrition Association was \$2.74 for high schools in the 2016–17 school year (School Nutrition Association 2018).

household income. Compared to those who remained, the non-decision makers' sample had a higher share of female students.

#### 4.2. The effect of locally sourced meal elements on student and parent WTP

Based on the estimated coefficient means, the presence of a locally sourced element in a school lunch increases the associated utility level of students compared to the same non-locally sourced element (Table 5). Higher prices of school lunches decrease utility. The coefficients of the no-buy option were negative and highly significant suggesting that the respondents preferred to spend their lunch credit on a meal described in the scenario instead of carrying over the whole credit to later days or spending the whole credit on healthy snacks. The significant standard deviations of the local attribute coefficients indicate the presence of substantial heterogeneity in preferences and that some respondents may prefer lower levels of certain attributes.<sup>10</sup>

To better interpret the magnitudes of RPL coefficients, we estimated the average marginal willingness-to-pay (WTP) for each attribute (Table 6). Based on student preferences, holding all other attributes constant, a locally produced entrée would add an estimated value of 41¢ (U.S. cents) on average to a school lunch compared to the same entrée that is not locally produced. Similarly, on average, a locally produced fruit would add a premium of 23¢ to a school lunch, and a locally produced vegetable would add a premium of 18¢ compared to the corresponding non-local elements. The higher WTP for entrées than for the side items is consistent with the fact the entrée is generally the costliest element in a school meal (Matts 2009) and mostly consumed without plate waste (Cohen et al. 2013). Parents have higher marginal WTP for locally produced entrées (45¢) and vegetables (33¢) than students. The joint marginal WTP estimates are higher than either the individual student's or parent's estimates and this is stable across elements.

The results show that incorporating locally sourced items in school meals may enhance utility so long as the lunch price does not increase too much. Among the three items, switching to a local entrée is likely to be more popular among the students followed by switching to local fruits and local vegetables. To put things into perspective, an average school meal price was \$2.71/meal in middle and high schools in 2016–17 school year based on the State of School Nutrition Survey 2018 (School Nutrition Association 2018). Thus, if we consider the highest and the lowest mean WTP estimates for each element from Table 6, keeping everything else constant, respondents would be willing to pay a premium of 15–20% for a school lunch with a locally produced entrée, compared with 7–13% and 6–15% for locally produced fruit and vegetable elements, respectively.

The pairwise between-meal element comparisons of WTP estimates (i.e., between rows within each column of Table 6) show that the marginal WTP estimates for local entrée and fruit are significantly different from each other among parents. Among students, the significantly different pair is local entrée and vegetable. Both these significant differences occur in joint responses. The marginal WTP between local vegetable and fruits are not significantly different from each other in any group, hence, the relative attractiveness of adding a local entrée versus local fruit/vegetable depends on the decision-making group.

#### 4.3. Parent and student dominated outcomes in joint decisions

Table 7 reports whether the parent or the student preferences dominate the joint decision. The numbers in each cell show what percentage of individual parent or individual student preferences dominate joint decisions. The first (second) inset column for each dyad member

features the percent where the confidence intervals do not (do) overlap with the other dyad member's confidence interval, revealing an indication of the degree of dominance. When it comes to entrées and vegetables, parents' preferences (the shaded columns) appear to dominate as the most frequent outcome was a parent attempting to dominate the student's preference for local entrées and vegetables. The opposite holds for locally sourced fruits with the students' preferences (shaded columns) dominating. The values in Table 7 are descriptive, therefore comparisons between any two values need to be made with caution. For example, for entrées parents dominate 20.07% of the joint preferences with no overlapping CI with student preferences and dominate 49.79% of the joint preferences with overlapping CIs.<sup>11</sup> We also analyze whose preferences dominate the joint decisions by student gender and find that parents dominate slightly more successfully when the student is female (Appendix figure A1.1). There is no specific pattern by student age in terms of parent-dominated outcomes (Appendix figure A1.2).

#### 4.4. Influence regressions

Based on the logistic regression results (Table 8), parent's influence is lower when the parent–child age difference is greatest, which could reflect past results that parents who were older when children were first born are less likely to have authoritarian parenting styles (Kendler, Sham and MacLean 1997). Parent's influence is higher when the student consumes a school lunch at least weekly. This may imply that in situations where the student eats school lunch on a regular basis, parents have more input in lunch related decision making. On average, a student who consumes school lunch on a weekly basis is 16 percentage points more likely to be influenced by the parent in the majority of the meal attributes than a comparable student who doesn't consume school lunch on a weekly basis. Female parent–female student dyads are 9 percentage points more likely to have more input from the parent compared to a male parent–male student dyad. The student is 8 percentage points less likely to be influenced by the parent if the yearly household income is higher than \$50,000. Parent's education, work status, student's eating habit, student's exposure to local foods in school, and whether or not the student received free or reduced-price meals do not seem to influence the joint decisions.

### 5. Discussion and policy implications

Overall, the presence of locally sourced elements compared to non-local elements in school lunches increases the associated utility level of students and parents regardless of whether the decision is made individually or jointly. Based on WTP estimates, entrée vs. fruits and entrée vs. vegetables show significant between-element differences in preferences for local sourcing. There is no significant between-element difference for fruits vs. vegetables across all the models. This might be an important result to School Food Authorities (SFAs) in deciding which elements to source locally. Given that there isn't significant tradeoffs between locally sourced fruits and vegetables regardless of whether parents or students made the choices, if we assume that all three locally sourced elements are equally costly, and there are no budgetary or personnel constraints, then locally sourced entrées would generate more value followed by vegetables and fruits. However, in reality, whether the schools can generate adequate revenue or achieve cost savings by featuring locally sourced items depends on factors such as seasonality and availability of the products, cost, capacity of the school kitchen, the flexibility the school to charge higher prices to full price students, and

<sup>10</sup> We caution the reader that not all variables presented in Table 4 are included in the choice model and Table 5, which presents the results of choice model, includes all estimated coefficients.

<sup>11</sup> In other words, 71.28% of the parent-dominated joint decisions for entrées have overlapping CI compared to only 54.97% of the student-dominated joint decisions for entrées (i.e., 49.79/(20.07+49.79) versus 16.57/(13.57+16.57)).

**Table 5**  
Model results from RPL models with correlated coefficients.

	(1) Parent-only		(2) Student-only		(3) Joint	
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Entrée: locally produced	0.931*** (0.148)	1.719*** (0.334)	0.733*** (0.132)	1.985*** (0.317)	0.735*** (0.072)	1.365*** (0.093)
Fruit: locally produced	0.412** (0.181)	2.432*** (0.280)	0.396** (0.164)	2.090*** (0.259)	0.475*** (0.072)	0.971*** (0.111)
Vegetable: locally produced	0.654*** (0.137)	1.474*** (0.259)	0.322*** (0.322)	1.502*** (0.268)	0.550*** (0.061)	0.708*** (0.113)
Price	-2.030*** (0.229)		-1.781*** (0.205)		-1.319*** (0.096)	
No-buy option	-9.070*** (0.688)		-7.701*** (0.605)		-6.577*** (0.335)	
Log likelihood	-2346.995		-2524.262		-4703.056	

Notes: Standard errors, clustered at the individual level in models (1), (2), and at the dyad-level in model (3) are shown in parantheses. Number of respondents/dyads in all models include 1,201 individuals or dyads, and 9608 observations in model (1) and (2), and 19,216 observations in model (3). Price enters the model in dollar. \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01,

**Table 6**  
Average marginal willingness-to-pay estimates.

	Parent (€)	Student (€)	Joint (€)
Entrée: locally produced	45*** (0.067) [32,58]	41*** (0.081) [25, 57]	55*** (0.049) [46, 65]
Fruit: locally produced	20** (0.091) [3, 38]	23*** (0.088) [6, 40]	36*** (0.057) [25, 47]
Vegetable: locally produced	33*** (0.060) [21, 45]	18*** (0.063) [6, 31]	42*** (0.044) [33, 51]

Notes: \*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01, the standard errors are shown in parantheses, the confidence interval for WTP estimates are shown in brackets. Price enters the model in dollars.

**Table 7**  
Whose preferences dominate the joint decision.

Parameters	Percentage of parent versus student dominated joint decisions with and without overlapping Confidence Intervals (CI's) of individual specific coefficients (%)			
	Parent dominates		Student dominates	
	CI's	CI's	CI's	CI's
	Do not overlap	Do overlap	Do not overlap	Do overlap
Entrée: locally produced	20.07	49.79	13.57	16.57
Fruit: locally produced	16.15	24.90	21.98	36.97
Vegetable: locally produced	17.15	40.47	15.82	26.56

Notes: See text for derivation of percentages. Shaded cells denote for each row/item, which party dominates the majority of choices.

the percent of students who pay full lunch price.<sup>12</sup>

Our marginal WTP estimates have implications for U.S.'s federal school lunch reimbursement policies. Even though the current federal reimbursement levels for school lunches served is unaffected by whether the food is sourced locally, these current reimbursement policies could be altered to include changes in reimbursement levels that reflect the WTP of the students. Further, schools often use other non-federal funds to fund school lunch programs and information on the WTP for local items could be essential for directing review of federal funding rules and for guiding resource on whether to subsidize schools' purchases of local foods, and philanthropic efforts to support local food acquisition by districts.

<sup>12</sup> Even if school food authorities are supposed to maintain a non-profit status, they would still aim to at least break-even.

**Table 8**  
Regression estimates of the within-dyad influence.

Dependent variable: y = 1 (if parent's influence > student's influence   dyad)	Average Marginal Effects
Difference between parent and student age	-0.0057*** (0.002)
Male parent - Female student	0.0512 (0.0528)
Female parent - Male student	0.1086 (0.0795)
Female parent - Female student	0.0906** (0.0451)
Male parent- Male student	(omitted)
Student is a picky eater	0.0194 (0.0558)
Received free or reduced-price meals	-0.0594 (0.0419)
Have school lunch at least once per week	0.1698*** (0.0484)
Student have awareness of local food in school cafeteria	0.0122 (0.0461)
Yearly household income is higher than \$50 k	-0.0821* (0.0469)
Parent has a Bachelors degree	-0.0100 (0.0410)
More than one adult work full or part time	-0.0183 (0.0337)
Observations	1201
R-squared	0.0212

Notes: The table shows the outcomes of the logistic regression of an indicator variable for higher overall influence by parents against the covariates of interest. The dependent variable y takes a value of 1 if parent's influences 2 of the 3 meal element preferences within a dyad, and 0 otherwise. The column on the far right shows the average marginal effects. \*, \*\*, \*\*\* denotes statistical significance at the 10, 5 and 1 percent levels. Standard errors are clustered at the state level.

In the U.S., the decline in school lunch participation rate is largely from a decline in participation of students who pay full price. Between 2010 and 2019 the school lunch participation rate among students paying full price decreased from 35% to 26% while the total up-take rate of school lunch program has also declined (U.S. Department of Agriculture, Food and Nutrition Service, 2020). Hence, our work informs the potential for 'recovering' that declining segment which could be available to cross-subsidize the school district SFAs. In schools that mainly or exclusively serve free/reduced-priced meals, it is still important to understand the lost welfare from not offering local foods; even if the students cannot pay the increased meal prices in those schools, it does not imply that there is no improvement in social welfare from providing local foods so long as the WTP of students participating in free/reduced priced meals is enhanced by the offering of local foods. In particular, if local foods would increase the amount of the meal consumed by students

having free/reduced-priced meals (a topic we do not investigate), it could yield improved overall nutrition for these students and yield important public health gains.

The differences between actual student preferences for local food and the parents' perceived student preferences have useful implications for policymakers, SFAs, and researchers depending on their goals. However, one needs to bear in mind that in this study we force parents and children to jointly decide in part of the choice experiment whereas the frequency of a parent and child jointly make lunch decisions varies across households. Since parents successfully dominate students to prefer vegetables when they make the choices together with their children, if an SFA specifically aims to serve more locally sourced vegetables, then targeting parents for promotional campaigns would be more sensible. For researchers, the findings imply that, when predicting lunch choice by only interviewing one member of the family, at least asking that member about how the school lunch related decisions are made at their households is important. Ignoring the parent-student interactions in school meal-related decisions may lead to inaccurate targeting of campaigns to increase demand for locally sourced elements in school meals.

Results from the influence regression hint that campaigns targeting parents may work better with female students and female parents and students who regularly participate in school lunches. Students from high income households with older parents are less likely to be influenced by parents thus targeting such parents to promote local food in those circumstances could be ineffective. Given that joint decisions are more favorable towards locally sourced foods, if SFAs have adequate resources, then targeting both parents and students would yield decisions in which meals with locally sourced elements are chosen more often. However, we caution that the extremeness of the joint estimates could be due to factors such as accumulated learning or fatigue by the participants.

There are several limitations to our study. First, we specify the price and no-buy option coefficients as fixed. Fixed price coefficients yield defined moments for WTP estimates (Ortega et al. 2012; Veronesi et al. 2014; Ward et al. 2014). However, the tradeoff is that we assume that all individuals have the same preference for price. Specifying all coefficients as nonrandom is observed to yield problems in model identification (Hensher, Shore and Train 2005; Ruud 1996).

Second, with the available information, we could not completely explain why joint estimates of preferences for local meal elements are more extreme than the individual estimates. It is possible that parents and students could consider entirely different factors when they make the choice for a meal option. What is important to parents could be student's nutrition, and they might be willing to spend some extra money for their children to meet the caloric and nutritional requirements. This is also evident from relatively more caloric entrées being valued more than fruits and vegetables. For students, factors such as palatability may matter more, and they might not value the "local" attribute as much as their parents would. However, recall all choice scenarios feature foods that respondents deemed to be among their favorite items and the choice scenarios merely reflect a different number of meal elements with local content.

Thirdly, the choice design is unable to isolate the effects of accumulated learning in later choices since two of the choices are the same between individual and joint decisions. Further, the survey was administered online, thus one could question if the respective parties actually completed their sections as prompted. In other words, can we rule out that the parent just answered all the questions to receive the compensation for completing the survey? If one party answered all questions on a regular basis, we would expect no difference between parent and student preferences for attributes. The extremeness of joint preferences and WTP estimates suggest that parents and students did answer their part of the survey individually and then jointly as prompted. Fourth, we acknowledge that the data are responses to hypothetical scenarios rather than revealed choice data. Given our objectives of

understanding differences between parent and student preferences and the potential role of parent-child interaction during decision making, a hypothetical choice experiment permits the cleanest approach to meeting these objectives and including responses from a national sample. Fifth, Poe et al. (2005) introduced advanced computational methods using the complete combinatorial approach to test the differences in empirical distributions. However, due to the computational limitations, we did not follow such approach. Finally, we do not discuss whether promoting local food in school lunches may have negative implications such as limited availability of diverse food items and inequity between school districts due to lack of funds to promote local foods. These are avenues for future research.

## 6. Conclusions

Whether questioned alone or jointly, we find students who obtain lunch through the national school lunch program in the U.S. and their parents would prefer that locally produced items be added to school lunch menus, and that the willingness to pay for such offerings range from \$0.18 to \$0.55 per meal (6% to 20% of meal price). The highest willingness to pay is associated with the addition of a main meal entrée that is locally sourced, while the addition of a locally sourced fruit or vegetable evokes a smaller willingness to pay.

While parent and student preferences align on some aspects of locally sourced meal elements, their preferences are not identical, and preferences identified from joint parent-student decisions differ significantly from those identified from decisions cast individually. We discuss the usefulness and policy implications of such preference differences. When parent and child make choices together, the marginal WTP for local content estimates are 25% to 133% greater than either the estimates from just the parents or just the students. We find parents are more likely to be the driver of the additional value placed upon locally produced vegetables with majority of them with overlapping preferences with students in these joint decisions while students are more likely to be the driver in the cases of heightened willingness to pay for fruits in joint decisions. Parents were more likely to influence the joint decision when students reported frequently relying upon school lunch compared to students who only occasionally ate a school lunch. We caution that joint choices were always made last in our experimental sequence; hence the altered magnitude may be due to accumulated individual learning or fatigue by both parent and student respondents.

Local food items are currently included in schools around the world. Our work suggests that both parents and students value the local sourcing of school meals, hence the local sourcing is not imposed on students by parents. Hence this study adds value to the motivation behind the FTS programs in the U.S. and similar programs in other countries. Our findings are consistent with limited evidence suggesting that consumers place higher value on local foods. We also provide new evidence to why analyzing both parent and student food choice behavior, rather than individual choices, is vital in this context. Our findings hold implications for efforts to promote locally sourced food elements in school lunches and the role of parent engagement in that process.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A

See Fig. A1.

See Table A1–A3.

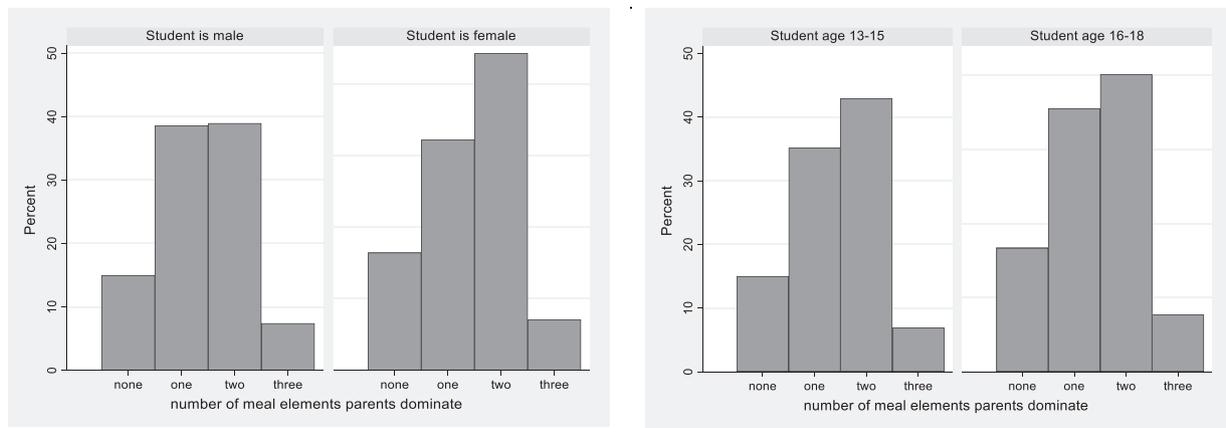


Fig. A1. Parent-dominated outcomes by student gender and age.

Table A1

List used to generate favorite entrée, vegetable, and fruit.

Favorite lunch food	Percent of Students (%)	Favorite vegetable	Percent of Students (%)	Favorite fruits	Percent of Students (%)
Chicken patty sandwich	12.66	Cooked sweet corn	32.06	Apple slices	20.48
Hamburger	15.99	Steamed broccoli	24.65	Canned pear slices	3.41
Cheese pizza	33.72	Steamed green beans	7.83	Fresh grapes	23.81
Macaroni and Cheese	9.08	Fresh baby carrots	13.24	Canned plums	0.33
Beef tacos	14.49	Cooked peas	2.58	Fresh red raspberries	4.91
Spaghetti with meat sauce	6.58	Fresh red peppers	2.50	Fresh strawberries	34.72
Cheese and bean enchilada	2.33	Fresh cucumber slices	15.90	Canned peach slices	6.00
Meatball sub sandwich	5.16	Cooked beets	1.25	Fresh cherries	6.33

Table A2

Comparison of key demographic averages of final sample (N = 1,201) against the groups who dropped out of the final sample due to reasons other than not meeting the criteria.

Variable	Description or Categories	Sample (N = 1,201)	Attention Fail Test 1 or 2 (%) (N = 202)	Parent does not make decisions regarding school lunches (%) (N = 169)	Did not complete the survey (%) (N = 340)
Parent's gender	Percentage of female	73.2	N/A		
	Percentage of male	26.7			
	Prefer not to answer	0.1			
Student's gender	Percentage of female	51.7	42.6	59.2	
	Percentage of male	48.3	56.9	40.2	
	Prefer not to answer	0.0	0.5	0.6	
Student's age	Years (mean and s.d.)	15.2 (1.4)	15.2 (1.5)	15.2 (1.4)	
Parent's race/ethnicity	Non-Hispanic White	69.8	61.4	61.0	
	Non-Hispanic Black	12.4	15.8	13.0	
	Hispanic	12.7	15.8	16.6	
	Other non-Hispanic Minority	5.1	6.9	9.5	
Household income	\$50,000 or higher	59.9	59.4	53.3	
Parent's education	Bachelor's degree or higher	39.4			
>1 adult work full or part time	Yes	40.4			
Urban/Rural status of residence	Rural	25.0			
	Urban	24.9			
	Sub-urban	50.1			
Frequency of eating school lunch	At least once a week	91.4	93.1	N/A	
Student: a picky eater	Yes	15.7			
Student: aware of local food school	Yes	15.7			
Average cost per lunch	All lunches	\$2.41			
	Excluding free lunches	\$3.39			
	Excluding free and reduced-price lunches	\$3.61			
Receive free or reduced-price meals	Received free school meals	25.2			
	Received reduced price school meals	9.7			

Notes: N/A indicates more than half of observations are missing or no observation as these respondents dropped out of the survey before the corresponding questions were asked.

## Appendix B. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.foodpol.2023.102420>.

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